# Meteorology research (1958-2001). 1958/2001

[Madison, Wisconsin]: [s.n.], 1958/2001

https://digital.library.wisc.edu/1711.dl/AG7BJSSNVHKMQ85

Res— meteorology



THE UNIVERSITY of WISCONSIN MADISON

UNIVERSITY COMMUNICATIONS
# NEWS RELEASES



FOR IMMEDIATE RELEASE
12/3/01
CONTACT: Charles Stearns, (608) 262-0780, chucks@ssec.wisc.edu
Matthew Lazzara, (608) 262-0436, mattl@ssec.wisc.edu

NOTE TO PHOTO EDITORS: To download high-resolution color head shots of scientists and other images from the Automatic Weather Stations project, visit: http://www.news.wisc.edu/newsphotos/weatherstation.html

## FORECASTERS STUDY ANTARCTICA WEATHER FROM WARMER VANTAGE

MADISON -- Matthew Lazzara isn't like most meteorologists. His forecasts never include "hot and dry" or "rain likely." But before you think he's describing your next vacation spot, know that his forecasts also include, "Low near minus 120 degrees Fahrenheit" and "Winds up to 120 miles per hour."

Lazzara forecasts for one of the planet's nastiest climates - Antarctica. Headquartered at a much warmer locale at the University of Wisconsin-Madison, Lazzara oversees dozens of Antarctic weather stations immune to freezer-like conditions to gather his data. He then shares this information with other Antarctic researchers, so they can avoid frost bite, hypothermia and getting lost in blinding snowstorms.

Lazzara, an atmospheric scientist, is part of a team of university researchers working on the Automatic Weather Stations project, which was started in 1980 by Antarctica pioneer Charles Stearns and is funded by the National Science Foundation's polar research program. Each year, this group builds and repairs 10-foot tall weather stations equipped to record temperature, humidity, air pressure, and wind speed and direction. From start to finish, each station costs $15,000.

The stations can bear the brunt of Antarctic weather. Down under, temperatures can reach the world record for the coldest -- minus 128.6 degrees Fahrenheit -- and hurricane-force gusts can be clocked up to 200 miles per hour. To stand stoic against these harsh conditions, the weather stations' control centers are specially designed. Enclosed in a metal box, "the electrical components can withstand temperatures around minus 100 degrees Fahrenheit," says the project's co-principal investigator George Weidner. Pointing to a drawer-like container built into a workbench, he says, "I test them out in this cooling chamber that can store dry ice."

That's not to say stations don't take a beating -- high winds can blast off parts and even paint.

Weidner tweaks some stations for specific locations. Those mounted onto the frozen water of an iceberg or ice sheet, for example, include a global positioning device to track their migration with the ice. "The stations do move, because you're putting them into ice," says Lazzara, who notes that the official location of the South Pole seems to slide because the ice sheet covering it slides about.

Of more than 50 UW-Madison weather stations scattered throughout the Antarctic, about 70 percent have been installed and serviced (or, more likely, uncovered from snow) by the UW-Madison team. Others have been built for cooperative research programs based at British, French, German and Japanese sites. "We have so many stations and so few people who can get to them," admits Lazzara. "We share service responsibilities with those who can."

More importantly, they also share data. "The Antarctic experience involves an awful lot of collaboration between nations that you typically don't see," he says. After processing the temperature readings and barometric levels gathered by the stations, Lazzara passes on the information to international weather labs and researchers. He explains, "We've been funded to get this data and give it away."

Scientists use the information to forecast weather both now and in the distant future. "If you're on a plane heading towards Antarctica, you want to know about the weather," says Weidner, who's traveled to the frosty continent 14 times. For this reason, many of the weather stations are located where researchers land, either by ship or plane.

"You want to be able to fly scientists to where they can do their research," says Lazzara, who once boarded a plane three times before he actually landed at McMurdo Station, the main U.S. site.

The real-time data used to forecast also can be used to develop accurate forecasting models. Lazzara explains, "For getting forecasting right, you really need observations." Computer modelers plug these observations into equations and design programs to predict other climate changes, such as global warming. In many cases, the data let modelers check the accuracy of their forecasts.

Though available worldwide, these data help researchers at UW-Madison. By putting the day-to-day data into a timeline, Weidner and his colleagues have shown that El Niño -- a weather pattern leaving the tropics warmer and wetter than usual -- also affects Antarctica: Some regions are colder and snowier than ever before. Lazzara relies on the data for a different reason: "Instead of using satellite detection, I'm going to use the relative humidity, wind speed and temperature data to verify when there's fog in Antarctica," Lazzara says.

Providing this information to everyone may eliminate some researchers' need to trek to Antarctica. Weidner says, "It's a challenge to do science down there. Everything takes three times longer.And, when the weather's good, you work -- sometimes 24 hours straight." But, he admits, "Mother Nature eventually wins."
# # #
-- Emily Carlson, (608) 262-9772, emilycarlson@facstaff.wisc.edu
Version for printing

**Retrieve release by month:** Dec 2001 Find

Receive news releases by email

File last updated: December 12, 2001

Research — meteorology



University Communications

# News Releases

UNIVERSITY OF WISCONSIN MADISON



**FOR IMMEDIATE RELEASE**
**May 22, 2000**
**CONTACT:** Steven Ackerman, (608) 263-3647; stevea@ssec.wisc.edu

## SPACE STATION BECKONS UW ICE CLOUD PROJECT

MADISON - Sometime in the year 2003, if all goes well, a University of Wisconsin-Madison experiment, designed to probe the nearly invisible ice clouds of Earth, will be hitched by astronauts to the International Space Station.

The project, known as CIRRUS, is one of five projects selected by NASA in a preliminary competition to develop some of the first scientific payloads for the orbiting space station. It is the only project in the competition that will be student-driven from beginning to end, says Steven Ackerman, the UW-Madison atmospheric scientist.

"Our proposal is unique because we'll have students build the instrument," Ackerman says. "They'll be involved from end to end. It's an opportunity for students to really get a taste of what it's like to work for NASA or an organization like that."

Of the five projects, two will be chosen for deployment in space, either aboard the space station or other craft such as a space shuttle or satellites. By making the cut, Ackerman's team of Wisconsin students, scientists and engineers will receive $300,000 to complete a proposal to design, build, deploy and operate a $15 million device capable of looking through the atmosphere to detect and characterize the ubiquitous particles of ice that play a key role in weather and climate.

CIRRUS, or Cloud Infrared Radiometer for University Earth System Science, will be designed to sample the far-infrared light reflected by the ice particles that exist, for example, in wispy high-altitude cirrus clouds and in the tops of massive thunderheads.

But the broad goal, he says, is to get some idea of how much ice truly exists in the atmosphere, how it is concentrated and the range of ice particle sizes. By reflecting light and interacting with other forms of water in the atmosphere, these atmospheric ice particles help regulate climate and influence patterns of local and regional weather.

"We want to see how much ice exists in the atmosphere, which is something we don't know. It's a very hard measurement to make and right now there are no Earth-viewing instruments that even make measurements in these wavelengths."

Ackerman says the information that would be collected by CIRRUS is the last frontier, the last data needed to fine-tune the supercomputer-driven climate models that scientists use to predict future climate. "It's the last big knob in the climate models that has no parameters. With CIRRUS, we would be able to collect data that no one else has seen before, and we could refine estimates that now differ by an order of magnitude."

The multibillion-dollar space station is now under construction by NASA and its international partners about 500 kilometers (310 miles) above the Earth. The advantage of the space station is that it will permit measurements to be made day and night. If deployed, CIRRUS would be perched on the outside of the space station for two years, allowing measurements to be made over the seasons.

"It would look down from the space station and look at ice in four different far-infrared wavelengths," he says.

The advantage of the far-infrared, a region of the electromagnetic spectrum invisible to the human eye, is that it provides a capability to look through clouds and sample ice wherever it exists in the atmosphere. Most other satellite-borne instruments can't look past the tops of clouds, Ackerman says.

"Thunderclouds, for example, are hard for satellites to measure because they only see the top. We would be able to see all the way through the cloud."

The full-blown CIRRUS proposal will be developed over the next year and also will involve students and faculty from the colleges of Letters and Science and Engineering. If selected, the CIRRUS instrument would be built at UW-Madison's Space Science and Engineering Center, one of a few university-based centers capable of building spaceflight hardware.

"It's exciting because it brings teaching right into the research," Ackerman says. "And of all the proposals submitted, ours is the only one where students would actually build the instrument."
###
Terry Devitt, 608/262-8282, trdevitt@facstaff.wisc.edu

Version for printing

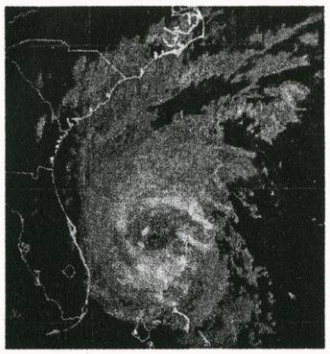
**Retrieve release by month:**
May 2000 Find

Receive news releases by email

**UComm Home** - Releases - Experts list - Staff contact info - News library - Photo library

# Developments to Watch

**EDITED BY ELLEN LICKING**



## READING WHAT'S WRITTEN ON THE WIND

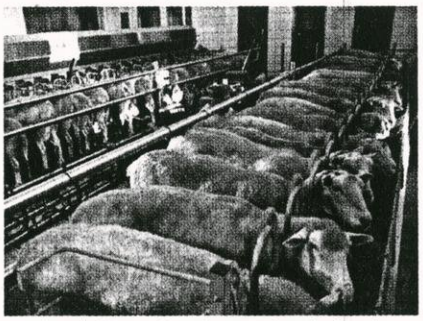
RESEARCHERS AT THE University of Wisconsin at Madison—a place better known for record snowfalls than tropical storms—have developed new satellite tools that are helping forecasters track hurricanes and monitor their intensity. The new technologies are based on a technique that merges the images taken by a string of satellites, each of which has its own view of earth, into a high-resolution composite graphic. Information, say temperature, can then be extracted from the montage and used in models. Meteorologists at the National Hurricane Center in Miami are currently using the innovative tools to improve their forecasts.

One of the many new tools available is a computer program that uses pattern-recognition software to measure hurricane intensity. This software scans satellite images and generates a number that quantifies the storm's strength. Previously, hurricane intensity was mostly subjective, based on the judgment of the forecaster on duty. "But this method takes the human guesswork out of the process," says Christopher S. Velden, one of the algorithm's designers. With hurricane season under way, that's something coastal residents from Texas to Virginia will be glad to hear. □

## IN SHEEP'S CLOTHING, A BALM FOR LUNG DISEASE

UNIVERSITY OF FLORIDA researchers are doing preliminary tests to see if a drug produced in the milk of genetically modified sheep can help people with chronic lung problems. The drug, a human protein called alpha-1-antitrypsin (AAT), is being used to treat six patients who suffer severe lung inflammation and emphysema because their bodies lack the means to produce the protein naturally. It was developed by PPL Therapeutics PLC of Edinburgh, Scotland, the creators of the cloned sheep Dolly.

Patients with AAT deficiency currently receive weekly injections of the drug that cost between $60,000 and $80,000 annually. Worse, because the drug is derived from human plasma, it's in short supply, leaving many of the 100,000 Americans with the disease clamoring for treatment. If PPL's recombinant version of AAT works, doctors could count on having an enormous drug supply at potentially cheaper prices. "It's just a matter of expanding the flock of transgenic sheep," says Dr. Mark L. Brantly, the project's lead researcher. Because PPL's drug is delivered as a mist that's inhaled just twice a day, patients could administer the drug themselves, avoiding the painful jabs of a needle and time-consuming visits to the clinic. "Quality of life will definitely improve," says Brantly. □



## IS THE SEA NOW A GIANT PETRI DISH?

GLOBAL WARMING AND POLLUTION HAVE CAUSED AN alarming spread of ocean diseases over the past six decades, according to a team of 13 biologists. In their survey of marine pathogens, appearing in the Sept. 3 issue of the journal *Science*, they discovered that diseases usually associated with one species, including nonmarine life, are increasingly spreading to other kinds of animals and plants in the sea, many of which may be disappearing without notice. For instance, the same scourge that is killing coral reefs may be decimating crabs and snails.

The researchers, led by C. Drew Harvell, an associate professor of ecology at Cornell University, say the culprits include long-term warming trends, extreme El Niño-types of weather events, and such human activities as aquaculture. Because of these pressures, overstressed marine life may be losing its ability to fight off diseases.

The biologists examined reports of marine diseases from 1931 to 1997. Not only did they find that the incidence of ocean diseases increased during the period but most "new" ones were caused by shifts to other species rather than the emergence of unfamiliar pathogens. The report cited 34 such examples, including seals infected with distemper from dogs and corals killed by soil-borne fungi. *Catherine Arnst*

## BENDING LIGHT WITH A NEW BREED OF FIBER OPTICS

OPTICAL FIBERS ARE OFTEN called light pipes. That name turns out to be much more accurate than previously imagined. Unlike ordinary optical fibers, which are solid glass, a new breed of hair-thin glass fibers has a hollow core for piping light.

Making these wispy glass straws is more complicated than "pulling" a solid fiber—a process that is similar to stretching a wad of taffy until it's a thread many yards long. So the hollow-core fibers produced by a team of British researchers at the University of Bath, described in the Sept. 3 issue of *Science*, may have only limited potential in telecommunications. However, what the new fibers promise to do over short hauls is astonishing.

For one thing, they can pipe light around 90-degree corners. That means optical chips suddenly become feasible. Today, optical chips are uneconomically large because solid fibers leak light at sharp corners, so optical circuits now have to turn gentle curves. The hollow-core variation avoids corner leaks with some optical trickery: patterns of holes in the glass too small for photons to squeeze through. Contrary to what you'd expect, adding holes transforms the glass into a light insulator.

Theoretically, tiny holes can also be used to create novel beams of interacting light, according to John B. Pendry, head of physics at London's Imperial College. Normally, light beams just pass right through each other. But interacting beams could perform switching, like transistors. Thus, all-optical chips and computers—operating at speeds way beyond current electronic models—may be on the horizon. *Otis Port*

*Advances gives a glimpse of the many significant research projects at the university. Tell us about your discoveries by e-mailing:* wisweek@news.wisc.edu.

### 150th child enrolled in UW asthma project

A baby born at the end of August has joined 149 other children in a university-community project to help determine the causes of childhood asthma.

Known as COAST (Childhood Origins of Asthma), the project seeks to explain why some young children develop full-blown asthma and others don't. Robert Lemanske, a nationally recognized asthma expert and professor of pediatrics and medicine, oversees the federally funded COAST project, which is based on Lemanske's theory that children develop asthma because of a combination of bad genetic luck and a common childhood virus.

At the center of Lemanske's theory are immune system hormones called cytokines. Some children inherit a cytokine imbalance and, as a result, become allergic to environmental triggers like house dust or pet dander. Because not everyone who has allergies develops asthma, he believes that something has to direct the allergic response into the lower airway. If the COAST project shows Lemanske's theory to be correct, it would help physicians identify children at risk of developing asthma and to intervene aggressively at the first signs of the disease to forestall lung damage. The COAST project is a joint effort of area hospitals and clinics. Information: 263-8539.

### Dane County land-use project touts UW technology

The kickoff of an innovative local land-use project will feature a newly developed suite of tools developed by the university's Land Information and Computer Graphics Facility.

"Planning Analyst" is a series of modules that help visualize alternative development patterns, evaluate impacts of proposed development and combine desired planning outcomes with relevant ordinances and standards. With the ability to better understand, forecast and visualize alternative land-use scenarios, communities will be able to make better informed land-use choices, says Ben Niemann, a professor in the College of Agricultural and Life Sciences.

Dane County Executive Kathleen Falk is scheduled to introduce the project, "Shaping Dane's Future: Community-Based Land Use Planning Demonstration Project," today, Sept. 8, in Verona, which has been selected as the pilot site for the project. The project will explore ways to engage Dane County citizens in the land use planning process.

### Campus lab tests for soybeanpests

For a second year, the university will help soybean growers monitor their fields for the soybean cyst nematode. Soybean growers can mail in a soil sample for analysis. The soybean cyst nematode attacks soybean roots. It has become one of the crop's most serious pests, according to Ann MacGuidwin, a nematologist in the College of Agricultural and Life Sciences. The nematode can reduce soybean yields even when plants appear normal above the ground.

"The only way to know for sure if the nematode is limiting yields is to run a soil test," MacGuidwin says. "A soil test also shows the pest's population density in a field, which is important for deciding whether or not to plant a soybean variety with resistance to the nematode."

# Satellite tools put hurricanes in sharper focus

**Brian Mattmiller**

A fleet of powerful new visualization tools developed at the university is giving forecasters an unprecedented look into the anatomy of typhoons and hurricanes, helping refine early warning systems.

Beyond better resolution, these satellite-based tools are helping scientists break tropical cyclones down into their component parts, dissecting some of the forces that create, fuel and steer these dangerous storms.

"What we're doing is fusing together images through the use of multiple satellites," says Chris Velden, a tropical cyclone researcher with the Cooperative Institute for Meteorological Satellite Studies (CIMSS). "Each satellite has its own view of the earth, and we're piecing many of them together for a more complete picture."

This "data fusion" technique is the source of several new university-based hurricane forecasting methods that are in daily use at the National Hurricane Center in Miami and the Joint Typhoon Warning Center in Pearl Harbor.

Velden says the new tools are designed to shed light on two of the biggest unknowns about tropical cyclones: Where they originate and how they gather and lose intensity. Just in the past five years, satellite technology has improved forecasting of the path of storms, but estimating their power has been difficult.

One new product introduced this year, called Wavetrak, combines data from five different satellites to create a 10-day movie loop of atmospheric waves sweeping out of central Africa, the birthplace of cyclones. Wavetrak is designed to study the atmospheric waves that act as a conveyor belt for conditions that cause cyclones.

"We're grappling with how and where these waves originate because about one in every 10 will form into a named tropical storm," Velden says. "This shows us the amplitude and strength of these waves as they come off Africa and into the Atlantic."

Wavetrak, created by Velden and research intern Jason Dunion, gives scientists a complete picture of a cyclone — from its birth over central Africa, to growth across the Atlantic and eventual fizzling out. It shows the succession of atmospheric waves moving along "like cars on a train."


This composite image showing hurricane Bret gives forecasters a clearer weather picture. Photo courtesy the Cooperative Institute for Meteorological Satellite Studies

**The Cooperative Institute for Meteorological Satellite Studies (CIMSS) tropical cyclone team posts recent and real-time movies and images of current cyclones in the Atlantic or Pacific Ocean. Visit: http://cimss.ssec.wisc.edu/tropic/tropic.html**

The technology has great benefit in seeing the genesis of storms. "It gives us an idea of exactly where they initiate over the African continent and their convective structure as they track over the ocean," Velden says.

On the question of measuring tropical cyclone intensity, the CIMSS team has a number of products in use by forecasters. One product is helping to provide a better handle on wind shear, an important predictor of intensity.

Wind shear is essentially the difference in speed between high-level and low-lying winds. A strong wind shear will slice the tops off of cyclones and slash their power. The CIMSS site provides a multi-colored map of high-resolution satellite observations. Updated every three hours, it shows the levels of wind shear across the Atlantic.

The site gives forecasters a highly visual record of wind-shear patterns that will either break up or add fuel to a storm. Velden says scientists want to pinpoint the thresholds of wind-shear effects, good or bad, on cyclones.

Velden says CIMSS is working to combine satellite-based data with information from radar and aircraft to produce storm images in three dimensions. Such a tool could lead to more accurate forecasts and, ultimately, greater public safety.

"We develop these tools in tandem with the forecasters," Velden says. "They know what they're looking for from us to aid the forecasting problem."

CIMSS is part of the Space Science and Engineering Center, which specializes in atmospheric studies of earth and other planets. It is supported by NASA and the National Oceanic and Atmospheric Administration. ■

# Team links genetic changes to aging process

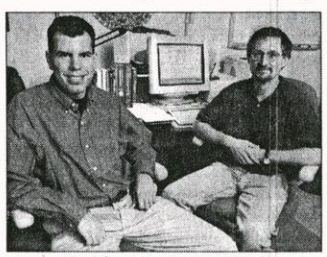
**Terry Devitt**

University scientists have, for the first time, profiled specific genetic changes during the aging of experimental animals, a discovery that could aid work to extend life span and preserve health.

The work conducted with mice combines a powerful new genetic technique with dietary restriction, the only known way to delay the aging process. The research was published recently in the journal Science.

The study is a milestone in aging research, providing scientists with an intimate look at the ebb and flow of genetic activity with age and the roles individual genes play in the process of growing old.

Moreover, it reveals how a low-calorie diet, the only known method of slowing aging in several animal species, works at the most basic level to extend life span and preserve health. Such knowledge, used in concert with new technologies capable of rapidly surveying the activity of thousands of genes at once, promises to accelerate the development of drugs that mimic the age-retarding effects of a low-calorie diet.



Tomas Prolla, left, and Richard Weindruch. Photo: Jeff Miller

The Wisconsin team, led by Tomas A. Prolla, an assistant professor of genetics, and Richard Weindruch, a professor of medicine, profiled the action of 6,347 genes.

"This study has analyzed more genes with regard to aging than all previous studies combined," Prolla says.

The study surveyed 5 to 10 percent of the mouse genome using a "gene chip" — a small glass plate containing DNA that, when read with a laser, quickly reveals activity levels for thousands of individual genes. "At the molecular level, normal aging looks like a state of chronic injury," says Prolla.

Many of the same genes that exhibited changes in activity with aging in mice on a standard diet remained almost completely intact in mice on a reduced diet.

The new study, says Weindruch, is also important because it shows how gene-chip technology could be used to screen for the effects of drugs on the aging process. ■

Res - Meteorology

1•8•4•8 NEWS
UNIVERSITY OF WISCONSIN–MADISON

Phone: 608/262–3571
Fax: 608/262–2331

Office of News and Public Affairs
28 Bascom Hall • 500 Lincoln Drive
Madison, Wisconsin 53706-1380

FOR IMMEDIATE RELEASE 8/27/99

**CONTACT: Chris Velden, (608) 262-9168; Home: (608) 274 5500; chrisv@ssec.wisc.edu**
**Terri Gregory, (608) 263-3373; terri.gregory@ssec.wisc.edu**

**NOTE TO PHOTO EDITORS: Four high-resolution, images are available for ddownloading at:**
**http://www.news.wisc.edu/newsphotos/hurricane.html**

## NEW SATELLITE TOOLS PUTTING HURRICANES IN SHARPER FOCUS

MADISON — A fleet of powerful new visualization tools is giving forecasters an unprecedented look into the anatomy of typhoons and hurricanes, helping refine early-warning systems.

Beyond better resolution, these satellite-based tools are helping scientists break tropical cyclones down into their component parts, dissecting some of the forces that create, fuel and steer these dangerous storms.

"What we're doing is fusing together images through the use of multiple satellites," says Chris Velden, a tropical cyclone researcher at the University of Wisconsin-Madison. "Each satellite has its own view of the earth, and we're piecing many of them together for a more complete picture."

This "data fusion" technique is the source of several new hurricane forecasting methods developed at UW-Madison that are in daily use at the National Hurricane Center in Miami and the Joint Typhoon Warning Center in Pearl Harbor.

The bank of images is publicly available on the web site of UW-Madison's Cooperative Institute for Meteorological Satellite Studies (CIMSS) tropical cyclone team, a group led by Velden. Visitors can peruse recent and real-time movies and images of current tropical storms Dennis, Emily and Cindy, or any current cyclone in the Atlantic or Pacific Ocean.

Visit: http://cimss.ssec.wisc.edu/tropic/tropic.html

--more--

Velden says the new tools are designed to shed light on two of the biggest unknowns about tropical cyclones: Where they originate and how they gather and lose intensity. Just in the past five years, satellite technology has improved forecasting of the path of storms, but estimating their power has been difficult.

One new product introduced this year, called Wavetrak, combines data from five different satellites to create a 10-day movie loop of atmospheric waves sweeping out of central Africa, the birthplace of cyclones. Wavetrak is designed to study the atmospheric waves that act as a conveyor belt for conditions that cause cyclones.

"We're grappling with how and where these waves originate, because about one in every ten will form into a named tropical storm," Velden says. "This shows us the amplitude and strength of these waves as they come off Africa and into the Atlantic."

Wavetrak, created by Velden and research intern Jason Dunion, gives scientists a complete picture of a cyclone – from its birth over central Africa, growth across the Atlantic and eventual fizzling out. It shows the succession of atmospheric waves moving along "like cars on a train."

The technology has great benefit in seeing the genesis of storms. "It gives us an idea of exactly where they initiate over the African continent and their convective structure as they track over the ocean."

On the question of measuring tropical cyclone intensity, the CIMSS team has a number of products in use by forecasters. One product is helping provide a better handle on wind shear, an important predictor of intensity.

Wind shear is essentially the difference in speed between high-level and low-lying winds. A strong wind shear will slice the tops off of cyclones and slash their power. The CIMSS site provides a multi-colored map, which uses high-resolution satellite observations updated every 3 hours, that shows the levels of wind shear across the Atlantic.

It gives forecasters a highly visual record of wind shear patterns that will either break up or add fuel to a storm. Velden says scientists want to pinpoint the thresholds of wind shear effects, good or bad, on cyclones.

--more--

Other CIMSS tools to track hurricane intensity include:

-- The Objective Dvorak Technique. In use for the first time this year, this algorithm provides atmospheric scientists with their first automated satellite-based tool for estimating hurricane intensity. It runs the multitude of satellite images available through an object-recognition scheme that produces an updated intensity in minutes. "This helps take the human guesswork out of it, and makes it totally computer-based," he says.

-- The Advance Microwave Sounding Unit (AMSU). By using microwave transmissions, this product has the ability to penetrate cloud cover and record the unique temperature signatures of hurricane cores. Intensity closely correlates with the temperature around the center of the storm, and AMSU provides color-coded images of hotspots.

-- Super-rapid scanning. Using satellite images taken every 60 seconds, compared to every 15 minutes, motion pictures can be created with precise detail of a storm. These special scans have to be requested by hurricane forecasters 24 hours in advance because of the amount of data being collected.

Velden says CIMSS is working to eventually combine satellite-based data with information from radar and aircraft to produce storm images in three dimensions. Such a tool could lead to more accurate forecasts and, ultimately, greater public safety.

"We develop these tools in tandem with the forecasters," Velden says. "They know what they're looking for from us to aid the forecasting problem."

CIMSS is part of UW-Madison's Space Science and Engineering Center, which specializes in atmospheric studies of earth and other planets. It is supported by NASA and the National Oceanic and Atmospheric Administration.

###

--- Brian Mattmiller, (608) 262-9772

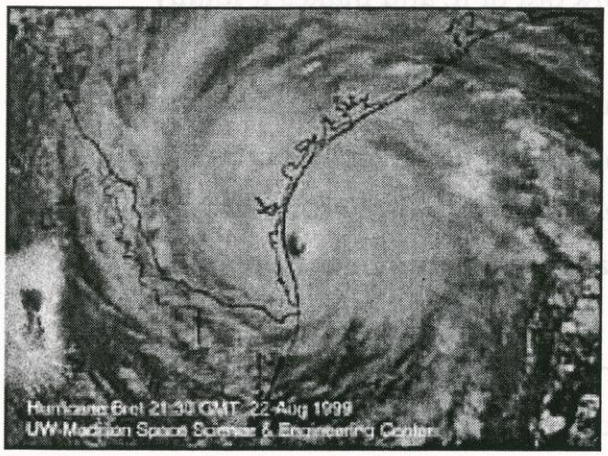
UW-MADISON

# PHOTO RESOURCES

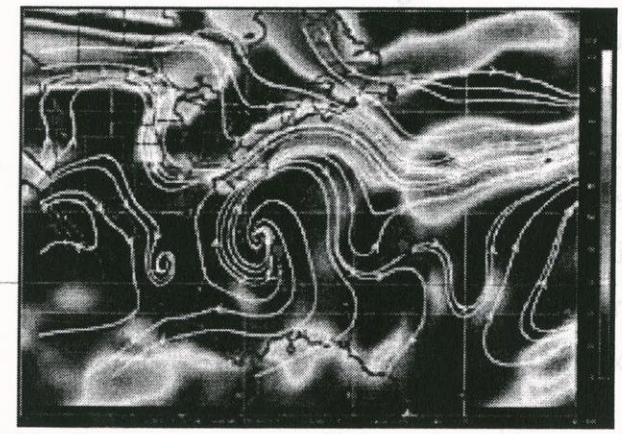
## News and Public Affairs

The thumbprints below have an accompanying high-resolution (170 dpi) JPEG version for use in print publications.

Please contact Nick Weaver at (608) 263-9141, jnweaver@facstaff.wisc.edu with any questions or additional requests regarding these images.




**Caption:** A multi-channel satellite image composite of Hurricane Bret.
**Images courtesy:** Space Science and Engineering Center
**Date:** 8/99
High Resolution JPEG 170 DPI



**Caption:** An example of the vertical wind shear field over the Atlantic including tropical cyclones Cindy, Dennis and Emily (red icons). Wind shear has a major impact on tropical cyclone intensity.
**Images courtesy:** Cooperative Institute for Meteorological Satellite Studies
**Date:** 8/99
High Resolution JPEG 170 DPI

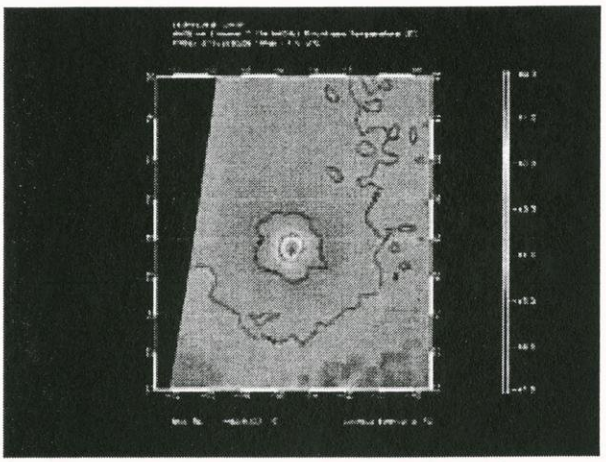
**Downloading these images**
You can download these images to your computer by either of the following methods:

**1)** move your mouse cursor over the high resolution text link for the image, hold down your mouse button (right button if you're using Windows) and select "Save this link as" ("Download this link as" in Internet Explorer) from the pull down menu;

**2)** click on the high resolution image to view its larger version, move the mouse cursor over the image, hold down your mouse button (right button if you're using Windows) and select "Save this image as" ("Download this image as" in Internet Explorer) from the pull down menu.

These directions may vary slightly depending on the browser software and operating system you are using.

**Caption:** An image from the Wavetrak product over the Atlantic, showing a satellite mosaic of infrared imagery and winds tracked from successive images. Dennis, Cindy and Emily all appear.
**Images courtesy:** Cooperative Institute for Meteorological Satellite Studies
**Date:** 8/99
High Resolution JPEG 170 DPI
Most recent version of this image



**Caption:** An example of the Advanced Microwave Sounding Unit, which can visualize temperatures within a storm. This image shows the warm thermal anomaly (in orange/yellow) in Hurricane Cindy. Temperature strongly correlates with the strength of a storm.
**Images courtesy:** Cooperative Institute for Meteorological Satellite Studies
**Date:** 8/99
High Resolution JPEG 170 DPI
Most recent version of this image

Res-
Meteorology

THE WISCONSIN WEEK WIRE - September 1, 1999
for UW-Madison faculty and staff
(Full issue: http://www.news.wisc.edu/wire/01-Sep-1999/ )

==========

The Wisconsin Week Wire is now delivered weekly. For updates of campus news as it happens and for the full content of Wisconsin Week's print edition, check our redesigned web site: http://www.news.wisc.edu/wisweek/

TOP NEWS
- o Study details genetic basis of aging
- o Physics team studies atomic life at 'absolute zero'
- o Convocation today features adventurer

RESEARCH
- o Tools sharpen focus on hurricanes

ON CAMPUS
- o Bliss-whirling at Union Theater
- o Fall blood drive gets underway
- o Events calendar: http://calendar.news.wisc.edu

NEWS IN BRIEF
- o Construction: Fluno project advances
- o Changes: New ID for PD
- o Notable: Department marks 50 years with volunteer work
- o Backward glance: 10 years ago in Wisconsin Week

RESOURCES
- o Automated e-mail eases course communication
- o Instructional technology grants available

NEWSMAKERS
- o Sports Illustrated: UW leads Big Ten in women's sports
- o More newsmakers: http://www.news.wisc.edu/inthenews/

UW-ELSEWHERE: NEWS FROM AROUND THE SYSTEM
- o Recent news from River Falls, Superior and Eau Claire

TIP
- o Training available for biological materials shipping

(Full issue: http://www.news.wisc.edu/wire/01-Sep-1999/ )

==========

---

*Top news*

STUDY DETAILS GENETIC BASIS OF AGING
University scientists have, for the first time, profiled specific genetic changes during the aging of experimental animals, a discovery that could aid work to extend life span and preserve health. The work conducted with mice combines a powerful new genetic technique with dietary restriction, the only known way to delay the aging process.
Full story: http://www.news.wisc.edu/wisweek/view.msql?id=1210

PHYSICS TEAM STUDIES ATOMIC LIFE AT 'ABSOLUTE ZERO'
With a lab full of lasers to corral and chill atoms, physicist Thad Walker is plunging into the frigid domain of "absolute zero." It's not just cold there. It's weird. In this chilly climate, physics professor Walker and his team of "atom trainers" work to ultimately control the behavior of atoms -- the physics equivalent of transforming a heavy-metal mosh pit into a military parade.
Full story: http://www.news.wisc.edu/wisweek/view.msql?id=1184

CONVOCATION TODAY FEATURES ADVENTURER
Arctic explorer Alvah Simon will give the Chancellor's Convocation address to new students today (Sept. 1) at 2 p.m. in the Kohl Center. Simon, author of "North to the Night: A Year in the Arctic Ice," will talk about his experiences surviving five months of isolation on his 36-foot sailboat high above the Arctic Circle. Faculty and staff are welcome to attend the free event.

---

*Research*

TOOLS SHARPEN FOCUS ON HURRICANES
A fleet of powerful new visualization tools is giving forecasters an unprecedented look into the anatomy of typhoons and hurricanes, helping refine early-warning systems and dissecting some of the forces that create, fuel and steer these dangerous storms. Several new hurricane forecasting methods developed at UW-Madison that are in daily use at the National Hurricane Center in Miami and the Joint Typhoon Warning Center in Pearl Harbor.
Full story: http://www.news.wisc.edu/wisweek/view.msql?id=1214

*On Campus*
(Events calendar: http://calendar.news.wisc.edu)

BLISS-WHIRLING AT UNION THEATER
Tibetan Buddhist nuns of Khachoe Ghakyil Nunnery in Kathmandu, Nepal, will present "Women's Freedom and Spiritual Liberation: An Evening of Sacred Performance" at Memorial Union Theater at 7:30 p.m. Wednesday, Sept. 8. Tickets: $12 adults, $8/students, seniors, children. Information: 262-2201.
Full story: http://www.news.wisc.edu/wisweek/view.msql?id=721

FALL BLOOD DRIVE GETS UNDERWAY
The Red Cross and the UW will kick off a semester of giving the gift of life with the All Campus Blood Drive. The blood drive will run Thursdays and Fridays while classes are in session, beginning Sept. 2-3. Room 302, Union South, 10 a.m. to 4 p.m. Appointments: 227-1357.

*News in brief*

CONSTRUCTION: FLUNO PROJECT ADVANCES
A "topping out" ceremony - the tradition of placing an evergreen tree on top of a new construction project when it reaches its highest point - will be held today (Wednesday, Sept. 1) at the Fluno Center for Executive Education at UW-Madison. The ceremony is for invitees only. The $24 million, eight-floor building taking shape on University Avenue will be the primary site for the Executive Education program of the School of Business. The Fluno Center for Executive Education is now scheduling programs to be held starting in March 2000.

CHANGES: NEW ID FOR PD
Since 1976, campus law enforcement has been known as University Police and Security -- "P & S" for short. The name officially changes today (Wednesday, Sept. 1) to University of Wisconsin-Madison Police Department, or UWPD. Police Captain Dale Burke asks the university community to revise mailing lists and other references to the department to reflect the new name.

NOTABLE: DEPARTMENT MARKS 50 YEARS WITH VOLUNTEER WORK
The Department of Engineering Professional Development is celebrating not only 50 years of continuing education but also, through several volunteer projects, its community ties. The service projects are a way of saying thank you to the community for its longtime support of the department's outreach mission, says EPD Chair Phil O'Leary. "We felt that as a group we had many capabilities that could be used to benefit the community," he says.

BACKWARD GLANCE: 10 YEARS AGO IN WISCONSIN WEEK
Frautschi Point will be preserved thanks to an arrangement that transfers the land to the university. ... Fall enrollment is expected to be 42,600, a drop of about 1,000. ... Office paper recycling is getting underway campuswide following a successful pilot project. ... Two scholars have produced a book of instructional strategies for teaching assistants.

---

*Resources*

AUTOMATED E-MAIL EASES COURSE COMMUNICATION
Faculty members and TAs can quickly and easily communicate with their students using an automated email distribution list based on course enrollment. The Classlist service from DoIT is fast, requires no address maintenance, and it's free. Using Registrar data throughout the semester, Classlist automatically updates e-mail distribution lists for your courses. To set up the Classlist, you submit forms through the Web or by e-mail.
For more see: http://wiscinfo.doit.wisc.edu/euc/classlist/

INSTRUCTIONAL TECHNOLOGY GRANTS AVAILABLE
A new grant called Web Works is available to UW-Madison faculty and instructional staff who wish to incorporate instructional technology more fully into their curriculum. Grant recipients will be offered customized training classes, as well as the option of hiring an assistant from a pool of 15 students training in instructional technology support. Any UW-Madison faculty or instructional staff member teaching courses is eligible to apply.
For more information:
http://www.wisc.edu/learntech/grants/webworks.htm

---

*Newsmakers*

SPORTS ILLUSTRATED: UW LEADS BIG TEN IN WOMEN'S SPORTS
http://cnnsi.com/siforwomen/issue_three/jock_schools/main/

More newsmakers: http://www.news.wisc.edu/inthenews/

---

*UW-Elsewhere: News from around the system*

RIVER FALLS: Chancellor Gary A. Thibodeau will retire by the start of the 2000 academic year. He has been diagnosed with colon cancer and says the health condition influenced his decision.

SUPERIOR: Richard Stewart will direct the university's new Superior Transportation Center.
http://www.uwsuper.edu/news/stories/center.htm

EAU CLAIRE: U.S. News & World Report has named UWEC as one of the best public regional universities in the Midwest.
http://www.uwec.edu/Admin/NewsBureau/release/current/082099us_news.html

---

*Tip*

TRAINING AVAILABLE FOR BIOLOGICAL MATERIALS SHIPPING
If your office ships biological materials, check out training and certification from the Office of Biological Safety. The U.S. Department of Transportation requires that all persons involved in shipping hazardous materials in commerce be trained and certified in proper handling of these materials. For information on training sessions, call 263-9026.

**ANOTHER PIECE FOUND IN MATTER-ANTIMATTER PUZZLE**

Using the world's highest-energy proton beam at the Fermi National Accelerator Laboratory in Batavia, Ill., three UW-Madison scientists were among 85 researchers from 12 institutions whose recent experiments helped peel away some of the mystery surrounding the relationship between matter and antimatter.

Physics professor Albert Erwin, assistant scientist Theodoros Alexopoulos and physics graduate student Ashkan Alavi-Harati were part of a team that reported Wednesday, Feb. 24, the discovery of an entirely new type of inequality between matter and antimatter.

First discovered in 1932, antimatter is an important constituent of the Standard Model of physics, which holds that every particle of matter has a corresponding antiparticle of antimatter. The antimatter counterpart of the electron, for example, is the positron.

The new result is of interest because it helps flesh out a model that may help explain what physicists call charge-parity violation, their name for nature's apparent preference for matter over antimatter. The latest result is the observation of direct charge-parity violation, providing a framework of evidence against which to test a model of physics that accounts for the phenomenon.

**BLAME THE BERMUDA HIGH**

La Nina may get the attention, but if forecasts of unusually wild weather this spring come true, lesser-known forces like "zonal jet streams" and "Bermuda highs" will be responsible.

UW-Madison weather expert Thomas Achtor says the lesser-known phenomena triggered this unseasonably mild winter and may also bring strong storms this spring.

Achtor, a senior research program manager with the Space Science and Engineering Center, said La Nina years typically bring colder-than-normal temperatures to central and eastern North America. La Ninas are defined by a sharp cooling of water in the central equatorial Pacific — the opposite of El Nino conditions the year before.

A stronger than normal "Bermuda high," or an anticyclone that funnels warm, moist air inland from the Atlantic Ocean, is also keeping things interesting. Combined with the zonal jet stream, this could pump unusually high amounts of moisture into already volatile conditions. "The strength of these two systems means we will likely see a very active storm season with more precipitation that normal," says Achtor, who with others at SSEC track global weather patterns through the Cooperative Institute for Meteorological Satellite Studies.

**UP TO SOME SKULL-DIGGERY**

Staff from UW-Madison's Geology Museum and area K-12 teachers recently cracked open the protective plaster casing surrounding the two-and-a-half-foot skull of a mosasaur, a giant marine lizard that cruised the oceans of Earth 80 million years ago.

The local teachers, part of a training program supported by the Howard Hughes Medical Institute, have been learning about paleontology in the field and how to apply that knowledge to improve science teaching in the classroom.

The mosasaur was a contemporary of the dinosaurs. The fossil was collected several summers ago in northwest Kansas by museum staff. Once prepared, the fossil skull will be on long-term loan to Monona Grove High School.



# Detector in polar ice to hunt for neutrinos

Terry Devitt

The hunt for the cosmic neutrino is on. This winter, after an extensive shakedown period, the Antarctic Muon and Neutrino Detector Array or AMANDA, a novel telescope set kilometers deep in the ice at the South Pole, began its search for the ghost-like cosmic neutrino. The nearly massless particle is rocketed through space, scientists think, by supernovas, black holes, quasars, gamma ray bursts and whirling neutron stars.

Unlike any other astronomical telescope ever built, AMANDA is not a telescope in the conventional sense. It is composed of 422 basketball-sized glass orbs, photomultiplier tubes arranged on cables and sunk deep into the ice in concentric rings.

The device looks down through the Earth and is designed to catch the fleeting signals left by cosmic neutrinos, high-energy particles that are believed to emanate from objects deep in space and whose bizarre properties permit them to pass through entire planets without skipping a beat.

If AMANDA successfully detects cosmic neutrinos and traces their paths back to the objects from which they come, it will open a new window to the universe, permitting scientists to study some of the most intriguing phenomena in the cosmos, according to Francis Halzen, a UW-Madison scientist who helped develop the telescope.

"We've spent over a year understanding

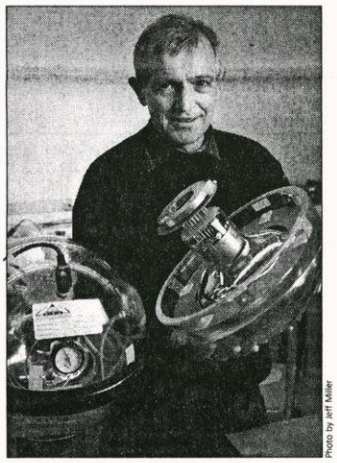


Photo by Jeff Miller

Francis Halzen, a UW-Madison scientist who helped develop AMANDA, shows the inside of one of the 422 basketball-sized glass orbs, called photomultiplier tubes, used to catch the fleeting signals left by high-energy neutrinos.

the idiosyncratic nature of this instrument," says Halzen. "Nobody's ever built anything like this before."

AMANDA was built with extensive support from the National Science Foundation and in collaboration with other institutions in Europe and the United States.

The AMANDA telescope works by detecting the fleeting flashes of blue light created by muons, particles created when neutrinos occasionally collide with other subatomic particles called nucleons. The muon's flash of light creates a bow wave much like that made by a boat in water. In theory, the bow wave will point back to the source from which the neutrino comes. The deep Antarctic ice is crystal clear and, at great depths, is free of air bubbles and nearly free of other imperfections. It serves as an ideal medium in which to look for the rare signals left by the billions of neutrinos that continuously pass through the Earth.

To detect these signals, AMANDA looks down through the Earth to suspected neutrino sources in the sky of the Northern Hemisphere.

"If something emits a lot of gamma rays, it's a good bet there are a lot of neutrinos there," says Robert Morse, a UW-Madison physicist who has spent years helping oversee the construction of AMANDA.

Suspected sources include black holes, the remains of supernovas, and neutron stars, planet-sized, burned out husks of stars that spin at amazing speeds. Other potential sources are what scientists call active galactic nuclei, things like quasars and blazers, extremely bright and energetic objects at the centers of distant galaxies.

What all of these objects have in common, says Morse, is that they act like enormous versions of the accelerators scientists build on Earth to study high-energy, subatomic particles. They also are at great distances from Earth.

In conventional forms of astronomy, the photon, the particle that makes up visible light and other parts of the electromagnetic spectrum, is what is sampled by telescopes on remote mountaintops, satellites and radio telescopes. But photons can be deflected and absorbed as they traverse space and encounter interstellar dust and pockets of gas and radiation. The cosmic neutrino, on the other hand, is unhindered by such obstacles.

The tradeoff, says Morse, is that neutrinos are very hard to detect. Moreover, the sun and cosmic rays crashing into the Earth's atmosphere also make neutrinos, creating a soup of high-energy particles. But neutrinos from different sources, whether the sun or from a distant black hole, have defining characteristics that would permit scientists to identify the particles of interest.

"It's like a police line-up," says Morse. "They have to pass the test."

Over the past year, the AMANDA telescope has been tuned and tested and has succeeded in sampling neutrinos, but not the cosmic neutrinos of interest.

"We've gotten the apparatus tuned up to the point that what we're seeing really are neutrinos," Halzen says. "But the majority of the neutrinos we've seen are atmospheric neutrinos. What we have to do now is pick out that one event out of 10 million."

Yet the neutrinos now being sampled by AMANDA are the highest energy neutrinos ever detected, according to Albrecht Karle, a UW-Madison physicist. And the muons they spawn are tracked in the AMANDA detector for distances of up to 400 meters through the crystal clear Antarctic ice.

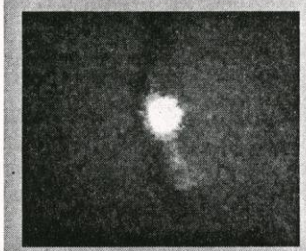
Constructed at a cost of $7 million over seven years, the AMANDA detector will nearly double in size next year with the addition of seven more strings, each with 48 photomultiplier tubes. The ultimate configuration, says Morse, is a proposed cubic kilometer detector of 80 to 100 strings with as many as 5,000 to 6,000 photomultiplier tubes.

"Neutrinos can bring us a message of the most violent and cataclysmic processes occurring at the very edge of the universe — colliding black holes, neutron stars and maybe even colliding galaxies," Morse says. "But it's very difficult to make the measurements. AMANDA, we think, is our best bet to do that." ■

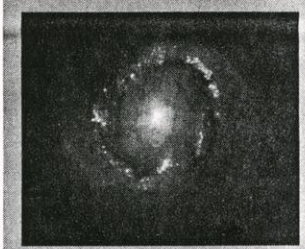
**What is AMANDA?**
AMANDA stands for Antarctic Muon and Neutrino Detector Array. A sort of telescope, it consists of strings of photomultiplier tubes sunk deep into the Antarctic ice using a hot-water drill. AMANDA is designed to detect the fleeting signatures of light left by cosmic neutrinos as they pass through the polar ice cap.

**What are neutrinos?**
Neutrinos are particles without electric charge and, as far as scientists know, they have no mass. Neutrinos are hard to find because their interaction with matter is extremely feeble, producing nothing more than a fleeting burst of light.

**Where do neutrinos come from?**
Scientists believe cosmic neutrinos are constantly bombarding the Earth from many distant sources, including:



**Black holes:** Massive black holes in the centers of galaxies swallow up most everything with huge gravitational pull.



**Other galaxies:** Supernovae, which are exploding stars, in distant galaxies are believed to emit neutrinos.

Courtesy NASA

**Quasars:** Quasars (quasi-stellar objects) have been enigmatic because they emit prodigious amounts of energy from a very compact source.

**Who cares?**
Scientists are searching for cosmic neutrinos because they promise insight into some of the most violent and enigmatic objects in the universe: black holes, supernovae and quasars. Finding the elusive particle would open a new realm of astronomy.

**Who pays?**
AMANDA is funded primarily by the National Science Foundation. UW-Madison and University of California-Irvine and UC-Berkeley have also made substantial contributions.

Res - Meteorology

THE WISCONSIN WEEK WIRE - March 17, 1999
for UW-Madison faculty and staff
(issue on Web at http://www.news.wisc.edu/wire/i031799/ )

==========

Selected stories from this issue of Wisconsin Week ...

FRONT PAGE
- o L&S career advising program slated for major upgrade
- o Service: A key in future UW learning
- o Frautschi Point cutting meant to restore oak savanna

PROFILE: Andrew Weiner
- o English professor masters art of interdisciplinary study

FEATURES
- o AMANDA: Detector in polar ice to hunt for neutrinos
- o 150 Years: La Follette Institute revives brainstorming between legislators and faculty

ISSUES
- o Report: Focus on grad education, faculty
- o Speech code vote called 'issue of common sense'
- o TAA, state to begin contract talks
- o Capitol capsule

RESEARCH
- o UW guardrail design could improve highway safety
- o Internet2 connection speeds data transfer
- o Research digest

CAMPUS NEWS
- o Firms quickly fill MGE innovation center
- o Retiring McGown nurtured Research Park to maturity
- o LeMoine, Mosse memorials set
- o Friends of UW-Madison Libraries sale offers 15,000 books
- o Newsmakers

ON CAMPUS
- o Visiting book artists to explore childhood memory
- o Asian American film directors visit campus
- o Chinese dissident Chai Ling to speak at Memorial Union
- o Former JAMA editor to address medical editing
- o Opera performs 'La Calisto'
- o Events calendar: http://calendar.news.wisc.edu

(issue on Web at http://www.news.wisc.edu/wire/i031799/ )

==========

*Front Page*

L&S CAREER ADVISING PROGRAM SLATED FOR MAJOR UPGRADE
The College of Letters and Science is upgrading its career services program to better serve the needs of the university's largest and most diverse group of students.
(Full story in Wisconsin Week, page 1)
http://www.news.wisc.edu/wire/i031799/caps.html

SERVICE: A KEY IN FUTURE UW LEARNING
Dean of Students Mary Rouse's appointment this week to lead UW-Madison's service initiatives highlights a growing priority in undergraduate education.
(Wisconsin Week, page 1)
http://www.news.wisc.edu/wire/i031799/service.html

FRAUTSCHI POINT CUTTING MEANT TO RESTORE OAK SAVANNA
When you're in the business of restoring lost landscapes, sometimes a chain saw is your best friend. That, at least, is the case when it comes to recreating oak savanna, as the UW Arboretum is now doing at Fraustchi Point on the west end of campus.
(Wisconsin Week, page 1)
http://www.news.wisc.edu/wire/i031799/frpoint.html

---

*Profile: Andrew Weiner*

ENGLISH PROFESSOR MASTERS ART OF INTERDISCILPINARY STUDY
Andrew Weiner has developed a record of fostering connections on campus as well as in the Spaightwood art gallery, 1150 Spaight St., that he runs with his wife, Sonja.
(Wisconsin Week, page 4)
http://www.news.wisc.edu/wire/i031799/weiner.html

---

*Features*

AMANDA: DETECTOR IN POLAR ICE TO HUNT FOR NEUTRINOS
The hunt for the cosmic neutrino is on. This winter, after an extensive shakedown period, a novel telescope set kilometers deep in the ice at the South Pole began its search for the ghost-like cosmic neutrino.
(Wisconsin Week, page 6)
http://www.news.wisc.edu/wire/i031799/amanda.html

150 YEARS: LA FOLLETTE INSTITUTE REVIVES
BRAINSTORMING BETWEEN LEGISLATORS AND FACULTY
A great tradition was revived this month as part of the Chancellor's Initiative. The La Follette Institute Policy Forums returned March 3 when a small group of faculty, staff and students met over dinner with interested legislators to discuss information technology policy, including issues of electronic commerce, archival retrieval and privacy.
(Wisconsin Week, page 5)
http://www.news.wisc.edu/wire/i031799/ci.html

*Issues*

REPORT: FOCUS ON GRAD EDUCATION, FACULTY
A new campus report, published as part of the 10-year campus reaccreditation, says the university must add graduate education and demands on faculty time to its four priorities adopted in 1995 as part of Chancellor David Ward's "A Vision for the Future."
(Wisconsin Week, page 16)
http://www.news.wisc.edu/wire/i031799/rp.html

SPEECH CODE VOTE CALLED 'ISSUE OF COMMON SENSE'
In a move that could be followed by universities and colleges nationwide, the Faculty Senate voted this month to essentially eliminate a controversial faculty speech code.
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/i031799/scode.html

TAA, STATE TO BEGIN CONTRACT TALKS
The Teaching Assistants' Association is seeking more pay for project and program assistants and health insurance for domestic partners as part of its 1999-2001 contract.
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/i031799/taa.html

CAPITOL CAPSULE
Budget review underway; building projects approved; first-day health coverage plan advances.
(Wisconsin Week, page 7)
http://www.news.wisc.edu/wire/i031799/capsule.html

---

*Research*

UW GUARDRAIL DESIGN COULD IMPROVE HIGWAY SAFETY
The guardrails along America's highways haven't changed much since the 1960s. But now, a UW-Madison engineer has developed a potentially safer guardrail made from glass fiber-reinforced polymers. The barrier is meant to better "capture" the wide range of vehicles on the market, from hulking 4-by-4s to the tiniest compact cars.
(Wisconsin Week, page 8)
http://www.news.wisc.edu/wire/i031799/grail.html

INTERNET2 CONNECTION SPEEDS DATA TRANSFER
The university's connection to Internet2 is up and running. I2 is a consortium of 90 primarily higher education research institutions seeking faster links to shared computing.
(Wisconsin Week, page 8)
http://www.news.wisc.edu/wire/i031799/i2.html

RESEARCH DIGEST
Another piece found in matter-antimatter puzzle; blame the Bermuda High for wild spring weather; area K-12 teachers are up to some skull-diggery.
(Wisconsin Week, page 6)
http://www.news.wisc.edu/wire/i031799/rd.html

*Campus News*

FIRMS QUICKLY FILL MGE INNOVATION CENTER
The new MGE Innovation Center will open Friday, March 19, with more than double its past building space. The latest University Research Park addition already has nearly a full house of tenants.
(Wisconsin Week, page 7)
http://www.news.wisc.edu/wire/i031799/mge.html

RETIRING MCGOWN NURTURED RESEARCH PARK TO MATURITY
Set to retire on June 30, Wayne McGown says his experience as both an early planner and long-term director of the park will be a particularly satisfying memory.
(Wisconsin Week, page 7)
http://www.news.wisc.edu/wire/i031799/mcgown.html

LEMOINE, MOSSE MEMORIALS SET
The life of the late Fannie LeMoine, professor of classics and comparative literature, will be celebrated Thursday, March 25, at 3:30 p.m. in the Memorial Union's Great Hall.
And a ceremony honoring the life and scholarship of George Mosse, Bascom-Weinstein Professor of Jewish Studies in the Department of History, has been scheduled for Sunday, March 28, at 11 a.m., also in Great Hall.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i031799/memorial.html

FRIENDS OF UW-MADISON LIBRARIES SALE OFFERS 15,000 BOOKS
Nearly 15,000 books on a wide range of subjects will be on sale in a fund-raiser for the Friends of the UW-Madison Libraries scheduled March 24-27.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i031799/booksale.html

NEWSMAKERS
Engineering professor Michael Corradini notes a decline in the nuclear power industry; Geneticist James Crow studies controversial calls for police databases of genetic fingerprints; bacteriology assistant professor Katrina Forest and others have high hopes for a new method of freezing embryos.
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/nm.html

---

*On Campus*
(Events calendar: http://calendar.news.wisc.edu )

VISITING BOOK ARTISTS TO EXPLORE CHILDHOOD MEMORY
Our relationship with memories will be the subtext of a visit by two internationally acclaimed artists who will be on campus this month.
(Wisconsin Week, page 9)
http://www.news.wisc.edu/wire/i031799/illus.html

ASIAN AMERICAN FILM DIRECTORS VISIT CAMPUS
Four Asian American filmmakers will bring their most recent works to campus March 27-28.
(Wisconsin Week, page 10)
http://www.news.wisc.edu/wire/i031799/asiafilm.html

CHINESE DISSIDENT CHAI LING TO SPEAK AT MEMORIAL UNION
Chinese dissident Chai Ling will speak at the Wisconsin Union Theater on the University of Wisconsin-Madison campus, Thursday, March 25, at 7:30 p.m.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i031799/chailing.html

FORMER JAMA EDITOR TO ADDRESS MEDICAL EDITING
George Lundberg, former editor-in-chief of The Journal of the American Medical Association, will speak on "The Ethics of Medical Editing" from 7:30-9 p.m. Monday, March 29, at 1100 Grainger Hall.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i031799/jamaed.html

OPERA PERFORMS 'LA CALISTO'
This spring's University Opera production of Francesco Cavalli's "La Calisto," to be staged March 25 and 27, will be a showcase for many developing opera singers on campus.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i031799/opera.html

The Wisconsin Week Wire: Vol. III (No. 5)
---

Res-
Meteorolog

March 15, 1999

TO: Editors, news directors
FROM: Terry Devitt (608) 262-8282; trdevitt@facstaff.wisc.edu
RE: High-Flying Atmospheric Science Photo Opportunity

Once again Wisconsin and nearby states will be a satellite-sensor proving ground as NASA and Wisconsin scientists conduct a series of high-flying experiments here using a NASA ER-2, a converted U-2 spy plane. The experiments will focus on testing a suite of instruments that will be deployed on future satellites, including polar-orbiting weather satellites and research satellites that will be launched as part of NASA's Earth Observing System.

The visiting ER-2, which last visited Madison in 1997, will be based at Truax Field where the aircraft and other equipment will be supported by the 115th Fighter Wing of the Wisconsin Air National Guard.

The ER-2 is capable of climbing as high as 12 miles, above 95 percent of the atmosphere, making it an ideal platform from which to test instruments that will look down on the Earth from space. The experiments are built around a suite of sensors designed to remotely sample clouds, atmospheric temperatures and moisture, and the Earth's surface. Of special interest will be observations of winter storm fronts and their interacting masses of air, and tests of instruments' ability to sense clouds against the backdrop of a snow-covered Earth. Flights of the aircraft will originate in Wisconsin but will extend to nearby states and north to Canada.

Wisconsin media are invited to view the aircraft and its scientific payloads from 11 a.m.-12:30 p.m, Friday, March 19 at Truax Field. Enter through the main gate at 3110 Mitchell St. There will be no formal press briefing, but scientists from UW-Madison's Space Science and Engineering Center will be on hand to explain their work and describe the instruments being tested.

For more information, contact Terri Gregory at (608) 263- 3373; terri.gregory@ssec.wisc.edu

Res - Meteor

THE WISCONSIN WEEK WIRE - January 13, 1999
for UW-Madison faculty and staff
(issue on Web at http://www.news.wisc.edu/wire/i011399/ )

==========

Selected stories from this issue of Wisconsin Week ...

FRONT PAGE
- o Sesquicentennial week looks to UW's future
- o Chancellor approves plan to add 32 faculty
- o Professor takes on death row appeal

PROFILE: Peter Gorman
- o Passion for 'trance music' animates automation librarian

FEATURES
- o 150 years: Feb. 7 concert recalls landmark visit by Ellington
- o 150 Years: Invent an ice cream for the sesquicentennial
- o Postcards from Pasadena

RESEARCH
- o NASA-funded consortium to bring space age forecasts to farm, forest

CAMPUS NEWS
- o UW staff clear snow with safety, environment in mind
- o Three diversity plan hearings scheduled on campus
- o Code of conduct forum set for Jan. 26
- o $12 million raised to support graduate fellowships
- o UW-Madison is no. 1 In current Peace Corps volunteers
- o ISIS transition continues through spring
- o Who knew? (Answers to your questions)

ON CAMPUS
- o Sesquicentennial series focuses on campus environment
- o Ceramic sculpture greets visitors to UW hospital
- o Events calendar: http://calendar.news.wisc.edu

(issue on Web at http://www.news.wisc.edu/wire/i011399/ )

==========

---

*Front Page*

SESQUICENTENNIAL WEEK LOOKS TO UW'S FUTURE

Clear your calendars for Feb. 8-12. It's UW-Madison's 150th birthday week, and you're invited to the party! Be sure to check the next issue of Wisconsin Week, published Wednesday, Jan. 27, which will feature detailed information about the week of sesquicentennial events by and for faculty, staff and students. The week is organized around the theme, "Building on Excellence: Creating Our Future."

(Full story in Wisconsin Week, page 1)

http://www.news.wisc.edu/wire/i011399/sesquiweek.html

Sesquicentennial Web site:
http://www.uw150.wisc.edu

CHANCELLOR APPROVES PLAN TO ADD 32 FACULTY
Twelve faculty hiring proposals spanning the biological, physical and social sciences and humanities have been approved by Chancellor David Ward in the first round of the Sesquicentennial Hires program.
(Wisconsin Week, page 1)
http://www.news.wisc.edu/wire/i011399/hires.html

PROFESSOR TAKES ON DEATH ROW APPEAL
At Holman Correctional Facility, just north of the Florida panhandle in Atmore, Ala., Jeffrey Day Rieber waits to die - and some Madison lawyers, UW-Madison law students and a law professor are laboring to prevent his death.
(Wisconsin Week, page 1)
http://www.news.wisc.edu/wire/i011399/fturk.html

---

*Profile: Peter Gorman*

PASSION FOR 'TRANCE MUSIC' ANIMATES AUTOMATION LIBRARIAN
Automation librarian Peter Gorman manages to gracefully integrate computers, Old Icelandic language and old-time music into a single life.
(Wisconsin Week, page 4)
http://www.news.wisc.edu/wire/i011399/gorman.html

---

*Features*

150 YEARS:
FEB. 7 CONCERT RECALLS LANDMARK VISIT BY ELLINGTON
As part of a weeklong residency at UW-Madison in 1972, Duke Ellington composed "The U-Wisc Suite," which the UW Jazz Ensemble will perform as part of the university's 150th Anniversary Concert Sunday, Feb. 7 at 1 p.m. The date coincides with a week of festivities commemorating the first UW classes in 1849.
(Wisconsin Week, page 5)
http://www.news.wisc.edu/wire/i011399/concert.html

150 YEARS:
INVENT AN ICE CREAM FOR THE SESQUICENTENNIAL
The university is sponsoring a statewide contest to create an ice cream flavor commemorating UW-Madison's sesquicentennial. Visit the web address below to send in your flavorful ideas.
(Wisconsin Week, page 5)

http://www.uw150.wisc.edu/projects/icecream.msql

POSTCARDS FROM PASADENA
Browse through a collection of images and stories that were updated daily on the UW-Madison web site during Rose Bowl week.
(Wisconsin Week, page 12)
http://www.news.wisc.edu/rosebowl/

---

*Research*

NASA-FUNDED CONSORTIUM TO BRING SPACE AGE FORECASTS TO FARM, FOREST
A new, NASA-funded research initiative, combining expertise from universities, industry, and state and federal government promises to bring space age technology to farm and forest in the Upper Midwest.
(Wisconsin Week, page 6)
http://www.news.wisc.edu/wire/i011399/nasaeos.html

---

*Campus News*

UW STAFF CLEAR SNOW WITH SAFETY, ENVIRONMENT IN MIND
As snow continues to blanket the campus, university officials are continuing to improve snow removal efforts to ensure public safety while protecting the environment.
(Wisconsin Week, page 6)
http://www.news.wisc.edu/wire/i011399/salt.html

THREE DIVERSITY PLAN HEARINGS SCHEDULED ON CAMPUS
UW-Madison's proposed plan to increase diversity over the next decade will be the subject of three upcoming public hearings. The first hearing for the Plan 2008 draft report is Tuesday, Jan. 26 from 4:30-6:30 p.m. at Memorial Union. Two other hearings are scheduled for Feb. 2 from 2:30-4:30 p.m. in Bascom Hall and Feb. 3 from 2:30-4:30 p.m. in Union South.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i011399/plan2008.html

CODE OF CONDUCT FORUM SET FOR JAN. 26
UW-Madison will hold its second public forum Tuesday, Jan. 26 on a proposed code of conduct for manufacturers of university apparel and other merchandise.
(Wisconsin Week, page 2)
http://www.news.wisc.edu/wire/i011399/code.html

$12 MILLION RAISED TO SUPPORT GRADUATE FELLOWSHIPS
Individuals and companies donated more than $12 million this past year to a new program, Wisconsin Distinguished Graduate Fellowships, that will help the university gain a significant

advantage in the heated competition for the nation's best and brightest graduate students.
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/i011399/grad.html

UW-MADISON IS NO. 1 IN CURRENT PEACE CORPS VOLUNTEERS
The university has the largest number of currently serving Peace Corps volunteers in the nation, according to a new ranking of colleges and universities.
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/i011399/pcorps.html

ISIS TRANSITION CONTINUES THROUGH SPRING
The implementation of the new student records system at UW-Madison continues as planned and should be completed by late spring.
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/i011399/isis.html

WHO KNEW? (Answers to your questions)
Please send your questions by e-mail to wisweek@macc.wisc.edu
o Where was the old ski jump on campus?
o Is there anywhere to go ice skating on campus?
(Wisconsin Week, page 3)
http://www.news.wisc.edu/wire/i011399/answers.html

---

*On Campus*
(Events calendar: http://calendar.news.wisc.edu )

SESQUICENTENNIAL SERIES FOCUSES ON CAMPUS ENVIRONMENT
"A Landscape for Learning," a spring-semester discussion series will bring together faculty and staff to discuss the environmental history and future of the UW-Madison campus.
(Wisconsin Week, page 7)
http://www.news.wisc.edu/wire/i011399/landscape.html

CERAMIC SCULPTURE GREETS VISITORS TO UW HOSPITAL
A bright new welcome awaits visitors just inside the main entrance to UW Hospital and Clinics. An original ceramic sculpture bursting with colorful images of people at play was recently installed in the entryway in honor of the hospital's 75th anniversary celebration next year.
(Wisconsin Week, page 8)
http://www.news.wisc.edu/wire/i011399/art.html

The Wisconsin Week Wire: Vol. II (No. 22)
---

## RESEARCH DIGEST

**LANDSCAPE MAY ALTER CLIMATE**

Greenhouse gases, the long-standing villains of climate change, may have a significant new partner in crime: wholesale changes to the world's landscapes by humans.

From the deforestation of the Amazon to the transformation of millions of acres of North American prairies to farmland, humans have remolded the surface of the Earth. Those changes, scientists now suspect, may have a significant influence on climate, changing regional weather patterns at least and possibly contributing to global shifts in climate.

Addressing scientists Tuesday, Dec. 8, in San Francisco at the fall meeting of the American Geophysical Union, UW-Madison climatologist Jonathan Foley said changes to the landscape, coupled with global increases in atmospheric carbon dioxide concentrations, could pack a one-two punch capable of remaking regional climates by altering patterns of rainfall and temperature.

In the past, climate-change scenarios have been linked primarily to the increasing concentrations in the world's atmosphere of the so-called greenhouse gases, carbon dioxide and methane, for example. But some scientists are now beginning to examine the influence on climate of the surface of the Earth and the collection of landscapes, such as forests, farmland and deserts that collectively make up what is known as the biosphere.

The biosphere, argues Foley, probably exerts an influence on climate that is equal to, and in some instances greater than, the accumulation of greenhouse gases. When humans alter landscapes on a massive scale, as has happened across the globe in the past 200 years as farms have replaced forests, basic patterns of climate are disrupted and change is set in motion.

**COLDS TRIGGER ASTHMA**

About 85 percent of severe asthma attacks are triggered by a viral respiratory infection. "Respiratory infections are the number one reason patients get attacks of asthma, wind up in the emergency room and are hospitalized," says William W. Busse, professor of medicine and head of the allergy and immunology section at the Medical School.

Recently, the National Institutes of Health awarded Busse and his research team a new $1.4 million grant to determine how respiratory viruses trigger the development of asthma or cause people who already have the disease to wheeze and cough.

Busse's team will focus on the common cold virus because it has been shown to be associated with worsening of asthma. Researchers will study how the rhinovirus sets up a chain of events that cause certain cells to travel to the airway and produce an inflammatory response that can persist for weeks.

**STUDENT-LED FUSION PROJECT WOWS SCIENTIFIC COMMUNITY**

A unique student-staffed fusion project in UW-Madison's College of Engineering is generating excitement in the physics community.

The project, called the Pegasus Torroidal Experiment, produced this year its first plasma — an ionized gas used to store energy and create a fusion reaction — faster than the field has seen before. Scientists from England, Russia and the U.S. sent congratulations on the feat.

What's equally remarkable is this project relies heavily on student researchers, who organize and execute all stages. For a glimpse into this grass-roots fusion effort, check "headlines" on the engineering web site, http://www.engr.wisc.edu/coe/headlines/1998 /Nov16.html.

# Maps give new view of world and cosmos

Terry Devitt

Purchased from a Koryak shaman in Siberia 100 years ago, the coat of softened reindeer skin is decorated with what was long thought to be a random design of bleached-hide disks. Only recently has the covey of disks been assigned what may be its true meaning: a sky map representing the constellations familiar to the Koryak.

This remarkable coat — as well as stick charts from the Marshall Islands, a Lukasa memory board from the Congo and an arrangement of knotted strings left by the Inca — represents an indigenous view of place, the subject of the latest volume in the massive *History of Cartography* project.

"This volume opens up the question of maps in non-Western societies," says David Woodward, a professor of geography and the co-editor of the multi-volume *History of Cartography* published by the University of Chicago Press.

"Here we have a whole volume about what many people wouldn't think of as maps because they look so different from Western ways of representing the world," Woodward says. "It is really overturning the whole idea of a map."

Instead of the measured, geometric representation of the world embodied in Western maps, charts and globes, indigenous societies often transcend the scientific measurement of the earthly or cosmological through such things as dance, calendrical art, chants and mnemonic devices such as the Lukasa memory board, a configuration of beads and cowrie shells signifying the locations of lakes, trees, spirit capitals and migration routes.

Such "maps" have different forms and functions than the purely cartographic purposes of traditional Western maps, according to Woodward.

Frequently, indigenous cultures view the physical landscape and universe as much more than a passive backdrop for human affairs. For instance, like the Koryak dancing coat with its summer and winter star maps, traditional cartography has a strong connection with shamanism and mystical knowledge.

Another important difference, says Woodward, is that indigenous maps frequently measure distance in time rather than space. Thus, travel is charted as the number of days it takes to arrive at a destination rather than miles or kilometers.

Like early Western maps, indigenous cartography has a tendency to place the well known prominently in the center, relegating the unfamiliar to the margins.

But there are some indigenous maps, notes Woodward, that have virtually nothing in common with Western concepts. Examples are the stick maps used only by the people of the Pacific Marshall Islands.

Made from coconut fronds lashed to an open frame, and using shells to denote islands, the maps were never carried on the great ocean-going canoes. Instead, they were simply consulted before a voyage or used to teach the principles of swell patterns, a navigational technique that can predict the presence of an island by noting changes in the regular ocean swells.

The common purpose of these indigenous cartographic devices — whether it be an Aztec codex, an Australian Aboriginal bark painting or a Marshall Islands stick chart — is to depict a people's spatial knowledge of the world, Woodward says. But in addition, he says, they serve to remind us that there are other ways to view the world: "As soon as you go beyond the normal Western idea of a map — through a Koryak dancing coat or an Inca khipu — you get new insight and are able to see what rich forms of representation they truly are." ■

# The wisdom behind WISE

## Learning community boosts undergraduate women's success in the sciences

Brian Mattmiller

Imagine you are a first-year physical sciences major, your mind swimming with algebraic notations and atomic weights. Your calculus, chemistry and physics courses are packed with aspiring medical students all gunning for perfect GPAs. Your grueling study regime has you politely declining nights out with friends, and your neighbor's late-night stereo jam is slowly driving you nuts.

But let's add another stress: Let's say you're a woman, outnumbered in most science classrooms by about four-to-one. A sense of isolation may creep in, and for the first time you entertain the thought, "Maybe I chose the wrong path."

This is a common scenario in American higher education, where more than half of all young women who begin pursuing a career in science or engineering change majors in the first two years. By comparison, about two in three men continue on with their first-choice majors in those fields.

At UW-Madison, a program at Elizabeth Waters Hall is countering the trend. Called Women in Science and Engineering (WISE), the program creates a social network and common academic ground for about 100 undergraduate women.

"This has been a small, low-profile program, but we've seen some very dramatic results," says Caitilyn Allen, a plant pathology and women's studies professor who helped create WISE five years ago. "The social and structural support is the important part."

WISE women live together on two Liz Waters floors, and share discussion sections of core chemistry courses, which are required of virtually all science and engineering majors. The community has a range of social events that include dinners with faculty and academic games like "Science Olympiad" held on Sunday, Dec. 6.

Allen says bringing like-minded students together helps battle the isolation, dearth of female role models and chilly classroom climate many women encounter.

By some measures, it's proving its value. WISE students in 1997-98 had an average GPA of 3.39, while UW-Madison women overall averaged 2.98 and men averaged 2.88.

WISE house fellow Monica Awe, a junior in genetics and communication arts, says the learning community's success is almost entirely student-directed. "I think that's the biggest plus," she says. "When you bring similar people together, that networking is bound to happen. And it happens naturally, there's nothing forced about it." ■

Photo by Hannah Swacker

A student tests the electrical conductivity of a potato as part of a Science Olympiad held Sunday, Dec. 6, in Elizabeth Waters Hall, home of the Women in Science and Engineering learning community. The program has developed an educational and social network for women with a common goal: succeeding in a fiercely competitive field where they will be a minority.

# Group plans for future biology buildings

Brian Mattmiller

"Interactive" and "collaborative" should be themes for planning a new generation of biology buildings at UW-Madison, according to a committee responsible for strategic planning in biology.

The committee has recommended that three new buildings in the Henry Mall complex be constructed to pull together faculty from a variety of departments who share similar teaching and research interests. The new buildings are planned to promote interaction between departments and new opportunities for collaboration.

The Biological Sciences Strategic Planning Committee is part of UW-Madison's larger strategic planning effort that would guide decision-making for future campus buildings. Committee members are now looking for feedback on their plan from faculty, staff and students in biological sciences.

The proposed new buildings include Microbial Sciences, which would integrate the departments of bacteriology, medical microbiology and immunology, and food microbiology and toxicology. A second building would replace two old biochemistry wings and house biochemists, structural biologists and molecular biologists. A third building would provide an expanded home for geneticists, and provide a campuswide focus for cellular and developmental biology and neurobiology.

For more information, including the full text of the committee's report, visit http://www.neuroscience.wisc.edu/bsspc.htm). ■

Res-
Meteor

FOR IMMEDIATE RELEASE 12/8/98
CONTACT: Jonathan Foley (608) 265-5144, jfoley@facstaff.wisc.edu

# LIKE GREENHOUSE GASES, LANDSCAPE CHANGES MAY ALTER CLIMATE

SAN FRANCISCO - Greenhouse gases, the long-standing villains of climate change, may have a significant new partner in crime: wholesale changes to the world's landscapes by humans.

>From the deforestation of the Amazon to the transformation of millions of acres of North American prairies to farmland, humans have remolded the surface of the Earth. Those changes, scientists now suspect, may have a significant influence on climate, changing regional weather patterns at least, and possibly contributing to global shifts in climate.

Addressing scientists here today (Dec. 8) at the fall meeting of the American Geophysical Union, University of Wisconsin-Madison climatologist Jonathan Foley said changes to the landscape, coupled with global increases in atmospheric carbon dioxide concentrations, could pack a one-two punch capable of remaking regional climates by altering patterns of rainfall and temperature.

Such changes, he said, are reflected in a novel study of the Amazon Basin, the first to simulate the combined effects on regional climate of large-scale deforestation and increases in global concentrations of carbon dioxide in the atmosphere. The study was conducted by Marcos Heil Costa, now a professor at the University of Viçosa in Brazil and Foley, a UW-Madison professor of atmospheric and oceanic sciences.

"It's a safe bet to say that the future climate of the Amazon will be determined by deforestation and carbon dioxide concentrations," Foley said in an interview.

In the past, climate change scenarios have been linked primarily to the increasing concentrations in the world's atmosphere of the so-called greenhouse gases, carbon dioxide and methane, for example. But some scientists are now beginning to examine the influence on climate of the surface of the Earth and the collection of landscapes, such as forests, farmland, and deserts that collectively make up what is known as the biosphere.

The biosphere, argues Foley, probably exerts an influence on climate that is equal to, and in some instances greater than, the accumulation of greenhouses gases.

When you alter landscapes on a massive scale, as has happened across the globe in the past 200 years as farms have replaced forests, basic patterns of climate are disrupted and climatic change is set in motion.

In his study of the Amazon basin, for example, when forest is cleared and replaced with pasture or cropland, the hydrologic cycle, where rain is recycled back to the atmosphere through soil, trees and forest plants by the process of evapotranspiration. That process, said Foley, is essential to a landscape's ability to cool itself. Without it, as reflected in the

model developed by Costa and Foley, it acts together with increased atmospheric carbon dioxide concentrations to significantly warm the regional climate of the Amazon basin.

"If you were to cut down a big chunk of the Amazon and replace it with grasslands and pasture, the ability of that land to cool itself off is diminished," said Foley. "The dominating effect is cutting off evapotranspiration. Forest (landscapes) can cool themselves off by releasing water (to the atmosphere)."

Moreover, Foley noted that wholesale changes to the landscape can affect climate by altering the ability of the biosphere to store carbon dioxide. Forests and prairies, for example, have a far greater ability to store carbon dioxide than cornfields or pasture. With deforestation, these "sinks" are eliminated and the ability of the biosphere to absorb and store greenhouse gases like carbon dioxide is reduced.

The supercomputer-driven model used by Costa and Foley showed that a significant deforestation of the Amazon, combined with increased carbon dioxide levels, would reduce annual rainfall by as much as 20 percent. Such a reduction, in addition to environmental consequences, would have an impact on such things as Brazil's hydroelectric capacity, a primary source of power there.

The scale of change factored into the model of a deforested Amazon is unlikely to occur, said Foley, because many parts of the Amazon basin flood annually and are unlikely to be converted to farmland. However, he said the results are important because it demonstrates how altered landscapes can feed climate change.

###

-- Terry Devitt (608) 262-8282, trdevitt@facstaff.wisc.edu

Flying action figures? Barbie mobile homes?

Upon his debut in the holiday toy market a few years ago, a certain talking bear developed a reputation for frightening children under a certain age. Any adult looking at the bear's benign countenance no doubt was hard pressed to understand the terror the toy inspired; yet, many children displayed that very reaction. Clearly the age recommendations on the packaging are merely suggestions, not rules.

Res. - Meteorology

Given that, when might your child be ready for, say, a toy doggie that walks himself? A motorized dune buggy? And, under what conditions might parents consider a particular toy downright unsafe? Gay Eastman, UW-Madison child development specialist, can offer some perspective on holiday purchases. Call her at (608) 262-1115.
- Barbara Wolff, (608) 262-8292

---

Lake Michigan is a laboratory for winter experiment

This month and next, Lake Michigan will be one big laboratory for scientists in search of small, fleeting parcels of air. In a study known as the Lake-Induced Convection Experiment (Lake-ICE), scientists from UW-Madison and elsewhere will conduct an extensive study of small-scale convection, vertically-moving air parcels that are little understood, but have big implications for local weather and our ability to study and forecast it.

Scientists from several Midwestern universities and the National Center for Atmospheric Research will use planes, satellites and other instruments to study the small-scale features and to test models used to forecast the weather.

Lake Michigan presents a predictable, stationary and warm surface over which to study the vertical circulation of air, according to Ed Eloranta, a senior scientist at UW-Madison's Space Science and Engineering Center. The little air features he and his colleagues are interested in last only about a half hour and are hard to put into forecast models. But factoring them into the forecast equation is necessary for accuracy.

The experiment will focus on a swath of Lake Michigan extending from Muskegon, Mich., to Sheboygan, where Eloranta has deployed a Volume Imaging Lidar, an instrument that utilizes a pulsed laser beam to map the three-dimensional structure of the atmosphere over time. The experiment will run through Jan. 25. Eloranta is eager to see how the images his instrument makes can be used to verify model accuracy. UW-Madison's Greg Tripoli and Brad Hoggatt will test Tripoli's own forecast model on the small features and on a regional scale.

Watch the UW Lidar Web site for a link to operational news and experiment updates: http://lidar.ssec.wisc.edu/ For more information or to set up an interview, contact Terri Gregory at (608) 263-3373
- Terry Devitt, (608) 262-8282

---

Gone, but not forgotten (and not gone, either).

Dealing with the holidays after a loved one dies can be particularly painful for the survivors. However, Susan L. Schoenbeck, clinical associate professor in the UW-Madison School of Nursing, brings relief to the grieving with her book, The Final Entrance: Journeys beyond Life.

The book contains tales of near-death experiences, visits by the recently departed, out-of-body travels and more, which Schoenbeck has collected in more than 20 years as a nurse and director of residential nursing home care. Schoenbeck is happy to share her conclusions about what could happen when we die; contact her through her publisher (Prairie Oak Press), (608) 255-2288.
- Barbara Wolff, (608) 262-8292

---

[illegible]-university committee to advise on development of west campus

Res.
Meterology

1 • 8 • 4 • 8

# NEWS

UNIVERSITY OF WISCONSIN–MADISON

Office of News and Public Affairs
28 Bascom Hall • 500 Lincoln Drive
Madison, Wisconsin 53706-1380

Phone: 608/262–3571
Fax: 608/262–2331

EMBARGOED FOR RELEASE 4 P.M. EST OCTOBER 16, 1997

**CONTACT: John Kutzbach, (608) 262-2839, jek@facstaff.wisc.edu**

## *KEYS TO PREDICTING CLIMATE:*
## THE SUN, MONSOONS, HIPPOS AND A WET STONE AGE SAHEL

MADISON — Scientists have long known that six thousand years ago, in what is now North African desert, hippos and crocodiles abounded, Neolithic fishermen thrived on the shores of numerous shallow lakes, and grasslands stretched to the horizon.

What they didn't know was why.

Now scientists are a step closer to solving this climatological riddle of the early Stone Age, and, importantly, their findings promise a helpful tuning of the sophisticated computer models used to predict future climate.

Writing in the Oct. 17 edition of the journal *Science*, University of Wisconsin-Madison researchers John E. Kutzbach and Zhengyu Liu describe a Neolithic Sahel that was watered to a significant extent by shifting tropical Atlantic monsoons, seasonal winds and rain that strongly influence climate over large regions of the Earth.

"The northernmost reach of the monsoon marks the limit of vegetation in the Sahel," said Kutzbach, a paleoclimatologist and director of the UW-Madison Center for Climatic Research. "There is a nice boundary where vegetation stops and sand begins."

Six thousand years ago, that boundary was 600 miles north, extending into a region that is now a drought-stricken swath of desert that spans much of North Africa. And for the past 15 years, Kutzbach and his colleagues have used some of the world's most intricate computer models of climate, developed at the National Center for Atmospheric Research, to tease out clues about why such a significant expanse of land experienced such a dramatic change in weather and climate.

"Here, the thing that makes the monsoon work is sun shining on continents, producing a temperature contrast between land and ocean," Kutzbach said. "Six thousand years ago, the monsoons were generally stronger because of changes in the Earth's orbit"

-more-

that brought the planet closest to the sun during the Northern Hemisphere summer.

"The summers were warmer, and the warmed air rose allowing moisture-laden air from the tropical Atlantic to penetrate significantly deeper into North Africa and increasing rainfall by as much as 25 percent," said Kutzbach.

As a result, grasslands flourished in the Sahel, recycling moisture and driving an even greater increase in precipitation. But those two phenomena — the shift in the Earth's orbit and the increase in vegetation — were not enough to fully account for the extremely strong monsoons of the early Stone Age.

"There was something missing," said Kutzbach. "It prompted the question: 'Is there something going on in the ocean that we need to take into account?' "

By merging the ocean and the atmosphere in the supercomputer-driven climate model, Kutzbach and Liu found a slight warming of the oceans in the Northern Hemisphere.

"By warming the region of the northern tropical Atlantic through increased solar radiation from the orbital change, the tropical convergence zone near the equator shifted north and the result was a deeper wedge of moist air that acted as a conveyor belt to feed more moisture into Africa."

Rainfall increased by an additional 25 percent and brought the computer simulations into "reasonably close agreement with the picture we have of the ancient landscape," Kutzbach said.

The new study is important not only because it may finally lay to rest an important climatological and archeological question, but also because the results can be used to further sharpen the complicated models scientists are betting on to predict future changes in climate.

"Nature knows how the atmosphere, vegetation and the ocean interact," said Kutzbach. "We've been trying to mirror these interactions in computer models."

And looking to the past, he said, where physical evidence can be matched to what the models say, is an excellent way to test them.

###

— Terry Devitt, (608) 262-8282, trdevitt@facstaff.wisc.edu

Res. Meteorology

# NEWS TIPS

1•8•4•8

UNIVERSITY OF WISCONSIN–MADISON
Office of News & Public Affairs
28 Bascom Hall • 500 Lincoln Drive
Madison, Wisconsin 53706–1380

Phone: 608/262–3571
Fax: 608/262–2331

October 13, 1997

**TO:** **Talk/public affairs show hosts and producers**
**FROM:** **Liz Beyler, (608) 263-1986**
**RE:** **UW-Madison experts — October interview ideas**

• **El Nino cometh: What's in store for Wisconsin?**

The periodic warming of the central Pacific Ocean known as El Nino (NEEN-yoh) has already begun to exert its influence on global and regional weather patterns. The result, many scientists believe, could be a warmer, drier winter for the northern United States, including Wisconsin.

UW-Madison atmospheric scientist John A. Young, an authority on El Nino and its effects, says the crystal ball of El Nino science is hazy at best, but the phenomenon could well have a profound influence on our winter weather. Young, who has participated in experiments aimed at measuring and better understanding this powerful influence of nature, can explain what an El Nino is, how it can influence weather well beyond the Pacific, and what it may means for us. Young can be reached at (608) 262-5963.

*--Terry Devitt, (608) 262-8282*

• **E-I-E-I-E-I-(uh)-O: Oktoberfest stereotypes revised**

Got your lederhosen? The polka band? The brats-und-braus? In short, think you're ready for an Oktoberfest? **Joe Salmons,** director of UW-Madison's Max Kade Institute for German- American Studies and associate professor of German, would like to enlighten you on a number of points concerning this beloved German — and German-American — autumn celebration. How is an Oktoberfest *truly* done? And what are the real meanings behind the festivities? Reach him at (608) 262-7546.

*— Barbara Wolff, (608) 262-8292*

- more -

• **Matters British**

The tension within the Royal family after Princess Diana's death and the place of royalty in modern Britain are matters that political scientist and British native **Graham Wilson** can discuss. A specialist in British and European politics, he can also talk about the new parliaments in Scotland and Wales, as well as the challenges facing the new labor government. Wilson can be reached at (608) 263-2241 or gwilson@polisci.wisc.edu.

*— Jeff Iseminger, (608) 262-8287*

• **Hmong advocate**

The Wisconsin Legislature has sent President Clinton and the United States Congress a resolution urging "full and immediate" U.S. citizenship for the Laotian armed services veterans who fought alongside American soldiers during the Vietnam War. Many of those Laotians are now in the U.S.

**John Duffy,** pursing his doctorate in history (subject: Hmong literacy), has worked with Laotian immigrants for many years. He began in 1983 as an English teacher at a refugee camp in the Philippines, and from 1990-1993, he worked as an educational advocate with the Hmong in Wausau. Not surprisingly, then, Duffy is well-versed in the issues and implications surrounding the resolution. Reach him at (608) 263-7266/(608) 839-8507.

*— Barbara Wolff, (608) 262-8292*

• **What's new with desktop publishing?**

How can you work smarter and faster with desktop publishing? Ellen Tyler, a faculty associate in the Department of Liberal Studies and the Arts, can give you the latest information for beginning as well as professional users. She is knowledgeable about the ins and outs of QuarkXPress as well as Aldus Pagemaker, Photoshop and Illustrator. Tyler teaches hundreds each year in professional workshops, offered by the Division of Continuing Studies. To schedule an interview about these software programs, and what's new and upcoming in the field, call Tyler at (608) 262-6130.

*— Mary Lock Albrecht, (608) 262-9792*

###

1 • 8 • 4 • 8

# NEWS

UNIVERSITY OF WISCONSIN–MADISON

Research - Meteorology

Phone: 608/262–3571
Fax: 608/262–2331

Office of News and Public Affairs
28 Bascom Hall • 500 Lincoln Drive
Madison, Wisconsin 53706-1380

FOR IMMEDIATE RELEASE 1/24/97

**CONTACT: Christopher Moeller, (608) 263-9597; Paul Menzel, (608) 263-4930; Terri Gregory, (608) 263-3373**

## FORMER SPY PLANE MAY REVEAL THE SECRETS OF CLOUDS

MADISON — Using a converted spy plane to take their experiment to the very top of the atmosphere, scientists hope to learn the secrets of winter clouds.

For three weeks, beginning Friday (Jan. 24), scientists from the University of Wisconsin-Madison's Space Science and Engineering Center and NASA will conduct a high-flying experiment out of Madison's Truax Field to map, measure and probe winter clouds over North America.

Known as WINCE for Winter Cloud Experiment, the set of observations will be made with the help of a NASA ER-2, a high-flying aircraft that, in a former life, was a spy plane. Its payload of six scientific instruments will give scientists a more certain understanding of the role clouds play in regulating climate. In addition, the experiment will serve as a critical testbed for instruments that will be flown on a constellation of Earth-observing satellites that NASA plans to launch over the next decade.

"Our objective is to study clouds in a way that will further our ability to study climate," said UW-Madison atmospheric scientist Christopher Moeller. "Clouds regulate the Earth's atmosphere. They have a fairly significant impact on the Earth's radiation balance."

The experiment depends on a relic of the Cold War, an ER-2 aircraft that once, as a U-2 spy plane, conducted high-flying espionage missions on behalf of the United States. It achieved fame and notoriety as the aircraft piloted by Francis Gary Powers, the U.S. pilot shot down and held captive by the Soviet Union in 1960 during the height of the Cold War.

But the planes, two of which have been retired from the spy business and rechristened as ER-2s, have become scientific workhorses, used by NASA since the 1970s as high-altitude platforms for scientific instruments.

For the WINCE experiment, the aircraft will be loaded with a suite of four different sensors and two camera systems, and flown above 95 percent of the Earth's

-more-

atmosphere to get a detailed picture of clouds over the winter landscape of the northern United States and southern Canada.

Clouds play a critical role in climate, both blanketing the Earth and keeping energy in, and reflecting incoming energy from the sun back into space. But the subtleties of their influence on climate and their overall role in the climate puzzle is not well understood, said Paul Menzel, a National Oceanic and Atmospheric Administration scientist stationed at UW-Madison's Space Science and Engineering Center.

"What we've been doing for some time is trying to understand the influence of clouds on the radiation budget of the Earth," said Menzel. "The question we're trying to answer is how much blocking do these clouds do?"

According to Moeller, one important way to approach that question is to obtain a better understanding of cloud microphysics by learning more about the size and shape of the tiny water droplets that make up clouds.

The experiment, says Menzel, is deliberately difficult: "We picked the winter because it is more challenging" to detect and measure clouds, especially cirrus clouds.

These high-altitude clouds, delicate wisps, patches and narrow bands composed of ice crystals, are hard for satellites to detect against the backdrop of a snow-covered Earth, Menzel said.

Moreover, surveying and assaying clouds in northern regions adds to the big picture of cloud influence on global climate, said Moeller.

"We need to know if clouds are increasing in cold regions as well as warm regions," said Moeller. "We need to know what's happening in different climate regimes. We would like to paint this big picture of what's going on on a global scale."

The question of clouds' role in climate is confounded by human influence on the atmosphere as pollutants such as carbon dioxide may be changing the equation, said Moeller. "We would like to get at that bottom line, but we know the answer may not be so simple. We know it's a question that's going to be researched for decades to come."

In addition to NASA and UW-Madison, others supporting and participating in the experiment include: the 115 Fighter Wing of the Wisconsin Air National Guard which is providing facilities and support for the ER-2 aircraft; Madison-based Persoft, Corp., a software development company that is providing a wireless communications network to facilitate data transfer between Truax Field and UW-Madison's Space Science and Engineering Center.

###

— Terry Devitt, (608) 262-8282, trdevitt@facstaff.wisc.edu

mance becomes intensified. As a performer, I find that very liberating."

Lloyd-Watts now lives in Kingston, Ontario. Her latest recording is "Classically Romantic Piano." Other recent releases include, "The Healing Heart of Music" and "Music For Your Baby."

Selections, she says, "were chosen for their potential to create balance, peace, and healing. For a newborn, these recordings can be like a calming, soothing friend, a favorite toy or blanket. For the inner child in all of us, the recordings offer sustenance to our intuitive and creative sensibilities."— *Barbara Wolff*


**• Madison, which boasts some eight hundred eating establishments, has more restaurants per person than any city in America, according to the Greater Madison Convention & Visitors Bureau. This adds up to one restaurant for every five hundred people.**

## Saving the Earth with Help from the Stars

If you've ever listened to the last song on Stevie Nicks's latest CD, "Street Angel," you can thank **Wayne Kirkham '68, MD'72** and **Sally Godenrath Kirkham '70, PhD'77.**

The song, called "Jane," "is just exquisite," says Sally. "Stevie wrote it at our request for Jane Goodall." Fervent environmentalists, the Kirkhams chaired a benefit gala in their hometown of Dallas, Texas, to raise money for the famed chimpanzee researcher and conservation advocate. When they introduced Goodall and Nicks, the former singer with Fleetwood Mac became so emotional, she couldn't stop crying. "It was extremely moving and it was good for Jane to feel that level of appreciation," says Sally. "It was very special."

Stevie Nicks is just one of the entertainers the Kirkhams have called upon to help the cause. Wayne, an otolaryngologist, has built a practice of treating celebrity throats, and many of his patients are themselves committed to environmental issues.

"I take care of a lot of big-name entertainers, from Mick Jagger, Sting, and Patti LaBelle, to opera singers like Cecilia Bartoli, who is the hottest mezzo-soprano in the world right now," says Wayne. His music background in Wisconsin's marching and concert bands, as well as the University Singers (now the Wisconsin Singers), has given him a feel for what performers need and want from their physician.

He's also seen fellow alum Steve Miller x'67, James Taylor, Prince, Randy Travis, Bono (who came on referral from Mick Jagger), U2 — and Ross Perot. "I can be taking care of the guys from Steely Dan one night, and the next night it may be Iron Maiden or Poison or David Lee Roth," he says. "Dan Fogelberg has been a longstanding patient of mine." Many of his clients, he says, are more than just patients. "When Stevie Ray Vaughn was killed in a plane crash [leaving Wisconsin's Alpine Valley via helicopter after a concert], we lost a really close friend.

"It's because of my training and background in Wisconsin that I've been able to do this," Wayne says. That's why he and Sally are as committed to UW–Madison as they are to the environment. They met when Sally founded the pompon squad in 1967, and Wayne, as head of the drum section in the band, was asked to write a drum routine so the squad could do a dance number for Yell Like Hell. (When the Alumni House was brand new, Wayne was there with the band and Sally was there with the pompon squad to dedicate it.)

Sally, who went on to get her doctorate in education, has a clinic in Dallas for children with reading and learning disabilities. The couple's son Stewart is a senior at UW–Madison, and sixteen-year-old Ryan wants to go to Wisconsin, too. Sally says she and Wayne enjoy coming back to campus, "and to relive all of this with Stewart has really been a thrill. It's a comfort, when you send your firstborn off, to be able to relate to everything he's going through."

The Kirkhams became some of the campus's most active recruiters when Stewart began attending college fairs in high school, and they found that UW–Madison wasn't represented. They contacted the Admissions Office and offered to put a crew together to represent Wisconsin. The couple makes a point of approaching the college fairs like a high-powered trade show. "We blow these people away down here," says Wayne. "We know it's a great school. But if people don't know about the University of Wisconsin in the South, then the value of our degree, which we feel is an excellent degree, is not what it should be. And the problem with those of us who are from the Midwest is that Midwesterners basically don't toot their own horns."

The Kirkhams are two Midwesterners who are blaring their horns to attract future Badgers, and it's paying off, they say. "We're getting more and more attention and applications. It's an easier sell." The couple are both board members on the North Texas alumni club and served as co-chairs of the UW Foundation's Campaign for Wisconsin, raising money in north Texas.

"There are two things that we really raise money for and go all-out for — the University of Wisconsin — and the environment. That's who we are and what we are," Wayne sums up. "I could go out and raise money for this disease and that disease, but if we can't drink the water, we can't breathe the air, we don't have any trees out there, and we don't have biodiversity, these other diseases don't count. We won't live long enough to develop cancer."



R- Meteorology

# e-mail from Antarctica

HENRY A. KOSHOLLEK / THE CAPITAL TIMES

***In the early 1900s, when explorers Robert Scott and Ernest Shackleton traversed Antarctica, it took dog sleds two months to reach the South Pole. Shackleton, who mistrusted dogs, tried using ponies and found that the mounts soon died, leaving his men to face starvation.***

***Today, LC–130 planes can make it to the Pole in three hours. And modern-day Antarctic adventurers, made up largely of scientists and their support staff, enjoy many of the comforts of home — including TVs, VCRs, a bowling alley, saunas, and even the occasional steak and lobster dinner, complete with candlelight and tablecloths.***

***Still, it's no picnic living on the coldest continent, even during their summer (our winter), when UW–Madison researchers head down to work on projects that range from studying ice streams and global weather to subatomic particles. Thanks to the efficiency of satellite uplinked e-mail, ON WISCONSIN has stayed in touch with two Badgers who agreed to update alums about life in the harshest environment on earth.***

***Suzanne Tegen '94, mentioned in the May/June 1995 ON WISCONSIN for her work in the university's Environmental Management office, is enjoying a unique opportunity to work in a recycling center at McMurdo Station. George Weidner '70, MS'76, a research meteorologist with the Space Science and Engineering Center, has traveled to Antarctica for the last fourteen years, setting up and monitoring Automatic Weather Stations (AWS) near McMurdo. Tegen, who will return in February, sends us this first report.***

**October 19, 1995**

No, I'm not frozen. I've just been a bit too exhausted to e-mail. After ten hours of work, I just make it to the galley for splendid cookin' and then usually cannot convince myself to get my ECW (Extreme Cold Weather) gear on and climb the hill to the smelly fumes building where we are allowed to use the computers.

**WEATHER**

Well, what do *you* think? It's pretty darn nippy! Temps range from 10 degrees Fahrenheit to -80 with wind chill. Yesterday was a balmy nine degrees and sunny by 7:30 a.m. There was almost no wind, which is surprising for the windiest place on earth. McMurdo (and Antarctica) is technically a "desert" where humidity is concerned.

I saw a Fata Morgana! They are a play on your eyes (due to ice crystal structure) much like a mirage in the desert. Anyway, it created cliffs and houselike structures out on the sea ice — weird.

**SCENERY**

WOW! Talk about amazing! White wonders! Ice caves, ten-thousand-foot mountains, barren ice "fields." When I start to get chilled out on the ice, I am consoled

only by the sight of our warm bus (Ivan the Terra Bus) that will take me back "home." McMurdo, or "Mactown," is not a pretty sight. All around us is pristine beauty, but we see metal corrugated sheds, Jamesways, and breathe in diesel fuel all day. Yuck. Ah, all for the good of science.

**WORK**

What do I do? Well, I'm a recycler, a wastoid, or a waste warrior, we like to say. An equipment operator from our fourteen-person crew picks up all of the dumpsters sorted into about seventeen different categories. He drops it at the barn, we check it, enter data on log sheets, separate if necessary, weigh it, and then we store it in our storage yard.

I haven't really made it out to the bars (all two of them). I have played ping-pong at the cafe and I found my new forte. I'm taking tae kwon do on Tuesdays and Thursdays, which helps me forget where I am. I do like it here and am quite happy.

## October 29

Hello Everyone! Here is another update from the ice.

**WEATHER**

Temps have remained around -50 up to -20 this week, hitting the nighttime low of -80 (all of these include windchill). However, I am pretty used to it. The wind is what knocks ya down. . . literally (at sixty knots, it's hard to stand on ice—even for big guys—I've seen it).

**TRAINING**

I attended a mandatory "Sea Ice Training" program this past week. A group of twelve people and an instructor took a Haaglund (a sturdy vehicle built by and for the Swedish army) out on the ice of the Ross Sea.

We learned how to drill a hole through the ice to test the thickness. We would do this in a real life situation if we crossed an ice barrier (where we could see the ice thickness changing). By calculating thickness, width of tire and weight of vehicle, you can tell whether or not you should cross the barrier.

We were also privileged to visit a diving hole. We all crowded into a dark shack out on the ice. The space was illuminated by the glow from the diving

*Ski-equipped LC-130 airplanes are* **de rigueur** *in Antarctica.*

hole. All the snow gets shoveled away near the hole, so that the natural light can penetrate the (two to three meters thick) ice and give the divers light down below.

It was fascinating. We peered through the hole in the ice (one meter in diameter) and saw absolutely clear water, eighty feet down! There were sea urchins and starfish. Antarctica has the clearest water in the world, so I can understand why we send all of our "human waste" and "waste water" back to the U.S.

The students in the class had to light a campinglike stove, as we about *froze* in another hut. We took turns huddling around the dying stove and running about to stay warm. That was a long exercise. We then ate our frozen peanut butter and jelly sandwiches (have I mentioned the nutritious meals at McMurdo?) and all had a chocolate bar—and lots of Hi-C drink box juice (navy issued, environmental disasters).

So, I learned bunches, but mainly, that I never want to be caught out on the sea ice.

**SCOTT'S HUT**

On our way home from training, we were lucky enough to stop by Scott's 1912 Hut. Scott and his men died less than two hundred miles from the hut, after a long, near impossible excursion. Shackleton and his men also used this hut years later, and raided Scott's supplies. The hut is boarded up, but has been left exactly like it was after Shackleton's crew found it.

There was also a real igloo at Cape Evans. The wind was blowing at fifty knots with gusts of fifty-five to sixty, and I was stunned at how much warmer I was in the igloo. In my next training course, I will build a snow hut (much like an igloo, but smaller) and sleep there overnight.

**ANIMALS**

Wednesday, I saw baby seals—newborns! They had been born twenty minutes before and still had umbilical cords attached. Thankfully, I brought my binoculars so I could see them up close.

There were sixteen mothers lying around. That's what they do. They just lie in their blubber and roll around. The males are all under water when it gets this cold (or windy). The mothers have to stay above water to protect their pups, since the young 'uns cannot yet survive under water.

**SOCIAL HAPS**

We celebrated Halloween Saturday night. The only party 'til New Years, I hear. It was loud and wild, with costumes galore. Jitterbug-swing lessons continue every Saturday night. They're crowded with enthusiastic toe-steppers. I think of people at home often, and wish we could communicate more. Many people here can just let go and will be in touch in four months, but I haven't reached that level yet. Hugs and warmth, Love, Suzanne.

***Meteorologist George Weidner spent November at McMurdo Station this year and is now back in Madison, analyzing his data.***

## November 12, 1995

Well, we had an interesting two days here. One of our weather stations thirty miles south of McMurdo reported 110-mile-per-hour winds. The ice runway was drifted over and the LC-130 planes parked at the runway had drifts around them as high as the aircraft.

**CONDITIONS**

There are three "conditions" regarding the weather here. Condition Three is

*"Ivan the Terra Bus" features balloon tires that enable the vehicle to float if it happens to crash through the ice.*

normal and there are no unusual restrictions on your travel. Condition Two implies restricted travel within town or in vehicles to and from the ice runway. Condition One (very high winds, low visibility, extreme cold) means everyone stays in the building they are in unless travel is absolutely necessary. We were in Condition One at times, which is very unusual for this time of year.

Not much was done over the last three days.

**SUNLIGHT**

Our program has in the past usually come down in January. January in McMurdo is actually nicer overall than in Wisconsin. With continuous sunlight, the temperatures are right around 30 degrees Fahrenheit most of the time.

## November 16

For those Automatic Weather Stations within "driving distance" of McMurdo Station one can use a treaded vehicle called a Spryte. It's the size of a truck but with treads like a tank. It is useful for going over ice and snow, but is very loud with a top speed of about fifteen miles per hour on snow. Any faster than that and one begins bouncing off the roof of the vehicle.

**FLAGS**

One trip using a Spryte had us following a flagged route to an AWS site some fifteen miles from McMurdo Station. It was foggy when we left and became extremely foggy by the time we were halfway there. At that point we could barely see the next flag along the route (the flags were about one-eighth mile apart). It was very eerie going along with no inkling of where the surface was, except for the tread marks in the snow behind us. Looking ahead we could not see a horizon or any surface definition at all. Without the flags marking the way, we would have had to stop and wait until the fog lifted, or followed our tracks back to McMurdo.

## November 21

A day in the field in Antarctica can be at times a challenging experience. It typically begins the night before when the schedules for the next day are posted. In the "old" days this consisted of walking over to the NSF administration building to read the posted schedule. Today we log into our e-mail account and scroll down until we see our science event number. The Automatic Weather Station program has been assigned event number S-283.

*Meteorologist George Weidner installed weather equipment at the South Pole, which has an elevation of some 11,000 feet due to its two-mile thick ice cover. Weidner says a popular T-shirt at the station reads "Ski the South Pole. Two inches of powder, two miles of base."*

**SCHEDULE**

For those who are here for the first time, being able to decipher the schedule is a challenge. It will appear something like-MCM PU 2/300 to BI PI 2. As an OAE (old Antarctic explorer) I can easily translate this as pick up two passengers at McMurdo helo pad and fly them with three hundred pounds of equipment/baggage to Black Island where they will be put in (left).

Once you know if you are on the schedule, you must estimate when you should be ready to go to the helo pad. Now you must always be ready to go at any time, since the events scheduled before you could get canceled. Also, the weather where you are going could be bad and your event moved to later in the day hoping for better weather.

**THE HELO**

There is a definite art to loading equipment onto the Huey UH-1N helo. Always let the helo crew load the equipment. They will quickly remove anything you have loaded yourself. Once everything is securely loaded, you'll be instructed to take a seat in the helo. If you have loaded a lot of equipment into the aircraft, your knees will be just under your chin as you squeeze into the seats.

If you're setting down on a snow surface, the helo will often not "shut down" since there is the chance that the snow will not be able to support the helo if it is not creating lift. Now you must unload your equipment while the blades are turning a few feet above your head. In doing so it is wise to keep low and always stay in view of the pilot.

At last the helo departs with a blizzard of snow from the rotating blades. As it slowly disappears from view, you become conscious of the silence. There are no sounds except those the field team are making. You have instructed the helo to return in two hours. During that time a new weather station will be set up and hopefully there will be some time to enjoy the beauty and silence of the Antarctic landscape.

*And then it's back to the base to relax in the bar, or perhaps the gym or the library — a far cry from the days when one of Scott's teams traveled for thirty-six days in almost total darkness, camping out in temperatures as low as 77 below zero, or when the explorer and his men ultimately gave up their lives to unlock the mysteries of this frozen continent.*□

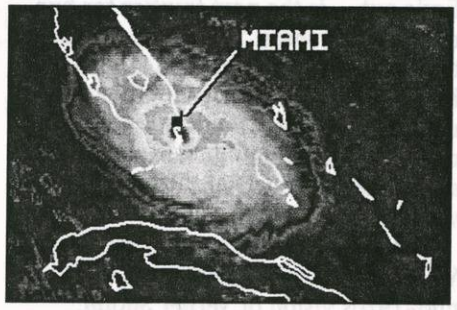
*—Edited by Niki Denison*

# THE SCIENCE BEHIND THE STORM

R- Meteorology

*A strong July thunderstorm gathers momentum over Lake Michigan, above. Below, color-enhanced imagery from a geostationary satellite highlights wind strengths of Hurricane Andrew. UW–Madison's Space Science and Engineering Center is home to some of the most sophisticated machinery in the world for tracking how severe weather develops.*

## *UW researchers probe the dimensions of high winds and other natural disasters*




**BY BRIAN MATTMILLER**
**PHOTOS BY JEFF MILLER**

It's a bright and cloudless July morning outside UW–Madison's Space Science and Engineering Center, but inside researcher Chris Velden '82 is exploring the unfriendly skies of hurricane season.

Velden's computer screen has honed in on the latest real-time satellite images of Hurricane Emilia, billowing over the Pacific Ocean just south of the Hawaiian islands. With winds peaking at 190 miles per hour, Velden says Emilia is considered a Category 5 — the highest level for hurricanes — and is on its way to becoming the biggest hurricane known in the mid-Pacific.

Big enough to evoke the names Hugo, or Andrew.

Never heard of Emilia? Consider yourself lucky, for it only brushed the southern shores of the islands and then moved on a relatively benign path through the vast Pacific — a path that separated Emilia from notoriety.

By midsummer, hurricane season is in full swing, and so is activity at the Space Science and Engineering Center (SSEC), one of the best places in the country to study severe weather. The center is also one of the university's most visible examples of a growing research effort aimed at understanding the patterns of natural disasters and ultimately reducing their risk.

## KEEPING AN EYE ON THE STORM

Despite being at least twelve hundred miles from the nearest coast, the SSEC is a national leader in tracking potentially destructive weather like hurricanes. Through a technology known as McIDAS — shorthand for Man-Computer Interactive Data Access System — the center has become the keeper of literally billions of bits of weather data from around the world.

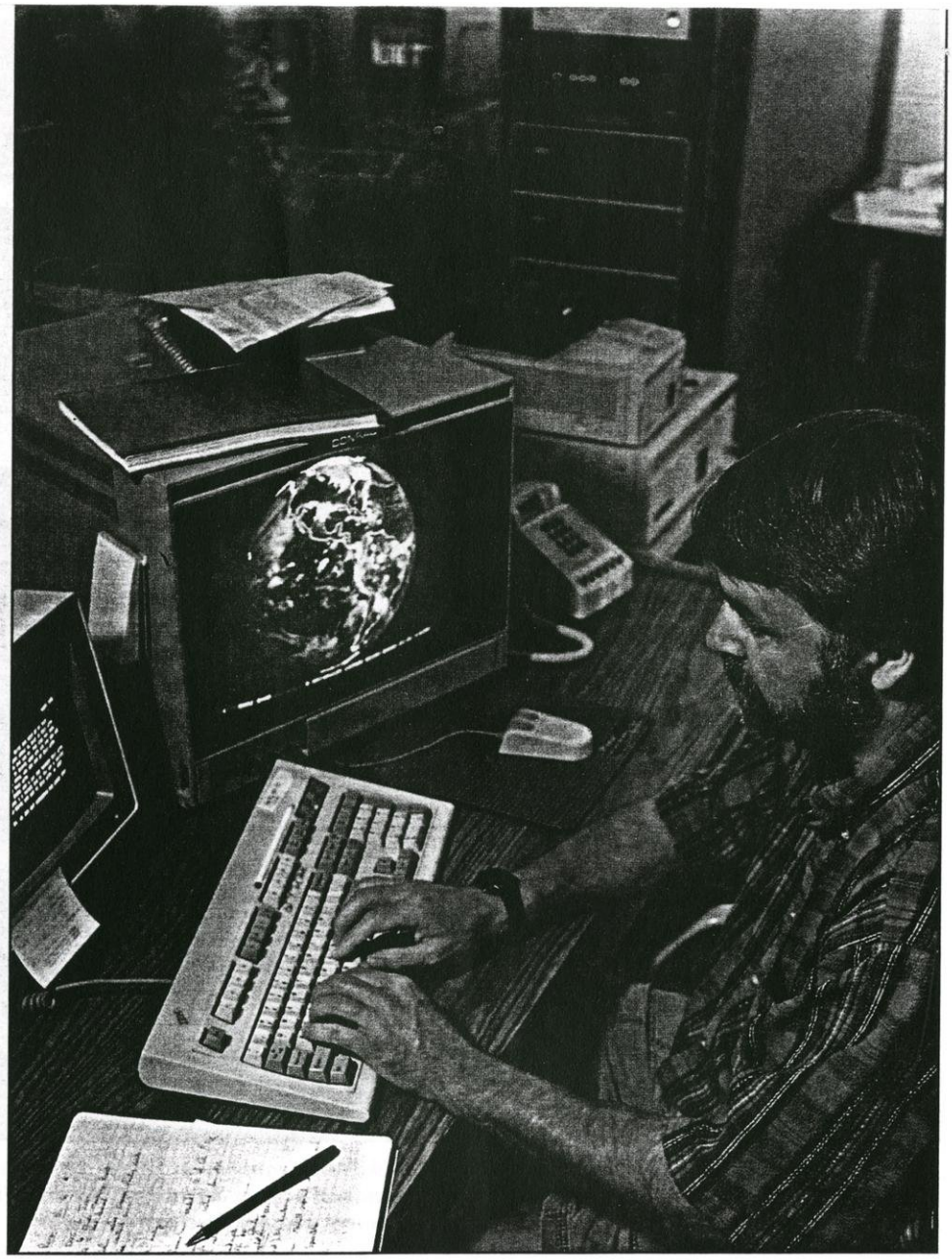
Velden specializes in hurricanes, which are difficult to study because they evolve in the open sea, far from weather balloons or ground observations. His research, he says, concentrates on utilizing meteorological satellite observations to focus on two central issues: "Where is a hurricane going, and how strong is it?"

Neither question has an easy answer. But Velden and his colleagues have been able to develop a more accurate way of detecting "atmospheric steering currents" that can determine a hurricane's path. "These are like rivers of wind, if you will, in the atmosphere that guide these hurricanes along," Velden says. By marking the speed and direction of winds ahead of the hurricane, the satellite data identifies air streams that can alter a hurricane's path, much like a river current acting on a floating log.

Understanding hurricane intensity — why some tropical storms gain momentum over the ocean while most fizzle out — is the next frontier for hurricane researchers. The science of identifying and tracking tropical storms, however, has fully arrived. "There are no more — or very few — surprises any more," Velden says. "As a potential atmospheric disturbance develops, we're capturing it."

The McIDAS system that makes Velden's research possible was the mid-1970s vision of Verner Suomi, SSEC founder and often called "the father of weather satellites." The system captures a flood of weather information in satellite dishes on the roof of the center, then translates it visually in a manner that humans can interpret.

"McIDAS is a very dynamic system and is constantly changing," says Thomas Achtor '80, a research manager for the center. "It's incredible in the electronic age that something can stay on top for more than twenty years."



*Thomas Achtor, a program manager with the Space Science and Engineering Center, calls up satellite images on the center's McIDAS computer system, which collects weather data from every corner of the globe and presents it in a visual form. "The visualization is the key," Achtor says. "We can do everything from nowcasting, which covers a very small land area, to looking at climate over the entire globe."*

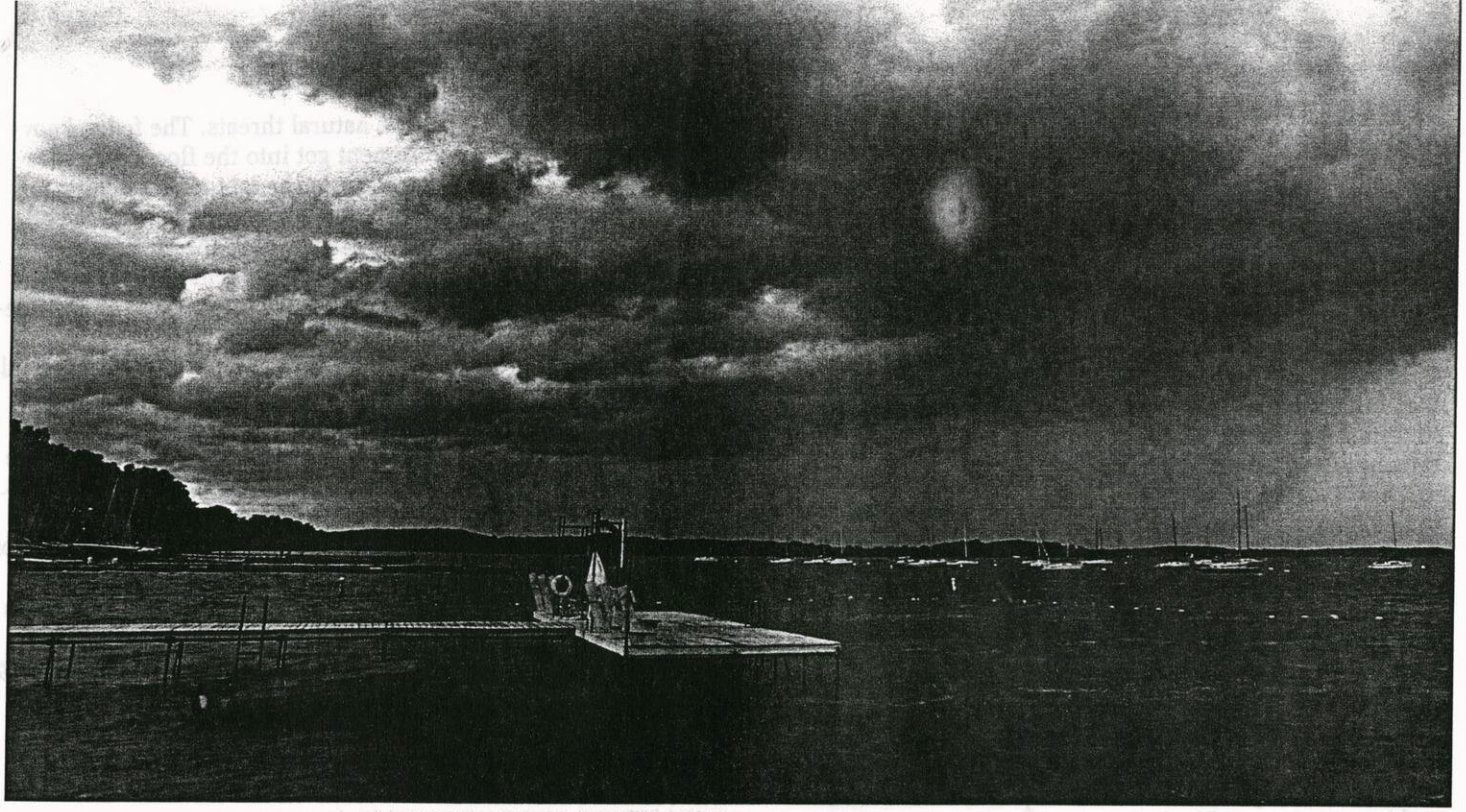
With support from a NASA grant, this summer Achtor presented a workshop for teachers, helping them to integrate McIDAS into a school curriculum and use its exciting technology to teach the physical sciences.

McIDAS' next evolution, Achtor says, will improve its visual punch. Through virtual reality technology, weather researchers will be able to view a hurricane on multiple screens, soaking in satellite, radar, and surface observations simultaneously — offering complete perspective on hurricanes and severe storms that otherwise wouldn't be possible.

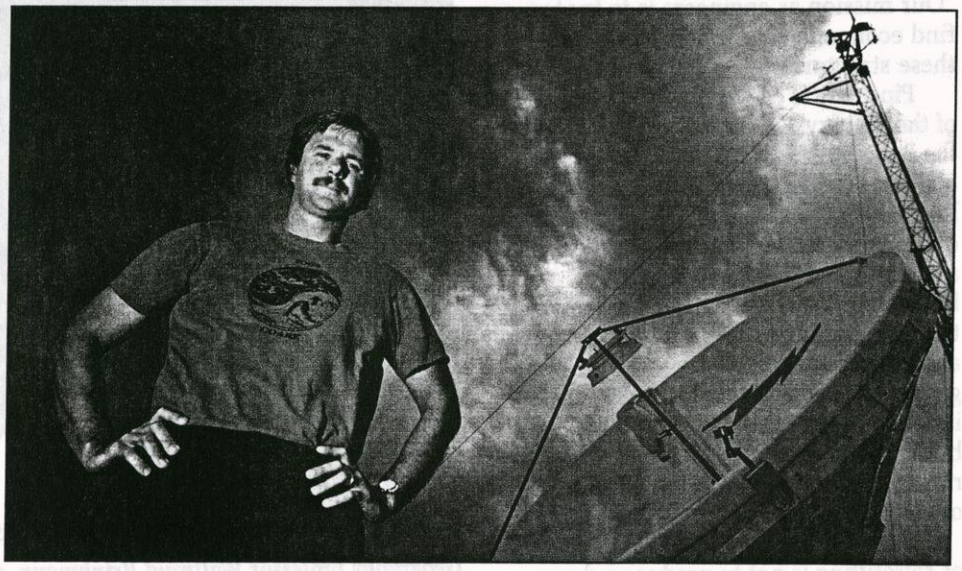
## LINKING FLOODS AND CLIMATE

On the Iowa side of the Mississippi River, a ferry ride away from Cassville, James Knox and his research associates dig for evidence of giant historic floods in the sloppy muck. Wearing grubby hats and soaked in bug spray, the trio sets up a coring rig among tall cottonwood trees that still have faint brownish rings about six feet up their trunks — a telltale sign of the 1993 flood's crest.

Knox, a geography professor, is studying the link between major Midwestern floods throughout history and



*A severe thunderstorm, viewed from the Memorial Union Terrace, approaches Lake Mendota, above. At right: Chris Velden, a researcher and hurricane expert, with one of the UW's numerous satellite dishes that retrieve weather data across the world.*



slight historical shifts in the region's climate. The evidence so far has been remarkable: Long-term trends of slightly warmer-than-normal weather can lead to centuries of minimal flooding. And a slight cooling pattern — even a single degree — can result in huge floods over the same interval.

The connection between flooding and climate could be helpful in improving current estimates of one-hundred-year flood probability. A federal committee looking at developing new flood plain policies for communities on the Mississippi is using Knox's data to help reach its conclusions.

"We can't accurately predict climate, to be sure," Knox says. "But we can say that if certain climate conditions are anticipated in the future, then a certain range of flooding events can also be anticipated for that period. It's a long way from telling what the year 2020 will bring, but such probability estimates are very useful for planning and policy decisions."

The past thirty years are a case in point, Knox says, given the number of dramatic floods in that time frame: 1965, 1969, 1973, and 1993. "Ordinarily one wouldn't expect to experience so many large floods clustered in such a small time interval," he says. "It looks like somebody flipped a switch."

Knox believes the flooding is more than likely related to climate. During the first half of the twentieth century, when a warmer and drier climate prevailed, relatively few large floods occurred on the upper Mississippi. And a trend toward slightly cooler and wetter weather during the past thirty to forty years has been associated with the more frequent flood occurrences.

Those climate-flood links are evident throughout history, Knox says. The most striking connection occurred between five hundred and seven hundred years ago — during a cool climate episode known as the Little Ice Age — when the upper Mississippi and its tributaries experienced a series of catastrophic floods that would make last year's pale in comparison.

Those past floods left a trail in the Mississippi mud. By extracting sediment core samples of up to twenty-five feet deep, and bringing them back to his lab for chemical and textural analyses, Knox can discover the history of flood magnitudes and their recurrence. In his latest paper for *Nature* magazine, he described a flood record for the upper Mississippi drainage system that dates back five thousand years.

## BUILDING FOR THE BIG ONE

An earthquake zone is the ultimate proving ground for a building's structural integrity. Fittingly enough, engineering professor Jose Pincheira has become a researcher of those buildings that failed to meet the challenge.

A native of Chile, Pincheira grew up near big earthquakes, including a Richter 7.8 quake in 1985 that rumbled for nearly a full minute. He studies the success or failure of older earthquake-rattled buildings to determine what retrofitting or strengthening techniques work best under stress.

Although seismic resistance codes for new buildings are effective, many of California's older buildings are at risk of failure in earthquakes. "Unreinforced masonry buildings are a tremendous problem, as well as reinforced concrete buildings constructed twenty or thirty years ago," Pincheira says. "Our mission as engineers is to try to find economically feasible solutions for these structures."

Pincheira is examining the aftermath of the January 17 Northridge quake in the Los Angeles area, the latest disastrous quake on California's fault-scarred coastline. He has studied hundreds of photos of Northridge structures that failed in sometimes baffling ways. Highway bridge beams popped from the weight of the road, leaving a mangled cage of metal and crumbled cement. An entire parking garage buckled and folded inward, as if its beams were rubber. An old multi-story brick warehouse lost an entire wall, but a rickety roof stayed intact, thanks to a row of metal reinforcements.

The goal of seismic resistant design or retrofitting is not to produce a damage-free building — any significant quake is going to rattle and crack even the strongest building, Pincheira says. "What we don't want to happen is for the structure to collapse," he says. "We would be able to accept severe damage like cracked concrete as long as the structure's still there and standing."

## DENYING THE DANGER

In the 1990s, the United States has been ruthlessly pounded with some of the biggest disasters on record.

Hurricane Andrew, in the summer of 1992, was the single most expensive disaster in American history. It caused thirty billion dollars in property damage and fifty-two deaths in Florida, Louisiana, and the Bahamas. In 1993 it was the same story, but a different force. The Upper Mississippi River experienced the flood of the century, causing between twelve and sixteen billion dollars in damages to buildings and agriculture, and thirty-eight deaths. And the Northridge earthquake caused fifty-seven deaths and damages of some twenty billion dollars when it struck this past January.

Geography professor Waltraud Brinkmann has found that despite these staggering statistics, people generally don't prepare themselves for the potential risks of natural disasters. She conducted a study for the National Science Foundation to determine how much the American public knew — or cared — about natural hazards. And she found people to be in a denial mode of major proportions.

"There are a lot of people who realize there's a problem, but they don't want to know how bad it is," she says. "Some people don't want to know how close they are to a fault, and just hope they never find out." In fact, she says, a large number of people in California even refused to be surveyed.

Failing to purchase federal flood insurance is perhaps the most telling example of Americans' reluctance to heed natural threats. The federal government got into the flood insurance business in the late 1960s, hoping to reduce the huge sums needed to bail out flooded areas. The government would pay 90 percent of the cost of flood insurance for property in the one-hundred-year flood plain.

But, it was learned following several major floods in the early 1970s, only a fraction of those eligible had purchased flood insurance. And the same was true for the Upper Midwest flooding in 1993. According to the National Insurance Information Institute, only 475 million of the 12 to 16 billion in flood damages were covered under the federal program.

"I don't think people really have a feel for how much this country is losing every year just in property losses," Brinkmann says. She is doing her share to spread the word about our cavalier responses to severe weather. She teaches a geography course called "Natural Hazards" that is one of the most popular physical science classes among undergraduates. While half of the class is devoted to the physical characteristics of natural hazards, the other half focuses on human adjustments and warning systems.

"People are attracted to the course," she says, "because there's hardly anybody who at some point in their lives hasn't experienced a natural hazard." □

***Geography professor Waltraud Brinkmann, who teaches one of the university's most popular physical sciences courses, called "Natural Hazards," says it's hard to understand why people often refuse to heed the risks of living in disaster-prone areas. Past studies she conducted for the National Science Foundation showed that many people would rather not confront the financial and social implications.***

R: meteorology

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 12/12/90

CONTACT: Stefan Hastenrath (608) 262-3659

# FORECAST METHOD GETS JUMP ON AFRICAN, BRAZILIAN DROUGHTS

By Matt Keefer
University News Service

MADISON--Drought-prone regions of West Africa, India and South America may soon have an "early warning" system to help farmers prepare for parched fields and dusty rivers before the rains don't fall.

In a new forecasting technique, scientists monitor the movements of large-scale circulation systems, the location of which determine seasonal rains in some of the world's most water-sensitive countries.

"In certain regions in the tropics -- like the West African Sahel or Northeast Brazil -- agricultural systems hinge on a single well-defined circulation system," said Stefan Hastenrath, a meteorologist at the University of Wisconsin-Madison.

"Either the system performs and there is abundant rainfall, or it fails and there is a drought," Hastenrath said. The kicker, however, is that drought in the tropics is almost always an economic catastrophe.

The new forecasting method takes advantage of the fact that these countries are located in regions where the weather systems are relatively well-defined. Early indications from Hastenrath's research in northeastern South America show that accurate drought prediction is on the horizon.

"The rainy season of Northeast Brazil is narrowly concentrated in March

-more-

and April," Hastenrath said, "and is primarily related to the location of the Intertropical Convergence Zone."

The Intertropical Convergence Zone is marked by heavy rainfall, and is formed where northeast trade winds clash with winds from the southern hemisphere.

"In drought years, when the March-April rains fail, the convergence zone hasn't migrated as far south as in good years," he said. As a result, the rains fall over the ocean -- and not on the farms of Brazil.

Similar convergence zones determine monsoons in India and rainfall in West Africa, Hastenrath said, but the relative strength of the circulation systems really drives the weather. In Brazilian drought years, for example, powerful southern winds push the convergence zone north.

Shifts in these zones develop over several months, Hastenrath said, and along the way, the system drops clues about the ultimate location of the seasonal rains.

One important "clue" in the Brazilian case is the amount of pre-season rainfall. By measuring pre-season precipitation at 27 sites in northeast Brazil, scientists can statistically predict more than half the inter-annual rainfall variability in the region.

A more demanding method requires monitoring the northern Atlantic winds and sea temperatures in the equatorial Pacific.

"This method shows the overwhelming control of the convergence zone," Hastenrath said. By including the roles of both the ocean and the atmosphere, forecast accuracy is increased to about 70 percent of the annual variability.

"In dry years, the south Atlantic tends to be colder and the north Atlantic warmer," Hastenrath said, and the southern trade winds are accelerated. The sea temperatures are an indicator of the southern oscillation -- long-term variations that affect the climate in tropical and mid-latitude regions including the United States.

"This team of winds and temperatures works together," he said, and its impact on climate can be predicted with increasing accuracy.

Climate prediction models similar to those for northeast Brazil have been devised for the Guyanas, Indonesia, Africa and India, Hastenrath said. The Sahel, for example, is located at the northern extreme of the same convergence zone that drives Brazil's weather.

"I call these the 'targets of opportunity,'" Hastenrath said, because they are the countries for which climate prediction is most feasible and that would most benefit from early forecasts.

Governments that are willing and able to take preparative action -- such as not selling surplus grain, purchasing food ahead of time or selectively farming the best lands -- could definitely use this forecast tool to their advantage, he said.

###

-- Matt Keefer (608) 262-2650

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Research - Meteorology

Release: Immediately 7/31/84

CONTACT: Charles E. Anderson (608) 262-0783

UW METEOROLOGIST TRACKS TORNADOES

by TERRY DEVITT
University News Service

MADISON--Tornadoes have been a particularly deadly force in Wisconsin this year, claiming nine lives and causing millions of dollars in property damage.

But if the work of University of Wisconsin-Madison meteorologist Charles Anderson pays off, Wisconsin forecasters will have a better idea of where to expect the so-called long-track, killer tornadoes that vex the state each spring and summer.

Spawned by violent thunderstorms, tornadoes are the most violent of atmospheric storms, yet they are also among the least understood. Tornadoes that remain on the ground for 20 miles or longer are considered long-track.

Anderson, a severe storms expert, is now poring over 100 years of weather data in an effort to identify areas of the state most likely to experience long-track tornadoes. This is important, Anderson said, because once long-track tornadoes have touched down in several places they are somewhat predictable.

"These tornadoes can have a ground track as long as 250 miles," Anderson said during a recent interview. "They move along fairly straight lines and once one has touched down and hit a few places you can get an idea of what kind of track it's going to follow."

-more-

Add 1--Tornado tracking

Anderson said once forecasters know where a long-track tornado is located and the direction it is headed, there is ample time to warn people in the twister's path.

Long-track tornadoes take a much higher toll in lives and property than short-lived twisters, according to Anderson.

"We find that the ones with the longest tracks are the most violent," he said. "Tornadoes that have shorter tracks are not killer tornadoes. They may cause some property damage, but they rarely kill people."

The tornado that leveled the Iowa County village of Barneveld and killed nine people on June 8 had a track of almost 100 miles, stretching in a straight line from Barneveld to Green Lake.

"We were extremely lucky that only nine persons were killed in Barneveld," Anderson added. "Long-track tornadoes are just bad news. They cause more deaths, they've got higher winds and they cause more damage."

Anderson's research points to two sections of the state that seem prone to these violent storms. The first is an area stretching from the Minnesota border near St. Paul across the north and north central parts of Wisconsin and includes the cities of Eau Claire, Wausau and Chippewa Falls. The second is a wide alley beginning in southwest Wisconsin and ending in the southeastern section of the state. Defining this tornado-prone area is especially important, Anderson said, because it is heavily populated and includes the cities of Milwaukee, Janesville, Beloit, Waukesha and Madison.

Identifying these areas is not only important for forecasters, said Anderson, it also will help scientists determine the best places to deploy a new generation of weather radar. The new radar system is scheduled for installation by 1990 and will be capable of pinpointing and tracking tornadoes. The radar now in use is not capable of detecting tornadoes and meteorologists must rely on human spotters to confirm that a tornado has formed and touched down.

Anderson added that once a tornado has been spotted, the cloud that produced the tornado can then be tracked by satellite.

###

Terry Devitt (608) 262-8282

Add 2--Tornado tracking

LONG-TRACK TORNADOES/ANDERSON JULY 19 TD

TORNADOES HAVE ALWAYS BEEN AN UNPLEASANT FACT OF LIFE IN WISCONSIN. BUT THERE ARE DIFFERENT KINDS OF TORNADOES AND SOME TAKE A MUCH HIGHER TOLL IN LIFE AND PROPERTY THAN OTHERS, SAYS UNIVERSITY OF WISCONSIN-MADISON METEOROLOGY PROFESSOR CHARLES ANDERSON.

IN: "WE CALL A...173
OUT: ...KILL PEOPLE."

ANDERSON SAYS THE TORNADO THAT STRUCK THE IOWA COUNTY VILLAGE OF BARNEVELD ON JUNE 8 WAS A LONG-TRACK TORNADO. THAT TWISTER KILLED NINE PEOPLE AND CUT A PATH OF DESTRUCTION 100 MILES LONG FROM BARNEVELD TO GREEN LAKE, WISCONSIN.

TORNADOES HAVE ALWAYS BEEN HARD TO PREDICT. RADAR AND SATELLITES ARE NOT ALWAYS CAPABLE OF IDENTIFYING TORNADOES, SAYS UNIVERSITY OF WISCONSIN-MADISON METEOROLOGIST CHARLES ANDERSON. BUT HE SAYS ONE TYPE OF TORNADO, ONCE IT HAS TOUCHED DOWN, IS FAIRLY PREDICTABLE.

IN: "WHEN WE'RE DEALING...242
OUT: ...TO FOLLOW."

ANDERSON SAYS ONCE FORECASTERS KNOW WHERE A LONG-TRACK TORNADO IS LOCATED AND THE DIRECTION IT IS HEADED, THERE IS AMPLE TIME TO WARN PEOPLE IN THE TWISTER'S PATH.

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 7/1/88

CONTACT: Reid Bryson (608) 262-5814

BRYSON: GREENHOUSE EFFECT UNLIKELY CAUSE OF DROUGHT, HEAT

By Steve Pomplun
Institute for Environmental Studies

MADISON--A lack of volcanic activity, and not the greenhouse effect, may be behind this year's heat and drought, according to an internationally known climatologist.

Reid Bryson, emeritus professor of environmental studies and meteorology at University of Wisconsin-Madison, says the weather pattern that has dried and baked the nation's midsection is similar to the one that created the Dust Bowl of the 1930s.

"If we want to find a cause of this drought, we should find a cause common to both of them," said Bryson. "About the only common denominator I can see is that both droughts have occurred during periods of very low volcanic activity."

Volcanoes inject aerosols -- fine particles and droplets of sulfuric acid -- into the upper atmosphere. These prevent a small but significant amount of sunlight from reaching the earth's surface. As in the 1930s, Bryson said, a dearth of volcanic activity has left the atmosphere relatively free of aerosols. The additional sunlight may be enough to alter air circulation patterns.

Bryson, who founded the UW-Madison department of meteorology and the

-more-

Institute for Environmental Studies (IES), believes atmospheric tides also may be contributing to the drought. He said the tides, large-scale movements of air similar to ocean tides, can affect temperature and rainfall.

Bryson strongly disagrees with those who blame this year's hot, dry weather on the greenhouse effect, the theory that a buildup of carbon dioxide in the atmosphere will cause a global warming trend. A number of scientists recently have said that the greenhouse effect is already having a measureable impact and that the drought and heat are a harbinger of future weather patterns in the central United States.

"I'm a little disturbed when I see well-known scientists making statements like that because generally speaking they're talking about theory," said Bryson. "Up until this year, most of what you heard about the greenhouse effect was that in 50 years the earth will be 'x'-degrees warmer. That's a 50-year forecast, isn't it? Have their theoretical models ever successfully made 50-year forecasts? Or 10-year forecasts? Or even five-month forecasts? They haven't, so I'm very skeptical that they're ready to use the theory to make claims about what's going to happen in the future."

Bryson, who since his retirement in 1985 has continued his work on computer models of the climate at IES's Center for Climatic Research, said the models used by greenhouse theorists are sophisticated but untested. He contends that the greenhouse models could be checked using weather events in the past.

"It's very simple to test a forecast scheme and see if it works," he said. "All they have to do is pretend it's 1900 and predict 1950. Can they predict this drought from 50 years ago? Until they demonstrate that they can, it's very difficult to put faith in their ability to predict the future, because it is faith that is being asked, faith that the theory is right."

###

-- Steve Pomplun (608) 263-3063

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 12/8/87

CONTACT: Pao Wang (608) 263-6479

UW RESEARCHER MAKES A STUDY OF SNOW

By JEFF ISEMINGER
University News Service

MADISON--To know snow is to know dirt.

In fact, dirt is the seed of snow, according to Pao Wang, professor of meteorology at University of Wisconsin-Madison. That's startling news for the person who grabs a handful of snow to eat and assumes it's clean if it isn't brown, black or yellow.

Not to worry, Wang says. Snow-seed dirt is microscopic.

Snow is grown miles high in the sky where dust and sand are lofted by wind. Ironically, most snow seeds come from arid lands that are vulnerable to wind erosion. So, indirectly, a desert can drape a landscape in white.

Dust particles become nuclei of snow crystals when they enter a cloud, according to Wang (A cloud is made of water drops or ice crystals or both, suspended in water vapor). Assuming it's cold enough, dust plus vapor equals snow. Water vapor freezes on contact with dust.

"What you see," said Wang, "is ice forming from vapor, not water. It looks like something is coming from nothing."

Vapor on snow makes crystals, as far as Wang and other scientists are concerned. Flakes, on the other hand, are created from crystals when water hits ice or ice hits ice.

"Then something mysterious happens -- something we really don't

-more-

understand," he said. The ice crystals "multiply like rabbits" without a boost from additional dust seeds. That can result in dustless crystals outnumbering dust-filled crystals as much as 10,000 to 1.

Some crystals clump into flakes, perhaps by colliding in turbulent air or succumbing to electrostatic attraction (as hair bends toward a charged comb). Again, meteorologists just don't know for sure.

To get a better fix on flake-forming, Wang will study snow in Southern California in January. That's not as silly as it sounds: UCLA has a special wind tunnel that Wang says "can suspend anything, including snow."

Wang will be able to observe crystals metamorphosing into flakes without the cover of clouds and the drag of gravity. Otherwise, catching a snowflake in the act of formation is like tracking a twig in a tornado.

Flakes and crystals are mostly hexagonal. One may resemble a six-sided column in a Greek temple, and another is like a six-leafed fern. But they have a common bond of six because the molecular structure of ice is hexagonal.

Crystals and flakes head earthward as they grow and gain weight. Since the journey is long, they pass through other clouds of water drops that feed their icy growth. In winter the ice stays frozen until it hits the ground. In summer it changes to rain. Thunderclouds are mountains of water and ice.

The snow that falls on your sleeve can be crystals, flakes or superflakes (normal flakes stuck together). Wang says there are no two identical flakes, but some simple crystals are virtually identical.

Skiers, shovelers and snowman-builders know that all snow is not equal. Wang says the quality of snow depends on the atmosphere's temperature and humidity. Powder snow is dry with very small crystals and few flakes, since there isn't enough moisture in the air to enlarge the crystals. Wet snow is rimed crystals, which Wang describes as "lots of water drops colliding and freezing on a single flake."

Snow does more than sustain the global loop of $H_2O$. It also strips the air of many natural and humanly-produced pollutants. Some pollutants, as we've seen, are encased in ice. Others are picked up by crystals and flakes on their way down.

###

-- Jeff Iseminger (608) 262-8290

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Research Meteorology

Release: Immediately 08/11/87

CONTACT: Renee Pruett (608) 255-8723

STORM CHASERS: UW-MADISON STUDENTS HEAD SOUTH TO STUDY SEVERE WEATHER

by Terry Devitt
University News Service

MADISON--For 22-year-old meteorology student Renee Pruett, the best way to learn about severe weather is to get square in the path of the worst storm nature sends your way.

And the only way for a land-bound meteorologist to do that, says the University of Wisconsin-Madison honors student, is to pack the needed research gear, jump in the car and hit the road to look for bad weather.

You become, said Pruett, a chaser of storms.

Pruett speaks from experience. Armed with grants from the Phi Kappa Phi Honor Society and the UW-Madison College of Letters and Science, Pruett recently formed a "chase team" and travelled south in search of the tall, anvil-shaped clouds that mark severe weather.

Being in the right place at the right time is crucial. And the right places, according to Pruett, are Oklahoma and Texas where the terrain and climate spawn storms that can be seen for miles across the southern plains.

The right time is late spring and early summer when some of the most dazzling and consistently severe weather in the world sweeps from the southwest across the Great Plains.

-more-

"Oklahoma has the highest recorded rate of severe thunderstorms in the world," said Pruett. "It's also easier to tell where a storm is and which way it's heading in a plains landscape."

Pruett's team -- modelled after the University of Oklahoma's storm-chase team -- was based in Norman, Okla., and consisted of four people: a team leader, a driver, a scribe and a movie photographer. Each team member had explicit responsibilities ranging from navigation and communications to photography and the recording of specific events and measurements.

A typical day for Pruett's team began in the map room at the University of Oklahoma where forecasts were made and the day's route planned. Once on the road, periodic checks with forecasters at the University of Oklahoma, UW-Madison and the National Weather Service helped the team locate severe weather.

The team chased storms for a total of 11 days, logging some 4,000 miles, and was able to intercept storms -- including four major storms -- on eight of those days.

"We were extremely lucky," said Pruett. "The first day down there we saw the most beautiful storm I've ever seen. We saw one very nice funnel which, at one point, went right overhead. We were also able to see a tornado from a distance."

The big storms intercepted by Pruett and her team produced large hail, damaging winds and, in some instances, as much as seven inches of rain.

Once a storm was spotted, the team maneuvered for position, set up cameras and instruments to measure temperature, wind speed and direction, sea level pressure and wind shear, and then took cover to wait out the wind, rain, hail and lightning.

In some cases, Pruett said, measurements were impossible to obtain because of intense lightning, heavy rain and darkness.

-more-

Add 2 -- Storm chasers

When intercepting a storm, Pruett said, safety was a principal concern: "We always tried to set up on the southeast side of the storm which is the safest. Tornadoes generally come out of the southwest and move northeast."

She does not recommend storm chasing for amateurs: "It's not a good idea for people to take this lightly," she said. "It can be confusing even for experienced meteorologists.

"In Wisconsin, it can be even more dangerous. There are too many trees and too many hills. You can go over a hill and find a tornado right on top of you."

But despite the risks, Pruett is considering storm chasing as a hobby to complement her graduate studies this fall at the University of Oklahoma -- a hotbed of storm chasing activity.

"There are very few people that have a chance to do this," she said, "and if you have a chance, you jump at it."

Other members of Pruett's team included UW-Madison undergraduate Ken Smith who served as the team's driver, undergraduate Jim Murphy who served as scribe and graduate student Pat Dills who acted as the team's photographer.

###

-- Terry Devitt (608) 262-8282

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 5/13/87

CONTACT: Douglas Clark (608) 263-7679

# WEATHER WATCHERS HELP STATE BUSINESSES

By INGA BRYNILDSON
University News Service

MADISON--Every day after breakfast, Eleanor Brenneke goes outside her Hortonville home and looks up at the clouds.

She also checks a rain gauge, uses a yardstick to measure the snow if there is any, records high and low temperatures and the direction of the wind.

Her husband, Howard, repeats the ritual at midnight.

State Climatologist Douglas R. Clark says the Brennekes are among an estimated 700 to 800 weather watchers throughout Wisconsin who record daily measurements of the weather.

From his office on the University of Wisconsin-Madison campus, Clark is attempting to organize the first comprehensive list of Wisconsin weather watchers to help industries, businesses and government agencies that need precise local weather information beyond what is currently available from National Weather Service records.

For example, Clark helped a southeastern Wisconsin beer company find much needed weather information to aid in the construction of a beer cooling warehouse.

"They needed to know just how hot and humid it gets in the summer so they could calculate the proper amount of insulation and specifications for a proper cooling system," he said.

-more-

By using local weather records, Clark saved the company the time and expense of having to conduct its own weather investigations.

"Collection of basic data is often 80 percent of the work of a research project," said Clark. "Anything to make that process less costly is going to save both industry and government money."

In another instance, Clark located weather records needed by a microfilm manufacturer. "They needed humidity information which influenced a metal-plating process at the heart of their manufacturing. They were trying to improve product quality by adjusting their operation to [take into account] the effect of humidity on the plating process."

Local weather information also is requested by insurance companies checking the validity of damage claims. "Someone may claim that lightning blew up their TV set. The insurance company needs weather information to see if that was even possible," Clark said.

Insurance lawyers also use weather information to determine culpability in traffic accidents, he said. "Rain and fog can vary greatly from place to place. Insurance companies need to know exactly when the fog or rainstorm occurred at the precise location of an accident."

Construction contractors rely on weather records to verify claims that weather was to blame for delays in contract work. "Weather records from a local observer become important evidence to show the number of dry and good working days that were available in the contract time," Clark explained.

People become weather watchers by hobby and sometimes by occupation, Clark said. Of the 200 observers who make up the National Weather Service network in Wisconsin, many are electric and gas utility or wastewater treatment plant operators.

Radio and television stations are also a good source for weather information. "Some maintain weather stations, others have developed their own

network of weather watchers," said Clark.

"Volunteers include gardeners, phenologists -- people who record the seasonal occurrence of natural events -- and others interested in observing and recording weather patterns," he said.

Brenneke says her weather watching started with a high school class project in 1938. During World War II she worked as an observer in the Green Bay office of the National Weather Service.

"I was sorry to give that up after the war, but we wanted to start a family," she said. "I've never lost interest in the weather. Our oldest son is a forecaster with the Air Force."

The Brennekes provide weather information to a local vegetable cannery. "We furnish maximum and minimum temperatures and precipitation totals daily during their growing and harvest seasons," Mrs. Brenneke said.

Clark estimates it costs about $50 to set up a home weather station. He recently mailed a survey trying to locate all state weather observers to find out who's watching the weather and what information they're recording. The information will be added to the National Environmental Data Referral Service of the National Oceanic and Atmospheric Administration.

Weather watchers who would like to be included in Clark's survey may write to him at the State Climatologist's Office, 1225 W. Dayton St., Madison, Wis., 53706.

###

-- Inga Brynildson (608) 262-9772

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 4/16/87

CONTACT: William Birkemeier (608) 262-3131

# RADAR SYSTEM TO IMPROVE WEATHER PREDICTION

By JEFF GREGORY
University News Service

MADISON--A new radar system under development by a university-industry research group may spell the end for the weather balloon and dramatically improve weather prediction, according to University of Wisconsin-Madison researchers.

William P. Birkemeier, UW-Madison professor of electrical and computer engineering, has been working with the Milwaukee-based Astronautics Corp. to begin moving the new device, called a wind profiler, into production and onto the market.

"The weather balloon is about to become obsolete," he said. "The wind profiler measures the wind right over your head -- something we couldn't do before."

Currently, most information about high-altitude winds is gleaned from balloons released twice a day from a hundred stations across the country. This device, instead of tracking balloons with radar as they move with the wind, tracks the wind itself by bouncing its beams off the water molecules caught up in breezes.

A major advantage, said Birkemeier, is that information about high-level wind speeds can be obtained hourly rather then twice a day. Such information is particularly important to rocket launches. NASA recently began re-examining

-more-

Birkemeier's theory that wind sheer -- sudden and powerful wind velocity changes undetected by meteorologists -- contributed to the January 1986 Challenger disaster.

The idea of the wind profiler, which Birkemeier describes as a "forest of TV antennas" about half the size of a football field, has been around for almost twenty years. The team's new version of the profiler required major improvements in radar detecting strategies and the computers needed to cope with the data produced by the system.

Birkemeier developed a method of computer-enhanced radar pulses that helps screen out such interference as airplanes, which had been a significant problem in previous wind-profiler designs. The system also corrects for "range ambiguities," when the radar interprets distant objects as being nearby.

Radar emits radio signals in short bursts and records the patterns reflected by an object. By changing the signal so that each pulse is different from the rest, the interference can be weeded out, he said.

A computer developed at Astronautics specifically for the device makes the profiler a reality. According to Verner E. Soumi, UW-Madison professor emeritus of meteorology and now chief scientist at Astronautics, processing the vast quantities of data produced by the wind profiler is a big job.

"Automating, making all this data available in real time definitely has been one of the major improvements," he said.

Although some meteorologists are not yet convinced of the profilers's reliability, Soumi is confident that "by and large most are looking forward to our data."

Jerry R. Normberg, project coordinator for the wind profiler at Astronautics, said each profiler is run by a separate computer. Data from satellites and the various stations are then collated at a central location. The National Oceanic and Atmospheric Administration is currently operating

five profilers experimentally in Colorado and has plans to spread 30 or more from the Rockies to the Appalachians by the early 1990s.

All three researchers agree that the profiler will be much more economical than the balloon stations.

Birkemeier believes there is money to made in wind profilers, and millions of dollars in government contracts are now the focus of industrial competition.

"Everybody has now gotten into the act because it's been proven to work and the world needs more accurate wind measurement," he said.

###

-- Jeff Gregory (608) 262-9772

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Research - Meteorology

Release: Immediately 10/9/86

==========

SCIENCE/METEOROLOGY:
A small army of scientists is set to begin a massive three-week study of Wisconsin cirrus clouds using a version of the former U-2 spy plane and portable laser-driven radars. The project is the brainchild of pioneering UW-Madison space scientist Verner Suomi. 635 words

==========

CONTACT: Don Wylie (608) 263-7458

# SCIENTISTS TO PUT WISCONSIN'S CLOUDS UNDER A MICROSCOPE

By TERRY DEVITT
University News Service

MADISON--Picture the following:

Satellite eyes zoom in on Wisconsin cloud cover. A NASA ER-2 -- a high-flying, long-winged aircraft packed with sophisticated meteorological gear -- soars aloft from Madison's Truax Field. Scientists in Oshkosh and Wausau deploy and aim portable laser-driven radars toward the heavens.

That scenario will become reality this week (Oct. 12) as scientists from around the country arrive in Wisconsin to begin an intensive three-week field study of cirrus clouds, feather-shaped streamers that play an important role in determining climate.

"We're trying to build tools to predict climate," said Don Wylie, a University of Wisconsin-Madison Space Science and Engineering Center scientist and an assistant manager for the project.

"You hear a lot about the greenhouse effect and the potential for climate change from things like volcanic eruptions," Wylie said, "but over the long-term, clouds play a far more important climatological role than any of

-more-

those other things."

The brainchild of UW-Madison's pioneering space and weather researcher Verner Suomi and Francis Bretherton of the National Center for Atmospheric Research in Boulder, Colo., the project is known as FIRE, a much shortened version of First International Satellite Cloud Climatology Program Regional Experiment. It is being directed by Steven Cox, a Colorado State professor and former student of Suomi's.

Some 40 scientists and a small army of technicians, support personnel and students from 10 universities and federal agencies will take part in the study.

They will employ the ER-2, a version of the former U-2 spy plane. The ER-2, equipped with infrared sensors and other gear designed to sample cirrus clouds, will crisscross the southern half of Wisconsin at altitudes as high as 70,000 feet.

According to Wylie, there will be at least two other aircraft equipped with sensors and particle samplers involved in the cloud survey. In addition, at least four weather satellites will contribute information during the course of the FIRE field survey.

In Oshkosh, Wausau and Madison scientists will deploy laser-driven radar known as LIDAR. By firing laser pulses at cirrus clouds and monitoring the reflection, much as radar operators monitor echoes produced by radio waves, scientists can determine such things as cloud height and density.

Why all this interest in cirrus clouds?

"There are two big problems in climatology," said Suomi. "One is the effect of oceans on climate and the other is the effect of clouds on climate."

The clouds scientists think might be the most important in determining climate are cirrus clouds, the type to be studied in the upcoming FIRE field survey, and marine stratus clouds, low clouds that form in layers over the ocean and that usually cover a large area of sky.

Add 2--Clouds

Marine stratus clouds will be the subject of a second intensive FIRE field survey next summer off the coast of southern California.

The two types of clouds are important to climate because they cover an estimated 70 percent of the Earth's surface. And although both cloud types play an important role in determining climate, they do so for different reasons, according to Wylie.

"Cirrus clouds can do the same thing as the so-called greenhouse effect," Wylie said. "They're thin clouds that let sunlight through, yet they act like a blanket and trap infrared radiation emitted by the Earth. Marine stratus, on the other hand, reflect sunlight and because they're low in the atmosphere they become very warm and emit infrared radiation to space."

According to Suomi, the two principal goals of FIRE are to learn more about the effect of cirrus and marine stratus clouds on the Earth's radiation budget and also how those two types of clouds form and decay.

"We have an almost trivial understanding of cirrus clouds," Suomi said. "We need a basic understanding of cloud system evolution and their radiative properties. We need that understanding to improve our weather and climate prediction models."

###

-- Terry Devitt (608) 262-8282

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Research Meteorology

Release: Immediately 8/7/86

Contact: Patricia Pauley (608) 262-1957

VIOLENT MILWAUKEE STORM TOUGH TO PREDICT: UW-MADISON METEOROLOGIST

MADISON--Advances in technology allow meteorologists to track storms as violent and unpredictable as tornadoes with a high degree of success. But a storm like the one that brought more than six inches of rain to southeast Wisconsin Wednesday (Aug. 6) eludes early detection, according to University of Wisconsin-Madison meteorologist Patricia Pauley.

"Radar and satellite data we saw showed nothing to indicate the terribly heavy rainfall rate," said Pauley, noting that UW-Madison's meteorology department gets its satellite information from the Man-computer Interactive Data Access System (McIDAS), a sophisticated weather computer developed at UW-Madison.

"McIDAS gives us the proverbial view from the top," she said. "We can get infra-red images indicating cloud temperature, which in turn allows us to make inferences about potential precipitation. Tall clouds are normally cold clouds with a potential for heavy rain, but the cloud tops Wednesday were much lower than what we would expect for so much precipitation."

Pauley said normally, cloud tops associated with fast, heavy rainfall peak between 50,000 and and 60,000 feet. Cloud tops at a maximum of only 25,000 feet accompanied Wednesday's deluge.

Because of prediction and observation problems, a storm like this is harder to prepare for in some respects than a hurricane or monsoon, Pauley

-more-

said. "While very heavy rain comes with those weather patterns, you at least have some notion that they're coming and, once they're here, that they're going on."

Scientists are currently trying to solve those problems, Pauley said. "There's a sensor that's been proposed to fly on the next generation of satellites. The sensor would be able to detect and measure precipitation rate. A device like that would perhaps have given a better indication of the storm's rainfall potential."

###

-- Barbara Wolff (608) 262-8292

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Research - Meteorology

Release: Immediately 7/3/86

CONTACT: Charles E. Anderson (608) 262-0783/262-2828

UW-MADISON SCIENTIST SHARPENS TORNADO FORECASTING TECHNIQUES

MADISON--If the work of a University of Wisconsin-Madison tornado expert pays off, weather forecasters may someday be able to quickly and accurately predict where tornadoes will strike and tell just how potent the twisters are likely to be.

By sharpening interpretations of satellite pictures of violent storms and by classifying tornado outbreaks based on the projected power of the tornadoes within a storm system, UW-Madison meteorologist Charles E. Anderson hopes to reforge what he calls "the weak link" in the nation's tornado warning system.

The weakness of the present system, according to Anderson, is that a tornado warning -- meaning that a tornado has been sighted -- is often vague and based on information supplied by observers armed with nothing more than a knowledge of what a funnel cloud looks like.

The upshot, he said, is that warnings frequently come late and with no clear indication of storm strength, location or direction.

"What we're trying to do is provide some notion of how severe the tornadoes might be once a tornado watch has been made, but before a tornado warning has been issued," Anderson said.

"It's very important to be able to categorize the type of outbreak that's likely to occur," Anderson said. "At the moment, there is no specific indication given as to the intensity of the tornado to be expected even when a tornado watch or a tornado warning is issued.

-more-

"It could be anything from a small storm that will only knock a few signs over to something so powerful that it could carry a house away," he said.

According to Anderson, providing trained local forecasters with computer-based image processing as well as "real-time" weather information from satellites and radar, would enable them to monitor and track storms that could spawn tornadoes. "The idea is to not just gauge strength, but to pinpoint a specific pathway," he said.

Such a capability would allow for earlier and more specific tornado warnings and would ultimately save lives, Anderson said.

Working under a two-year grant from the National Aeronautics and Space Administration (NASA) and using McIDAS, a sophisticated computer imaging system, Anderson and graduate student Kevin Schrab are studying satellite images of past tornado outbreaks to learn about the life cycle of such storms.

The project is akin to what a football coach does with game film. Tapes and pictures of storm systems are played and analyzed until a clear picture develops of how the killer storms form, grow and move across the landscape.

Anderson's studies of past storms show that the most violent storms are the most vigorous. "It's almost a one-to-one relationship," Anderson said. "The strongest storms grow very quickly. This is something you can easily see in a sequence of satellite pictures."

Another clue to storm strength, said Anderson, is to what degree a thunderhead's anvil -- the distinct protrusion at the top of a thundercloud -- deviates from the winds aloft.

"From the storms that we've looked at, we've found that the greater the deviation angle, the more powerful that individual outbreak is. The deviation angle seems to indicate the intensity of rotation within the storm."

###

-- Terry Devitt (608) 262-8282

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 12/23/85

CONTACT: William L. Smith (608) 263-4085, Christopher Velden (608) 263-4206

WISCONSIN SCIENTISTS TO PARTICIPATE IN STUDY OF EAST COAST STORMS

MADISON--For two months this winter, University of Wisconsin-Madison scientists will participate in the largest study of East Coast storms ever attempted.

The study, involving some 25 universities, federal agencies and private institutions, is aimed at improving short-range forecasting of coastal storms, storms which cause extensive property damage and loss of life each year, according to UW-Madison researcher William L. Smith.

Smith said the study, known as GALE for Genesis Atlantic Lows Experiment, is intended to learn more about the interaction between large storms and the ocean. Scientists also hope the study will help them create better computer models to predict major storms.

UW-Madison scientists, working through the Space Science and Engineering Center (SSEC) here, will provide support through a state-of-the-art, computerized imaging system called McIDAS, for Man-Computer Interactive Data Access System. It provides immediate access to satellite images and other important weather data as it is being gathered.

Information processed by McIDAS here will be funneled to a McIDAS workstation at the Raleigh-Durham, N.C., airport, field headquarters for the $10 million project.

Smith said the field phase of the experiment will begin Jan. 15 and continue through March 15. After that, the information collected will be used

-more-

to help UW-Madison researchers at the Cooperative Institute for Meteorological Satellite Studies develop and refine improved rain forecasting techniques.

While GALE is under way in the U.S., Canadian scientists will be conducting a similar experiment in Canada's Atlantic provinces with similar support from UW-Madison's SSEC.

The SSEC portion of GALE's $10 million budget is $300,000.

###

-- Terri Gregory (608) 263-3373/271-1358

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 9/27/85

CONTACT: Christopher S. Velden (305) 350-4460

WISCONSIN COMPUTER SYSTEM HELPED HURRICANE CENTER TRACK GLORIA

MADISON--As Hurricane Gloria raked the eastern seaboard this week, a computer system developed at University of Wisconsin-Madison was key to providing enough warning for hundreds of thousands of people to flee areas endangered by one of the most powerful Atlantic storms in memory.

A sister version of the same computer-driven imaging system, known as McIDAS, was credited this June with saving thousands of people when a Bay of Bengal hurricane lashed the coast of Bangladesh.

National Hurricane Center forecasters in Florida used McIDAS's computer-generated pictures and information to track and predict Gloria's path as it swept toward a 750-mile stretch of seacoast between North Carolina and Maine. Christopher S. Velden, a McIDAS specialist from UW-Madison's Space Science and Engineering Center, was in Florida helping NHC meteorologists learn how to use the recently-installed system.

"McIDAS has been enormously useful for giving us a look at weather like we've never gotten before," Velden said in a telephone interview. "Its graphics make the (weather) systems very easy to visualize."

Many of those same computer-generated pictures have shown up in newspaper and television reports as Gloria stalked north toward landfall.

The system at NHC -- which got its baptism under fire by tracking Hurricane Elena -- draws information from weather satellites, radar and teletyped weather reports. It then creates computer images of the weather as

-more-

it happens, and can overlay numbers and symbols representing factors such as wind speed, temperature and humidity. It also is linked to the master McIDAS system at UW-Madison's space science center.

The computer does not do the actual forecast, Velden said, but makes the job easier for meteorologists. "McIDAS is a tool that puts all the data together on one screen, allowing a forecaster to think clearer and quicker," he said.

By tracking storms in "real time," meteorologists are better able to predict the time and place the storm will strike. These predictions of Gloria's path let those in its way flee or find shelter in time.

The first version of McIDAS, which is short for Man-computer Interactive Data Access System, was developed at UW-Madison's space science center in the early 1970s. Designed originally to use satellite pictures to track wind patterns, it has evolved into a much more sophisticated system that handles billions of bits of data involving almost every aspect of Earth's atmosphere.

Although McIDAS can display weather within minutes of the time it happens, observers now can view the weather only from a satellite's perspective -- looking straight down. A planned upgrade, however, will allow users to alter their perspective up and down, and in effect "fly" the video terminal through weather systems of interest. Another feature gives a three-dimensional effect if a user wears special 3-D glasses.

Scientists at the Space Science and Engineering Center said that McIDAS was developed as a research tool that would let UW-Madison meteorology and planetary atmosphere professors study and develop theories to explain the weather. A number of U.S. agencies and foreign governments, however, have bought versions of the system for uses that include operational weather forecasting.

Besides the hurricane center, other users now include the National Severe Storms Forecast Center, National Aeronautics and Space Administration, U.S. Air Force, People's Republic of China, Bangladesh and Australia.

###

-- Jeff Gregory, University-Industry Research Program, (608) 263-2876

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 4/9/86

CONTACT: Waltraud A. R. Brinkmann (608) 262-6316/263-2086

# STUDY IDENTIFIES LIGHTNING AS CHIEF CAUSE OF STORM-RELATED DEATHS

By TERRY DEVITT
University News Service

MADISON--While tornadoes usually get top billing among Wisconsin's storm-related killers, death by lightning is at least three times more likely, according to a University of Wisconsin-Madison study.

Using data collected over a 24-year period by the National Oceanic and Atmospheric Administration (NOAA), climatologist Waltraud A. R. Brinkmann found that lightning is responsible for more than 50 percent of all deaths that occur during violent storms in Wisconsin.

By comparison, tornadoes account for only 15 percent of storm-related deaths.

Yet, said Brinkmann, most people think of tornadoes when they think of dangerous storms.

"Death by lightning is a single event and gets little attention," he said. "Tornadoes are more dramatic and always make the evening news."

Although tornadoes are a secondary cause of storm-related death everywhere in the state, they are the primary cause of storm-related injuries. According to the study, tornadoes are responsible for 50 percent of all such injuries, while lightning accounts for just 16 percent.

The discrepancy, Brinkmann said, is because an individual struck by lightning is far more likely to be killed than injured.

-more-

According to the study, death by lightning occurs more frequently in northern Wisconsin where fishing, boating and other outdoor activities are at their peak during the height of the thunderstorm season.

Storm-related deaths in the densely populated southern portion of the state are more likely to be caused by rain and wind, particularly drowning, said Brinkmann. According to the study, wind and rain account for 34 percent of deaths linked to storms.

Brinkmann's study also showed that much of the state's severe thunderstorm activity is confined to two broad tracks, one in southern Wisconsin and the other in the northwestern corner of the state.

Most of the state's severe thunderstorms track across a 13-county area in southwestern and southcentral Wisconsin in spring and early summer and then migrate northward with the jet stream to northwestern Wisconsin later in the year, Brinkmann said.

Counties in the southern track include Crawford, Vernon, Richland, Monroe, Iowa, Green, Juneau, Adams, Marquette, Jackson, Lafayette, Buffalo and Pepin. The northern track, according to the study, covers Douglas, Burnett, Washburn, Ashland, Iron, Sawyer, Rusk and Taylor counties.

"Thunderstorm activity is especially intense in early spring when most of the activity is taking place along the southern track," Brinkmann said. "By early June, the area of maximum activity is over the northern portion of the southern track and activity over the northern track is just beginning."

The tracks are miniature reflections of the two major cyclone tracks that cut across North America, Brinkmann said.

Thunderstorm activity is the lowest in central Wisconsin and along Lake Michigan where solar radiation, a principal ingredient of the thunderstorm recipe, is absorbed by the lake in a process known as the "lake effect."

###

-- Terry Devitt (608) 262-8282

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 8/1/85

CONTACT: Charles E. Anderson (608) 262-2827

# LIGHTNING OFTEN THE SPARK OF DEATH, SAYS UW-MADISON PROF

By Sue Reynard
UIR Science Writer

MADISON--The return of thunderstorms may bring a spark of life to parched crops, but the lightning they bring often is the spark of death.

Each year, lightning claims an average of 200 lives in the U.S. alone. Just last week (Saturday, July 27), two hikers in Yosemite National Park were killed by lightning and two others were seriously injured as they climbed the park's famous Half Dome.

And lightning-sparked fires cause more property damage nationwide than any other weather-related source, says University of Wisconsin-Madison meteorologist Charles E. Anderson.

"Worldwide there are about 2,000 thunderstorms occurring at any instant," he said.

Storms play an important role in maintaining the proper balance of electrical energy in the earth's atmosphere, said Anderson. But their power can wreak havoc on the ground.

"One problem is that it's impossible to predict where the lightning from these storms will hit," Anderson said. This unpredictability contributed to the problems faced recently by firefighters in the western United States.

But lightning poses a threat wherever it occurs, simply because each

-more-

thunderbolt carries an immense amount of energy.

Anderson called lightning "a flow of electrical energy between negative charges in one storm cloud and positive charges in the ground or another cloud.

"The negative charges slowly and invisibly establish contact with the positive charges. But the return flow of charge, positive to negative, is a swift, brilliant flash. That's lightning."

A lightning flash travels upward from the ground, not down from the cloud as is commonly believed, Anderson said.

"The flash, or return stroke, can carry an electrical current tens of thousands of times more powerful than household current," said Anderson. "Even an average thunderbolt can heat the inside of a tree to over 50,000 degrees Fahrenheit -- that's more than enough to make it burst into flames."

It's also enough energy to kill a person or an animal by causing fatal burns or stopping the heart.

"A storm can be more serious than it appears, because often what we see as a single flash of lightning can be ten or more strokes," added Anderson.

The only real advance in preventing lightning damage came when Benjamin Franklin invented the lightning rod in 1752, said Anderson. These rods attract lightning that approaches a building and conduct it to the ground where it dissipates harmlessly.

Other efforts to control lightning damage have been largely unsuccessful because no one really know how or why lightning forms, Anderson said.

"We understand many of the basic principles, such as the reason for the flow of charge," said Anderson, "but the major unsolved problem is how the negative and positive charges get separated in the first place."

Scientists are also baffled about how a thunderstorm can recharge itself quickly enough to release so much current.

"A typical isolated thunderstorm will exist for about an hour," Anderson said. "During most of this time, it can discharge up to 30 lightning bolts per minute. In general, opposite electrical charges rapidly equalize and their current dies out. But in these storms they manage to stay separated and keep generating bolts."

###

-- Sue Reynard (608) 263-2876

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 7/25/85

CONTACT: Charles E. Anderson (608) 262-0783

# UNIQUE STORM PRODUCED BARNEVELD TWISTER

By LANCE QUALE
University News Service

MADISON--The killer tornado that devastated Barneveld, Wis. in June, 1984 was just one of seven tornadoes produced by a single storm system, a system nearly 10 times larger than any previously identified with tornadoes, according to a University of Wisconsin-Madison researcher.

The seven tornadoes that raced across Wisconsin on June 8, 1984 came out of a giant storm more than 60 miles across, meteorology Professor Charles E. Anderson said. A typical tornado-producing storm has about a six-mile diameter.

Anderson said most of that night's tornadoes seem to have been produced in rotating spiral arms that developed out of the central body of the storm.

"People in the tornado warning business should be alert to this type of phenomenon," Anderson said.

Anderson has tentatively named the new type of storm system a "spiral mesolow" -- spiral to describe the rotating pattern, and mesolow to describe the large size of the main storm.

Anderson will present his findings at the American Meteorological Society's Severe Storms Conference in Indianapolis in October.

According to Anderson, the Barneveld tornado caught forecasters by surprise because the storm did not resemble those that typically produce tornadoes. Usually, tornado watchers use radar to look for small rotating thunderstorms that produce small "hook echoes" that look like a figure "6" on

-more-

the radar screen.

Tornadoes frequently spin out of the hook, which may then produce other tornadoes, Anderson said. Multiple tornadoes may also be produced by a series of separate small thunderstorms, as was the case earlier this year when powerful tornadoes struck Ohio, Pennsylvania and Ontario.

But the single large storm that gave rise to the Barneveld tornado produced at least six other tornadoes, several of which may have been produced simultaneously in different parts of the storm, Anderson said.

The unusual pattern initially puzzled meteorologists. "In the beginning, we didn't know what we had. We were looking for the standard hook echo.

"But this may be more common than we suspect. We haven't been looking for it. If we go back and examine past events more carefully, we may find this pattern."

Anderson said the tornado that struck Barneveld received the highest possible rating on the Fujita scale of tornado intensity.

"That was probably the only F-5 tornado in the United States in 1984," he said. "It could be that the intensity was related to the tremendously large-scale rotating system, which, if localized, could create a very great internal spinning capability. I think that's one of the dominant factors here."

Anderson's findings are based on radar images obtained from ground stations at Neenah, Wis. and Marseilles, Ill. Using color enhancement techniques and a sophisticated UW-Madison weather computer, Anderson obtained much more detail than through traditional tornado-monitoring techniques.

Anderson's study of debris fallout patterns from the Barneveld tornado also provided additional information on the size and scope of the storm system.

###

--Lance Quale (608) 262-3846

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 6/14/84

CONTACT: Charles E. Anderson (608) 262-0783

METEOROLOGIST EXPLORES TORNADO SAFETY MYTHS

MADISON--Lightning streaks across the sky. Branches rap against the windows. The scream of sirens cuts the night, announcing the sighting of a nearby tornado.

What to do? Where to take shelter?

Charles E. Anderson, who has studied tornados for 25 years at the University of Wisconsin-Madison, says it is probably safest to head for the area under your basement steps.

Although at one time the National Weather Service advised people to go to the southwest corner of the basement during a tornado, the meteorology professor said those safety instructions have been revised in light of recent research.

"Civil engineers have pretty well demonstrated that going into the southwest corner doesn't offer much protection if the house above it caves in," Anderson said during a recent interview. "But the basement steps are usually strong enough to shelter people from falling debris."

In a house without a basement, he said a bathroom or utility room may offer some protection during tornados. He explained that the plumbing provides structural reinforcement and may help keep the room intact.

Another common action -- to open a window to equalize the pressure inside and outside the house during a tornado -- may do more harm than good, he said. Most houses leak enough air to prevent a large pressure difference without

-more-

having to open a window, according to Anderson, and closed windows can prevent flying debris from getting into the house.

Anderson added that one myth about tornado safety is that surrounding lakes, rivers or hills will offer some natural protection. But the geographic placement of a city or village doesn't guarantee its safety, he said. Tornados have crossed mountains and cut swaths of destruction up and down the hillsides.

"Tornados will move across lakes and become waterspouts," he said. "There are also reports of tornados moving across rivers and draining them at those points."

Anderson said Wisconsin is a tornado prone state.

"Simply because we're fairly far north doesn't mean we're free from the threat of tornados," he said. "We're prime tornado country. That includes the whole area east of the Rockies, although the lower part of the Mississippi Valley region has the highest incidence of tornados."

Anderson said Wisconsin, on average, suffers more tornado damage than neighboring Illinois. About 18 tornado sightings occur in Wisconsin each year, he said, but this season's total is likely to be above average.

"With the sightings on April 27 and again last week," he said, "we're running ahead of schedule. So far, about 16 tornados have been sighted this year."

Although tornados can form almost any time during the year, he said they occur most frequently during the early summer months because warm, unstable air from the Gulf of Mexico comes in contact with centers of cool air and high pressure from Canada. This mixture of air produces the rotating thunderstorms in which tornados form.

"The month of June is normally our heaviest tornado month," he said.

###

-- Jennifer Zinecker (608) 262-2650

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: HOLD FOR AM's RELEASE, MAY 26, 1984

CONTACT: Reid Bryson, Institute for Environmental Studies, (608) 262-5957

# CLIMATE FORECASTS STILL NEED PERFECTING, SAYS UW-MADISON SCIENTIST

MADISON--Long-range climate forecasts are not yet accurate enough for scientists to estimate in advance how climate will affect crop yields around the world, but they still can be useful to agricultural policymakers, according to a University of Wisconsin-Madison climatologist.

Reid A. Bryson told colleagues at the annual meeting of the American Association for the Advancement of Science (AAAS) here today (May 26) that the best forecasting methods now available have a 55 to 70 percent chance of being correct, depending on place and season.

"This is enough, at least, to provide guidance on which way to hedge a food-supply policy decision," he said.

Bryson, director of the Institute for Environmental Studies at UW-Madison, has been working for 11 years to develop forecasting models that can predict with reasonable accuracy, months or even years in advance, such things as temperature and precipitation.

At an AAAS session on world food production potential, he said climatic variation, like food production itself, is a complicated thing driven by many factors. Scientists have isolated what they believe to be a number of those factors, he said, but nobody has solved the puzzle of how to incorporate them all in a single forecasting method.

If accurate enough, long-range climate forecasts would take some of the guesswork out out of agricultural planning for farmers and government

-more-

officials. They would make it easier to anticipate and cope with drought and other weather-related threats to food production.

Computer models that simulate the present climate have improved rapidly in recent years, according to Bryson, but models that can actually predict climate change have been much more difficult to perfect.

He said scientists have many clues to the factors behind changes in climate. The amounts of carbon dioxide and volcanic aerosols (mostly tiny droplets of sulfuric acid) in the atmosphere, albedo (the degree to which the earth reflects the sun's energy back into space), and astronomical variations are all thought to be partly responsible.

Bryson said when those factors are used individually in climate forecasting, they show some utility in making long-range predictions of temperature and precipitation, but not a great deal.

Pary of the problem is that most of the models developed so far take only one or two factors into account at a time, he said, and there is a need for models and forecasting methods that take them all into account.

###

-- Tom Sinclair (608) 263-5599

research news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 1/18/84

CONTACT: Fred Mosher (608)262-3755; John Bates (608) 262-6361

# SPACE-AGE TOOLS IMPROVING 'TORNADO WATCH' FORECASTS

by Mark Bello,
University News Service

MADISON--Using new tools to track the erratic movements of violent storms, scientists at the National Severe Storms Forecasting Center in Kansas City, Mo., have improved the accuracy of their tornado forecasts by 20 percent.

That's one encouraging development cited in a recent review of the center's two-year-old Centralized Storm Information System, an experimental computer system intended to help forecasters evaluate the huge amount of weather information gathered on land, at sea and in space.

At the heart of the storm information system is McIDAS, the Man-computer Interactive Data Access System. It is the product of a decade of research and development at University of Wisconsin-Madison's Space Science and Engineering Center (SSEC). Through McIDAS, forecasters in Kansas City have almost immediate access to satellite images and other important weather data as it is being gathered.

During 1982, the first year the storm information system was operating, tornado forecasts were correct more than half the time, as compared with a success rate of about 40 percent in 1981, according to an evaluation done by Fred Mosher, a UW-Madison scientist, and J.T. Schaefer, head of the National Weather Service's Techniques Development Unit in Kansas City.

-more-

Mosher and Schaefer also reported that when Kansas City forecasters sounded a generalized severe storm watch for a particular area, a record four out of five predictions were correct in 1982. Preliminary data indicate the same rate of forecasting precision for 1983.

Severe storms include tornadoes, dust storms, thunderstorms, snowstorms and other types of violent weather. Forecasters at the Center are responsible for issuing severe-storm "watches," which means they must contact local agencies when they diagnose conditions as ripe, say, for a tornado or snowstorm. "Warnings" are the responsibility of local officials and are issued only when a funnel cloud or severe storm is sighted.

Mosher, who directed the installation of McIDAS at the Kansas City center, said the computer provides a way to pull together the deluge of weather data coming into the facility into meaningful patterns -- maps, graphs, charts, enhanced and superimposed images -- on a television screen.

"The forecasters are looking at more data," said Mosher. "But because the data presentations have a higher information content, forecasters spend less time staring at data and more time understanding what's happening with the weather."

Rather than evaluating radar blips to assess the growth and movement of severe storms, many forecasters in Kansas City now monitor storms using real-time satellite images on the screens of their computer terminals. That capability not only permits better storm surveillance, but also allows forecasters to monitor more storms than is possible with radar.

As a result, forecasters have a better vantage point for identifying conditions that could spawn tornadoes and other types of short-lived but destructive storms.

Within the torrents of data streaming into the McIDAS computer terminals at the severe storms center are temperature and humidity soundings from a satellite-borne device called VAS. Like McIDAS, the experimental sounding

device originated at UW-Madison's SSEC. And it, too, promises to be a boon to severe-storm forecasting.

Able to detect infrared light, VAS probes the earth's atmosphere to gather temperature and humidity data at several levels. Prior to VAS, which was conceived in 1971 by SSEC Director Verner Suomi, such data was available only from scattered weather balloons and a polar-orbiting satellite that has a field of view smaller than higher-orbiting VAS satellites.

VAS can monitor the same storm system almost continuously because the satellites carrying the instrument are in geosynchronous orbit -- seemingly fixed in one position above the earth. Perched 22,000 miles above the earth, three VAS-equipped satellites are providing scientists with their first glimpses of the energy exchanges believed to trigger hurricanes, tornadoes, thunderstorms and other violent storms.

As researchers refine their VAS methods, they also are discovering new uses for the instrument.

In its most recent battery of tests, VAS provided the most accurate measurements to date of sea surface temperatures, a key variable in modeling large-scale and seasonal weather systems, concluded researchers participating in a workshop at NASA's Jet Propulsion Laboratory in California.

In tests conducted over the Pacific and Atlantic Oceans during March and July 1982, temperature estimates based on measurements made by VAS's closest competitor, a device called an Advanced Very High Resolution Radiometer that is aboard a polar-orbiting satellite, were confounded by volcanic aerosols.

As a result, said UW-Madison space scientist John Bates, VAS was the only instrument to detect the onset of El Nino, the warming of eastern Pacific Ocean waters that has been blamed for much of the world's unusual weather during 1982-83.

###

-- Mark Bello (608) 262-8282

research news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 5/17/83 mb

CONTACT: David Martin (608) 262-4363

METEOROLOGISTS PIECING TOGETHER MONSOON JIGSAW

MADISON--Indian and Wisconsin scientists are unraveling the complex set of forces that drive the summer monsoon--the world's most important seasonal weather phenomenon.

Atmospheric physicist M.S. Narayanan, of India's Space Applications Center, and meteorologist David Martin, of the University of Wisconsin-Madison's Space Science and Engineering Center, have been poring over satellite photographs and soundings of the 1979 summer monsoon. With the data collected during the Global Weather Experiment, they are pinning down some of the factors that influence the enormous and often-erratic wind system.

Among their findings so far is an atmospheric "lid" that keeps the monsoon intact until it can deliver its precious rain to sun-baked southern Asia.

The monsoon winds, which may reach hurricane force, bring life-giving rains to India and the rest of the region, filling reservoirs and quenching parched agricultural areas. The lives of nearly half the world's population revolve around the four- to five-month monsoon season.

"Everything is so critically dependent on the monsoon" in India, explained Narayanan, who recently returned to India after a year of research at UW-Madison. "A (rainfall) delay of 10 or 12 days seems trivial here (in Wisconsin), but it can bring down the whole system in India."

- more -

Research that sheds light on the monsoon's fickle nature does more than satisfy scientific curiosity. It also is a step toward a model for forecasting monsoon behavior, an elusive achievement that would eliminate the crucial guessing game Asian farmers must play with the weather.

But before scientists can develop a forecasting model, they must assemble all the parts of the model. That's the task Narayanan and Martin have taken on.

Narayanan is the first to "see" in satellite data a thin layer of warm air that positions itself over the monsoon system as the winds develop in the Arabian Sea between Arabia and India, usually in early June.

The 1,500-foot-thick layer, warmer than the air below it, acts as a lid to prevent cooler, moisture-laden air from rising. Without a lid, the air would continue to rise and cool, releasing its moisture prematurely as rain over the ocean.

According to Narayanan, the lid is warm air from the coast of Arabia and Africa that settles over the cooler oceanic air and, in effect, seals the monsoon system. The inversion prevents rain from falling over the ocean and usually breaks up when the monsoon reaches the coast of India, he said.

The Indian scientist said nobody understands all the forces that contribute to the benevolent natural phenomenon, but he suspects that dust particles blown from the arid Arabian Peninsula play an important role.

"The more dust in the air, the stronger the inversion appears to be," Narayanan said.

Martin and a UW-Madison colleague, Michael Howland, are developing a method for compiling what would seem to be the most basic of weather information--daily rainfall totals. But rainfall measurements are not available for much of the monsoon region.

Observation stations on six Arabian Sea islands provide scattered rainfall information during the early stages of the monsoon. On land, monitoring is more extensive, but less than complete.

But by using infrared and visible-light satellite photos, "we think we will be able to provide maps of daily rainfall to serve many needs," Martin said.

One need is forecasting. The monsoon owes its beginnings to the sun's energy, but other factors, including the energy released by condensation, come into play as the system matures.

"The energy (from condensation) represents a source of heat for the atmosphere, and this heat can alter the winds that create the rain clouds and steer them through southern Asia," Martin said.

Martin and others have proved that visible-light and infrared satellite photos can be used to measure rainfall, but their analytical methods must be refined and simplified before they can be practical.

A day's worth of satellite photos of the monsoon region yields a hundred billion bits of information. With the aid of a computer, the Wisconsin researchers can scan the enormous amount of pictorial data for brightness and textural patterns representing rainfall.

They have yet to meet their goal of processing a day's worth of photos in 24 hours, however. To shorten the analysis, Martin and Howland will automate more of the scanning process, leaving only the most important data for meteorologists to evaluate.

Even with a perfected method for measuring rainfall, weather researchers are a long way from accomplishing their ultimate goal of predicting monsoon behavior. Researchers also must account for many other factors--"from the molecular to the planetary"--that influence the mammoth weather system, Martin said.

"Predicting monsoons over their lifetimes remains a distant goal," he said. "It's the kind of problem that will occupy the efforts of the next generation of meteorologists."

###

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 3/15/83 mb

CONTACT: Robert J. Fox (608) 262-0544

WEATHER SATELLITE PROPOSAL RAISES RESEARCH CONCERNS

MADISON--The executive director of a major center for weather research said Friday he would object to giving full control over the nation's weather satellite system to private industry.

Robert J. Fox, executive director of University of Wisconsin-Madison's Space Science and Engineering Center, said he was not necessarily against the idea but was concerned about "the continuing evolution of our system for collecting and analyzing weather data." He said he was still waiting for details on a Reagan administration proposal to sell the nation's four weather satellites.

"My initial reaction is neither one of opposition nor one of strong favor," Fox said. "I want to know whether NOAA (National Oceanic and Atmospheric Administration) and NASA (National Aeronautical and Space Administration) will have a chance to advance the satellite system."

NOAA, the Commerce Department agency charged with developing the ability to forecast the weather adequately, funds much of the weather research at the SSEC. Fox estimated that 60 percent of the center's annual research budget of $6 million supports weather-related studies.

SSEC has designed, or participated in research leading to, many of the meteorological sensing devices on weather satellites now in orbit. Currently, two SSEC projects are developing instruments for the next generation of weather satellites.

- more -

"A lot of what NOAA funds is in basic research," Fox said. "Take the research away and the (satellite) system can run on inertia for a couple of years. Then development would stop."

The National Weather Service uses atmospheric information collected by NOAA satellites for its forecasts; researchers use the same information to improve their understanding of the factors influencing weather.

"No one has ever proposed that we commercialize our planetary programs, because they are regarded as true research," Fox said. "Weather-satellite studies are research of the planet earth."

If satellite data were used solely for day-to-day forecasts, he added, then "commercialization would be a more clear-cut issue."

Fox also said a good system for collecting weather data "is as much a national necessity as is an interstate highway system." He cited agriculture, construction, shipping and utilities as examples of industries that would benefit greatly from improved weather forecasting, especially for five- to 30-day periods.

"Improvements in these forecasts are closely coupled to the rapid implementation of new research results into the operational system," Fox said.

Selling the satellites must not "disrupt this close coupling or it will lead to the stagnation of weather services," he stressed.

However, Fox said he is "not positive" that transferring the satellites to private industry would lead to stagnation. He said he "only suspects" that it would. The Reagan administration has argued that the private sector would operate the satellites more efficiently than NOAA.

Private weather-forecasting services do already exist, selling their interpretations of satellite and other data available from the National Weather Service.

Fox's boss, SSEC director Verner E. Suomi, said he expects to learn more about the proposed satellite sale when he testifies Monday before the U.S. Senate Subcommittee on Science and Technology. Suomi, who has been involved in the weather satellite program since it began in the early 1960s, will testify on the impact of proposed cuts in NOAA's budget.

###

research news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 11/8/82 jwh

CONTACT: Pao-Kuan Wang (608) 263-6479

ANCIENT CHINESE RECORDS LINK WINTER THUNDER WITH COLD

MADISON--By studying ancient Chinese records, a University of Wisconsin-Madison meteorologist has found that rare winter thunderstorms may signal a colder-than-average winter.

Professor Pao-Kuan Wang of UW-Madison's meteorology department looked at the winter thunderstorm precisely because it is so rare, and thus was recorded by ancient Chinese scribes. He concentrated his search on extensive official histories which reach back about 3,000 years.

Wang said climatic and astronomic happenings were considered very important in ancient China. The feelings of God, according to ancient astrologers, would be displayed by unusual phenomena. Solar eclipses or winter thunderstorms, since they are so infrequent, were often regarded as evil, possibly portending political collapse or danger to the ruler.

"These events are strange and the scribes wrote down anything strange," Wang said. "It becomes a very complete record."

Wang compared his findings to ancient Chinese winter temperature data collected by K. C. Chu of the Chinese Academy of Sciences. Chu looked at temperature indicators within the official histories that even included plant and animal reactions to changing weather.

- more -

When Chu's graph of winter temperature fluctuations was plotted alongside a graph of Wang's winter thunderstorm frequency, even Wang was surprised. "It's almost a peak-to-peak correspondence," he said.

"If you compare the two curves, you find that the colder the winter is, the more likely you'll have winter thunderstorms." More broadly, "it appears that in China, temperature and electrical activity in the atmosphere are associated."

Wang doesn't claim to understand the phenomenon completely, but noted that lightning accompanying heavy snow indicates very strong frontal instability. That means the air at the storm front is likely to produce heavy weather.

The mechanism of cloud electrification that produces lightning is, even today, unexplained, he noted.

Wang wouldn't hazard a guess on the chances for winter thunderstorms in the coming season, but did cite a "controversial" Chinese study that used planetary alignment to predict that a cold 1982-83 winter is coming. "We better watch out," he laughed.

Originally from Taiwan, Wang has studied the ancient Chinese histories most of his life. He said the documents are written in a literary form of Chinese that has never been spoken. He also is a virtuoso artist of the xiao, a vertically-held bamboo flute of Chinese origin.

###

research news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 6/2/82 dls

CONTACT: Charles E. Anderson (608) 262-0783

'BLACK HOLES' MAY POINT TO TORNADOS

MADISON--Researchers at University of Wisconsin-Madison are studying a phenomenon that could let weather forecasters spot severe tornados from space before they cause damage on earth.

"Black holes," or cloud-void areas that appear on satellite photographs of some severe storm clouds, seem to be associated with "killer tornados," says meteorology Professor Charles E. Anderson.

One such cloud-void area showed up on 1981 satellite photographs of the Binger, Okla., area about 30 minutes before a powerful tornado actually touched down, Anderson said, suggesting the phenomenon might constitute a warning signal when it is better understood.

"We're looking at any possible help we can get," he remarked.

Anderson currently heads a team that has been studying severe storms for the past 11 years with funding from the National Science Foundation. The researchers use the McIDAS system, developed by UW-Madison's Space Science and Engineering Center, which pulls together satellite images and other weather information into a single TV picture, and can then calculate and display other results.

Anderson had speculated on the significance of the black holes in an article three years ago, but until recently there was no proof that they were anything more than shadows cast by irregularities on top of the cloud formations.

- more -

Last month, however, the National Severe Storms Forecast Center in Norman, Okla., released a report based on Doppler radar observations. Among other firsts, the scientists found an echo-free center, a place in the tornado where there was almost none of the precipitation, dust, or other objects that reflect radar beams.

The echo-free center coincided in size and location with the tornado funnel. Moreover, Anderson observed, it coincided with the cloud-void area in the satellite photographs. "They had a hole in the radar, and we had a visual," he explained. "This is the first time for visual and Doppler radar confirmation of the same phenomenon."

The Binger twister, which struck May 22 last year, generated winds up to 196 miles per hour and averaged a half-mile in width during its 14-mile journey along the ground. It picked up and hurled from its funnel cattle, farm combines, a semi-trailer truck, oil storage tanks and other debris.

The UW-Madison team is now reviewing photographic records of a number of other storms, including a tornado that killed 66 people in Wichita Falls, Texas, on April 10, 1979.

Anderson and scientists at the Norman center believe that, unlike the rest of a tornado where updrafts produce condensation and precipitation, air within the funnel is sinking, and so must be dry and clear. It is also probably warmer than air in the surrounding vortex, Anderson noted, so that infra-red nighttime satellite observations may reveal the same phenomenon that is visible as a black hole in daylight cloud photographs.

"Tornados are so widespread, so frequent," said Anderson, that "there must be some common denominator--some way of explaining them." So far, cloud-free voids have been spotted in the clouds of only the most violent of tornados, but that is significant, according to the scientist. "It's the killer tornados that the public needs to be warned about," he said.

###

UIR/RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON

UNIVERSITY-INDUSTRY RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2840

UIR SCIENCE WRITING DIVISION
(Graduate Student Science Writing Program)

Additional Information: Reid A. Bryson (608/262-5957)
May 17, 1982

Research Meteorology

YEAR-IN-ADVANCE CLIMATE FORECASTING POSSIBLE

Madison, Wis.--A new technique making forecasts of monthly average weather--temperature and precipitation--a year or more in advance with some degree of accuracy has been developed by meteorologists at the University of Wisconsin-Madison.

The method has undergone regular testing and improvement since 1976, with results indicating that an accuracy of about 10 per cent over what could be expected by chance can be achieved.

The forecasts are not for particular days but for monthly means--whether the temperature and precipitation for the month will be above or below the long-term average.

"Forecast skill, though small, was significantly better than would be expected by chance," says Reid A. Bryson, meteorologist and director of the UW-Madison's Institute for Environmental Studies.

-more-

With colleague J.B. Blechman, Bryson has made forecasts of monthly precipitation and mean temperature a year in advance for some 200 stations in North America and Asia. Some 2000 forecasts were then checked against the actual records for the period.

"For partly unknown reasons the precipitation forecasts were more accurate than those for temperature," the scientists report.

The purpose of the research is to devise a forecasting method capable of indicating climatic conditions a year or more in advance for farmers and industries.

"When we began, we were aware that forecasts of factors other than temperature and precipitation would also be useful, but felt that if we could not predict these we certainly could not predict others such as net radiation and potential evapotranspiration," Bryson points out.

There is a certain part of the variability in climate, he adds, that remains, and may always be, beyond the capability of meteorologists to predict, but there appears also to be a certain amount of predictability in climate, the result of physical factors at work on the atmosphere.

These forces or influences at work on the atmosphere include such measurable events as volcanism, atmospheric tides caused by the sun and moon, and a slight wobble--called the Chandler effect--of the earth around its axis, somewhat like the wobble of a spinning top.

The effects caused by these forces are small but measurable, and are sufficient for example to create average winds of up to one meter per second and influence seasonal weather patterns.

"These forces are sufficient to modify the normal monthly general circulation patterns," the Wisconsin scientists point out.

The strength of the tides and the effect of the Chandler wobble ebb and wane over different cyclic time periods, and these, combined with variations in the intensity of volcanic activity, result in a complex pattern of global atmospheric effects that have been programmed into a computerized model by Bryson, Blechman, and a group of students.

Over the years since 1976, they have made forecasts a year or more in advance and deposited the forecasts with a variety of agencies to lend credence to subsequent calculations of forecast accuracy. The agencies included the National Oceanic and Atmospheric Administration, the U.S. Air Force, the U.S. Office of Technology Assessment, and Lawrence Livermore Laboratories.

A forecast was considered correct if it correctly predicted that precipitation would be above or below the mean for the month; it was also considered correct if it predicted that temperature would be near the mean, in the upper-third, or in the lower-third of all past cases.

Temperature data usually fall equally above and below the mean, and thus, climatologically, one may expect 50 per cent of the signs of the departures to be correct if no skill were present, Bryson points out. This is not quite true for precipitation, so they have made adjustments in the methods to allow for that fact.

Thus, he adds, any verification score that exceeds 50 per cent correct will demonstrate that the prediction is more accurate than would be expected by chance.

"Scores on the individual months range from excellent to terrible," says Bryson. "Overall, the forecasts improve on chance by something better than five per cent. For some months, however, forecast accuracy was consistently better. At present we are able to forecast large departures from the mean with more skill in summer and small departures better in winter."

The Wisconsin meteorologists at first believed that precipitation would be more difficult to forecast correctly than temperature. This turned out not to be the case.

"From our results, it appears that July precipitation forecasts can be made with an accuracy of nearly 70 per cent. The accuracy of the temperature forecasts for July, as well as for the average over the rest of the year, was quite a bit less accurate, averaging about 60 per cent."

In addition to forecasts for the U.S., Bryson and his colleagues made forecasts for the Indian monsoon, for the U.S.S.R., and for Japan. In general, forecast accuracy for these parts of the world were comparable to those for the U.S. Most accurate were forecasts for summer precipitation in the Soviet grain belt.

In forecasts of precipitation, predictions of up to as long as six years in advance appeared as accurate as those for one year, but this was not true in the case of temperature.

While the technique has not been perfected to the point where it is immediately useful to everyone, Bryson and Blechman are optimistic about the possibilities for improvement.

add four--weather forecasts

"Only a few physical factors have been used so far, but forecasts based on them do, indeed, improve our forecasting skill, and thus constitute a step toward better and longer-range forecasts.

"The results show that the long-range forecast problem is not an intractable one. We did not need a large and complex monitoring program carried on for many years. We did not need to wait for the development of some kind of super-computer.

"We believe that better-than-chance forecasts can be produced, and perhaps eventually we will find that climatic forecasting will be less difficult than weather forecasting.

#########

research news

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Release: Immediately 10/24/80 jhs

CONTACT: Fred Mosher (608) 262-3755/263-7974

UW-MADISON GETTING A '3-D' LOOK AT EARTH'S ATMOSPHERE

MADISON--After some nervewracking teething troubles and "a week of frantic checkout," scientists at University of Wisconsin-Madison are getting the world's first, continuous three-dimensional look at the earth's atmosphere from space.

A detector called BAS, launched aboard the GOES-D weather satellite Sept. 9, "is performing as specified," said Space Science and Engineering Center scientist Paul Menzel. The detector picks up infrared radiation from the atmosphere on a dozen different wavelengths, each representing the temperature or humidity of a specific altitude range, and then transmits the information back to earth. Scientists can use the data to paint an in-depth picture of the atmosphere over a continental-sized area.

UW-Madison scientists involved in the project say the information received so far is "right on target" with readings from weather balloons known to be accurate.

Fred Mosher, project manager, said VAS will be used soon to probe thunderstorms, winter storms and even hurricanes, as well as for the more prosaic cloud-tracking chores meteorologists perform to get an overall idea of how the air moves.

Although the data is coming through now, problems at the Wallops Island receiving station in Virginia caused some anxious moments when the system checkout began Sept. 22. "It was a week of frantic checkout," Menzel said, before scientists were convinced "everything in the sky is working beautifully."

- more -

The scientists are still testing VAS's capabilities, but already it has produced several times more data in one day than its chief rival, the U.S. network of weather balloons. Although VAS is not as accurate at any given altitude as a balloon's thermometer, its overall temperature profile is almost as good, it takes readings which blanket a viewing area, and--most importantly--it can take readings much more often.

Weather balloons are normally sent up every 12 hours from stations scattered throughout the United States. VAS already has done the United States twice that fast, and has the eventual capability of checking small areas every 10 or 20 minutes.

The GOES-D satellite, operated by the National Oceanic and Atmospheric Administration (NOAA), is parked now in a stationary orbit over the equator south of America's Great Plains. It will remain there until it must be moved to replace one of two other satellites expected to fail soon. Meanwhile, testing is going on eight hours a day, five days a week at the Space Science and Engineering Center, the only place besides Goddard Space Flight Center in Maryland to receive the signals as they are sent.

UW-Madison originated the design concept for VAS here in the late 1960s, worked on the VAS instrument beginning in the mid-1970s, and began development of the computer programs to receive the data about three years ago.

When NOAA decides the testing phase is over, it will start the clock ticking on a 79-day period of scientific data gathering from VAS before taking it over for its routine weather observation mission. Two other VAS-equipped satellites are in the works, however, with the first, GOES-E, scheduled for launch in March.

The only other satellites with a capacity resembling GOES-D are in low, polar orbits that don't give a view of the same area twice in succession.

VAS is an acronym for VISSR Atmospheric Sounder. VISSR, in turn, is short for Visible Infrared Spin-Scan Radiometer.

###

research news

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Release: Immediately 8/28/80 jhs

SEVERE STORM FORECASTERS EYE UW-MADISON'S McIDAS

MADISON--A weather research tool developed at University of Wisconsin-Madison points the way to faster and more precise forecasts of severe storms and tornadoes, say officials of the National Severe Storms Forecast Center in Kansas City, Mo.

Since St. Patrick's Day, federal severe storms forecasters have been testing the capabilities of a system of computers and color TV screens named McIdas by its creators here at UW-Madison's Space Science and Engineering Center. The system pulls together weather satellite images and normal earthbound readings, and can display combinations of the information on a color TV screen.

"McIdas has given us, as forecasters and as researchers in severe storms, a viewpoint of the data we have never really had before," according to Joe Schaefer, chief of the National Weather Service's Techniques Development Unit in Kansas City.

He noted that McIdas' satellite information is received 24 minutes faster and shows more detail than the present pictures relayed through Washington, D.C. The advantage of being able to "superimpose and juxtapose observations from different sensors on the same color screen" is unmatched, Schaefer added.

This ability to pull the information together into a meaningful pattern is what makes McIdeas so valuable to a forecaster sitting in front of its screens and keyboards, developers say. That's also why, when they began putting it togehher six years ago, they named it McIdas--short for Man-computer Interactive Data Access System.

- more -

More than just a display unit, McIdas can use the raw information to calculate tables, graphs, contour lines and wind speeds. It then can overlay them in a single, multi-colored picture--superimposing, for example, high altitude temperature readings on a live, infra-red satellite image.

Edward W. Ferguson, manager of the Satellite Field Services Station in Kansas City, praised the ability of McIdas to fill the gaps between weather station reports with calculations and satellite information. "What we did before in our minds," he noted, "we do at the touch of a button. It upstages the heck out of our present way of operating."

The move to test McIdas' abilities came from the Weather Service's knowledge of how the system has developed since 1974, and from a Texas tornado which slammed into Wichita Falls with scant warning last year. A congressional delegation led by Reps. Don Fuqua, D-Fla., and Larry Winn Jr., R-Kan., both of the House Subcommittee on Space Science and Applications, was shown McIdas videotapes last summer which indicated the warning time might have been increased with a system like McIdas.

Representatives of both the federal forecast services and UW-Madison stress that McIdas is not being used as an "operational" system--it's an experiment to show what can be done.

###

UIR / RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON

UNIVERSITY-INDUSTRY RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2876

UIR SCIENCE WRITING DIVISION
(Graduate Student Science Writing Program)

For Additional Information: Prof. Charles Anderson (608) 262-0783

July 17, 1979

TORNADO PREDICTION GOAL OF RESEARCH

Photograph Available

by Barbara Voss
UW Science Writer

Madison, Wis.--On Palm Sunday, April 11, 1965, a tornado ripped through Monroe, Wisconsin, without "official warning," causing up to $20 million in damage and injuring some 100 persons.

In April, 1974, the worst Wisconsin tornado of the year plowed into Oshkosh, Wisconsin, doing $3 million in damage and killing two people. Without "official warning."

Saturday evening, June 9, 1979, a tornado touched down in Monroe--the same town hit in 1965--causing a million dollars' worth of damage and injuring four persons. Again: no "real warning."

The most skilled meteorologists today cannot predict when a tornado will form--or where it will travel when it begins its vicious life-cycle.

-more-

Meteorologists know that nature's most concentrated knockout punch begins life as a spiral of air in a thunderhead--the towering dark cloud with the anvil-like top that characterizes thunderstorms.

All thunderheads have updrafts--some as fast as 70-90 mph--and downdrafts that slowly spin and spiral inside the black tower, to accompanying tune of thunder and the flashing light of thunderbolts. But the question is: which one of these thunderheads begets the violently rotating column of air--the tornado?

Meteorologists can determine when conditions are ripe for tornado formation; but the only accurate tornado warnings today occur when a funnel is sighted--either on weather station radar or by someone observing it directly.

But even weather station radar can be deceptive. On the radar screen, a hook on a side of a spiralling cloud usually indicates the formation of tornado. But--as in the Monroe tornado of June 9--a tornado formed between two or more "hooks," deceiving the meteorologists and yielding an inaccurate prediction.

The goal of Project Sesame--a joint venture undertaken by a number of meteorologists at midwestern universities and government laboratories--is to understand the dynamics of severe thunderstorms. This information may make it possible to issue warnings to endangered areas up to an hour or more in advance of tornadoes.

With present knowledge and equipment, the most anyone can expect is a half-hour's warning. As evidenced by the many tornadoes that have defied prediction, this system is uncertain at best.

"We hope eventually to identify the storm cloud that will produce a tornado by the outflow of air in a certain section of the cloud," says meterologist Charles Anderson, head of the participating research group at the University of Wisconsin-Madison.

add two--tornadoes

Anderson has been studying cloud patterns associated with different tornadoes, including the April 10, 1979, twister that hit Wichita Falls, Texas, with deadly effect.

"In this day and age the loss of 54 lives from a tornado is simply not necessary--we're in the horse-and-buggy days of tornado prediction," says Anderson. "Most persons killed in the Texas tornado were caught in automobiles. With proper forewarning, at least many of them could have been spared."

Project Sesame will not lead to tornado prevention--but it will most likely lead to more accurate tornado prediction.

Anderson points out that if meteorologists could measure what is termed the swirl ratio--the amount of air flowing into the funnel cloud versus the amount spiralling up and out--they could predict precisely the location, time, and intensity of the tornado.

Using infrared satellite photographs, Anderson is developing ways to measure the amount of air flowing out of the anvil of a tornado-producing thunderhead. He can then determine the swirl ratio, using data from weather stations to obtain estimates of the amount of air flowing into the cloud.

The complexity of the task of measuring these two air-flow patterns is the result of the complexity of the tornado; it is a small cloud, less than a mile in diameter, sometimes narrowing at the bottom. The funnel contains water drops, dust, and debris.

The classic tornado is a single funnel, and these are by far the most common, but multiple tornadoes have been observed--the Oshkosh tornado was multiple until it re-formed into a single funnel just prior to hitting the city. The multiple tornadoes are wider, more diffuse and turbulent, and have several funnels revolving like tops around a common center.

All of this variation causes great difficulty to meteorologists attempting to interpret what can been seen from satellites or on a radar screen.

Once meteorologists begin to use new theories and instruments to probe into the tornado's inner workings, the weather service accuracy in tornado prediction should increase.

The midwestern United States is the main tornado belt in the world; tornadoes are most likely to occur in the spring or summer--and always within thunderstorms.

Thunderstorms form as a result of what is called thermal instability in the atmosphere. The cumulus and cumulonimbus clouds, typical of thunderstorms, are boxes of air that have been lifted to a point high enough to condense water vapor.

Cumulus clouds begin their movement as a result of atmospheric instability. The air surrounding the warmer lighter air of a cumulus cloud forces the air upward at a rapid rate. After the rising cloud grows to certain size, it begins to fall, continuing to increase in size.

The atmospheric instability in which thunderstorms begin may be a result of the cooling of cloud tops, heating of a cloud base from the ground, or warm and cold air fronts meeting one another. Thunderstorms occur in a relatively small local area. Tornadoes occur in only a very small percentage of thunderstorm clouds.

Meteorologists know little about the mechanism creating spin in the drafts of vertical air. The swirling motion seems to originate when sheets of vertically moving air masses tilt toward the horizontal plane. Two motions--the vertical air movement and the rotation--produce the tornado funnel.

Anderson simulates tornadoes in a "Tornado Vortex Simulator." A project of three graduate students--Jerry Blechman, Wayne Madsen, and Gary Wade--the machine has three basic parts. The top is a honeycomb-like structure of one-inch straws, below this is a Plexiglas enclosure, and at the bottom is an upright screen attached to the floor of the Plexiglas container. Through this screen, air can enter the chamber.

Air is sucked upward through the straws at the top. This creates an upward flow of air in the container; the screen rotates, giving the flowing air a spinning motion. The operator feeds dry ice into the inflowing air to make the air patterns visible.

The screen can be rotated at various speeds and Anderson relates the behavior of air in the simulator to atmospheric patterns observed in satellite photographs--studying the relationship between size of the anvil and the swirl ratio.

With the present inability to predict with accuracy just where and when a tornado will strike, meteorologists are forced to base predictions on the possibility that a tornado may form in an area up to 200 miles wide, and at almost any time over a period of several hours. This need to be indefinite and imprecise usually results in a lack of really adequate precaution on the part of the people who may be involved, and accidents and deaths are certain to occur when a severe tornado hits.

When swirl ratios produced under various conditions in the simulator are known, the knowledge will be used to identify the atmospheric conditions that exist in tornado-producing thunderheads.

With satellite photographs, cloud characteristics of tornado-forming storms will be identified and the knowledge will be useful for making much more accurate tornado predictions.

add five--tornadoes

There will probably be as many tornado watches if not more, but more precise tornado warnings. The time when funnel clouds form and the place where they are found will be known with a greater degree of accuracy.

Meanwhile, forecasters must rely on the somewhat more vague forecasts with which everyone is now familiar--with the hope that the somewhat uncertain warning possible now is better than no warning at all.

Considering that even this degree of accuracy was not possible 10 or 20 years ago, it is reasonable to expect that much better tornado forecasting can be expected in the next decade with modern techniques available--satellites and tornado simulators in meteorological laboratories.

# # #

research news

EDITORS: PAPER SHORTAGE REQUIRES SINGLE SPACING.
YOUR COOPERATION APPRECIATED.

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Release: Immediately 7/11/79 jhs

CONTACT: Paul Menzel (608) 262-0118

'VAS' TO CAST A KEEN EYE ON SEVERE STORMS

MADISON--The most up-to-date system ever assembled for studying severe weather such as thunderstorms and tornadoes is scheduled to go into operation next year at University of Wisconsin-Madison.

Researchers said the system will collect information from present ground stations and satellites, and add data from a sophisticated weather instrument due for launch into stationary orbit next summer aboard the GOES-4 weather satellite. All the information will be fed into a single computer at the University's Space Science and Engineering Center for study by weather experts.

The new instrument, called VAS, will provide information of the kind only available now every six hours from polar orbiting satellites. Aboard the stationary GOES-4 the delay between observations will be cut to as little as 15 minutes.

In severe weather forecasts, noted Paul Menzel, manager of the UW-Madison project, time is a critical factor in warning a community of danger or giving a reliable "all clear."

Menzel said VAS, developed and built with assistance from the space science center, will look down at the atmosphere's infrared light, measuring it at a dozen different frequencies.

"You can get vertical information if you take pictures in different infrared frequencies," Menzel said. With 12 of them, VAS will let weather researchers and forecasters look at the atmosphere layer by layer, in roughly three-mile bands from the ground up to 36 miles high. That's important, he said, because severe weather is basically vertical weather--caused by the tumbling of air layers at different altitudes, temperatures and humidities.

Trying to make sense out of quickly changing weather--like thunderstorms and tornadoes--requires an even more complete picture, however. Menzel said that's the aim of equipment and computer programs developed here over the past 10 years, and now being redone to accommodate VAS; they will pull together the information from VAS, four other satellites and normal earth-bound stations.

The images and numbers will go into the computer, to be compared, analyzed and saved. A weather expert sitting in front of two television screens then will be able to display combinations of information and pictures by using a keyboard and two toggle-like "joy sticks."

- more -

The difference between VAS and earlier infrared systems is the difference between a motion picture and a snapshot, Menzel said.

Presently, two infrared monitors are in polar orbits passing over the United States at six-hour intervals. But VAS, in its stationary orbit west of Peru and due south of Kansas City, will give continuous coverage of the contiguous 48 states. Depending on how much of an area operators want to scan, it can return a new, dozen-layered image as fast as every 15 minutes.

"You've got to be able to watch storms develop," Menzel said, because they happen so fast. "You can't just take a snapshot."

UW-Madison researchers expect access to VAS for 79 days during the first year after its scheduled launch in August 1980. A typical day, said Menzel, will consist of checking early morning ground reports to find potential trouble spots and then telling VAS to look there. As the day's storm pattern develops, VAS will be reprogrammed to concentrate its attention on the more serious storms.

UW-Madison will be using VAS as an experimental research tool--to learn more about severe storms and how they can be predicted. Forecasting will be a secondary interest, done to test the theory.

Links already have been established, however, with computers at Goddard Space Flight Center, the National Meteorological Center and the National Center of Atmospheric Research. And one of the major lines of research will be to develop weather rules that can be turned into programs for the giant forecasting computers.

In addition, the National Oceanic and Atmospheric Administration has expressed interest in using VAS in day-to-day forecasting and has explored consulting with UW-Madison in helping them build a similar information system.

"The part of the program that's missing is how to get the information to the public," said Professor Verner E. Suomi, director of the Space Science and Engineering Center. "This needs considerably more development."

Questions on the distribution of severe storm information also will bring a Congressional oversight committee to Madison this weekend (July 14-15) to study the VAS approach.

The concept of VAS goes back 10 years to ideas developed by Suomi, who once likened the gathering of weather data to "trying to take a drink from a fire hydrant." VAS information will be handled by the center's present McIDAS System, built starting in 1972. McIDAS combines human and computer analysis and already has links to satellite and ground stations.

The VAS system research here is being funded by the National Aeronautics and Space Administration. Much of the theoretical work is being done by a National Environmental Satellite Service team which has been at UW-Madison almost two years.

- o -

EDITORS: "VAS" stands for "visible infrared spin-scan radiometric atmospheric sounder." That's why we didn't tell you earlier!

###

uw news

EDITORS: PAPER SHORTAGE REQUIRES SINGLE SPACING.
YOUR COOPERATION APPRECIATED.

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Release: Immediately 7/11/79 jhs

CONGRESSIONAL OVERSIGHT GROUP TO VIEW WEATHER RESEARCH

MADISON--The University of Wisconsin-Madison will be one of three planned stops this weekend for a Congressional oversight committee looking into the present and future of severe storm forecasting.

Led by Rep. Don Fuqua, D-Fla., head of the House Committee on Science and Technology, the group will see the National Severe Storms Forecast Center in Kansas City on Friday (July 13); the National Center for Atmospheric Research, Boulder, Colo., on Saturday; and UW-Madison's Space Science and Engineering Center on Sunday.

In Madison, the oversight group will be briefed on the progress made by UW-Madison researchers on a computerized weather information system called VAS. The system will combine ground and present satellite observations with information from a sophisticated new weather satellite, GOES-4, slated for launch in August 1980.

The oversight tour was spurred by Congressional hearings on severe weather forecasting last July and by tornadoes this year which killed 59 persons in Wichita Falls, Texas, despite storm warnings. "This raises the obvious question of whether there are serious shortcomings in the methods being employed in developing a weather forecast and effectively disseminating it to the public," according to an oversight committee statement.

GOES-4 will be able to supply information on weather conditions at a dozen altitudes from the ground up to 36 miles. The VAS system, under development here for 10 years, will analyze the information through UW-Madison's existing McIDAS System--a computer-human combination which can display weather information and pictures on television screens.

###

EDITORS: See accompanying story on VAS.

The eight-member oversight group will arrive in Madison Saturday evening and stay at Howard Johnson's (251-5511). The briefing at UW-Madison is scheduled to begin at 9:30 a.m. Sunday in Room 648 of the Meteorology and Space Science Building, 1225 W. Dayton St. The actual demonstration is expected to begin about 11 a.m. and last about an hour. Members of the oversight group and UW-Madison researchers should be free to answer press questions just before lunch, slated at 12:15 in the third floor conference room. The tour will conclude about 2 p.m. Wisconsin legislators have been invited to join the group on its oversight tour.

###

semester; Young wants to avoid any drop policy that he feels would imprison a student in a course that the student didn't do well in or like.

Different Standards

Whatever the final revision, it's clear that universities have a tough time agreeing on how to handle dropped courses.

At the UW — Madison, for example, the 12 week standard is used by the College of Letters and Science, the College of Agricultural and Life Sciences, Allied Health Professions, the School of Education and the School of Nursing. But an eight week standard is used by the School of Business, the College of Engineering, the School of Family Resources and the School of Pharmacy.

# Global Test Scheduled For Weather Forecasts

MS 12/15/78

Washington, D.C. — UPI — The largest international scientific experiment ever conducted gets underway next month to give Earth's atmosphere its first complete physical examination, it was announced Thursday.

The $300 million project, planned in the United States by a committee headed by Verner Suomi, a University of Wisconsin — Madison meteorology professor, is designed to fill in broad gaps in regular weather reports from around the globe.

The project will put together the first comprehensive record of the state of the atmosphere and oceans for the better part of a year.

Suomi said it is theoretically possible to have relatively accurate two week forecasts, and "my guess is we ought to do pretty well for about 10 days."

Only about 15% of the Earth's surface is now regularly monitored. The equatorial tropics, which play a key role in the globe's weather "machine," and the vast lonely expanses of southern oceans are barely covered.

The result, Suomi said, is that meteorologists do not have enough information to develop accurate forecasts of more than a few days.

The experiment will end Nov. 30.

"We will have the most complete record ever assembled of the world's weather," said Richard Frank, administrator of the National Oceanic and Atmospheric Administration.

To monitor the world's weather, scientists from 147 nations will use 10 satellites from the US, the Soviet Union, Japan and Europe, 50 research ships from 22 nations, 110 aircraft, 300 balloons and 300 instrumented buoys.

The mass of data will first be examined by centers in a number of nations and then forwarded to World Data Centers in Moscow and Washington and to meteorological research labs in England and Princeton, N.J., for computer analysis.

# Cardinal donates $2,500 to PC

DC 12/15/78
By Perry Greene
of the Cardinal Staff

The Daily Cardinal Board of Control voted Thursday to approve allocation of $2,500 to the Press Connection towards the purchase of the United Press International (UPI) wire services. The Board of Control, which oversees the paper's finances, met in a special session to review the vote of the Cardinal staff to donate the money. The UPI wire includes state and sports news and a laser photo line.

The staff vote, which followed three lengthy debates, overturned an earlier vote against giving the Connection a donation. The purpose in stipulating that the donation go towards the UPI wire services was the belief that the wire service will help the Connection to increase state coverage, thereby making it a more viable alternative to the MNI scab papers.

Michael Arndt, editor-in-chief of the Daily Cardinal, echoing the sentiments of the staff, successfully moved the allocation through the Board.

"The money this board controls is money donated by the staff, donated because we do not pay the staff what they are worth," Arndt said. "The staff is being cheated out of the profits of its labor (by being underpaid) and it should be able to use this money as it sees fit."

The vote by the board was one of the more important votes since the 1976 vote to give the David Fine defense fund $5,000. Two faculty members, and the Cardinal staff members voiced their opinion that the staff would usurp the actions of the Board had it ruled against the allocation.

The major arguement against the allocation was that the Cardinal funds should be spent for the betterment of the Cardinal itself. It was also argued that a business competitor should not be supported, because it is financially irresponsible.

The major impetus to the favorable vote for the allocation was expressed by board secretary, Suzy Parker, "We have a situation here where corporatism is taking over any vestibule of community newspapers corprotism based on profits, not the needs of the community."

# Earlier signs of severe weather found

WSJ 11/19/78



LONDON — One of the hopeful dreams of weather forecasters is to be able to foresee droughts, hard winters and other short-term climatic changes months or more in advance. While this goal remains tantalizingly out of reach, there are signs that perhaps it can be achieved.

Jay S. Winston and Arthur F. Krueger of the National Oceanic and Atmospheric Administration (NOAA), for example, have identified tropical weather patterns that foreshadowed the past two severe winters in the Northern Hemisphere.

And, at the University of Wisconsin, Stefan Hastenrath and Daryl Covey have found distinctive air pressure and sea surface temperature patterns that precede droughts and floods in northeast Brazil and the El Nino ocean current changes that bring disaster to rich fisheries off Ecuador and Peru.

Presenting their findings at a conference on tropical meterology at Britain's Royal Society, these researchers explained they are not trying to develop forecasting methods at this time. Nevertheless, they believe they have identified the kind of observable weather factors that might well be a basis for a practical forecasting system. At the very least, they said, this represents a point at which research to develop such a system could begin.

Winston and Krueger, who work with NOAA's National Environmental Satellite Service, studied four years of satellite data that reflect both tropical wind patterns and the net energy income between sunshine that warms the tropical air and sea and outgoing heat radiation that tends to cool them down. As the period of severe winters approached, they saw distinctive patterns evolve.

Cloudiness expanded to change the tropical energy income distribution. Upper air temperature rose a degree or two on average — a warming that represented an increase in atmospheric energy, some of which could be exported to feed the unusually energetic higher-latitude winter winds. There also were general increases in anomalous easterly upper-air flows.

Reviewing these and other findings at the conference, Winston said: "There were some very large-scale things going on . . . I'm sure this feeds back strongly into the middle-latitude circulation." Also, he said, these distinctive changes were evident in satellite observations months in advance of the onset of severe winter.

What he and Krueger have found complements findings of Jerome Namias of Scripps Institution of Oceanography. Namias has studied the interplay of sea surface temperatures and atmospheric flow patterns, especially in the North Pacific, which are strongly involved in, and foreshadow, North American general weather.

In particular, he has described how the interplay of the planetary air flow and sea temperatures both foreshadowed and helped produce the severe winter weather and western drought (followed by floods) over North America in the past few years. He too linked this with tropical influences.

Namias uses such factors to try to predict weather several months in advance — an experiment in which he has had some modest success.

Commenting on this in relation to the harsh 1976-77 winter, he wrote in the Monthly Weather Review last March: "Many of the phenomena were clear enough in their evolution so that by November a forecast was made, which, while qualitatively correct, did not — nor could not with the present state of the art — predict the degree of severity of the eastern cold or western drought."

In like manner, Covey and Hastenrath find strong links between sea surface temperatures and northern Brazilian droughts and the El Nino phenomenon. This latter effect involves ocean conditions off Equador and Peru.

Normally, the currents and winds are such as to bring deep water to the surface in this area. The upwelling water is relatively cold and rich in nutrients that support one of the world's most abundant fisheries. During El Nino years, the upwelling of deep water stops. Warmer nutrient-poor surface water intrudes and fish populations decline precipitously.

Hastenrath told the London conference that the Brazilian drought is associated with such factors as high sea-level air pressure over the South Atlantic and low pressure over the North Atlantic, cold water in the South Atlantic plus higher-than-normal temperatures in a band across the North Atlantic and in parts of the eastern Pacific.

Comparable temperature and pressure patterns precede and accompany Central American droughts and the El Nino. The relationship is clear enough, he said, to suggest it might be made a basis for long-range forecasting.

He addeed that research to develop forecasting methods should look closely at such well-defined recurring weather "disasters." "The mechanism of extreme events in specific regions is fundamental in climate and in the search for the means of making seasonal predictions," he said.

No meteorologist can predict whether, or when, such research would pay off, even if it were started right away. Indicators such as those reported at the London conference may or may not turn out to be helpful in a working forecast system.

Thus, Winston and Hastenrath were careful not to raise false hopes in their presentations. Nevertheless, this uncertainty does not undercut the clear implication that meteorologists very well may be on the track of the kind of predictive elements that would-be long-range weather forecasters have been wanting.

PARADE Mgz. 11/19/78

## *Sad Story*

If you're attending a public university this year, the average cost will be $3054. Attendance at a private university will be $5110.

According to the College Entrance Examination Board, the total four-year cost for a student who entered a public university this fall will approach $17,000. A private university will cost $30,000.

In the 1990's, a four-year public university education will cost about $47,000, a four-year private university education about $82,000.

UIR / RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON

UNIVERSITY-INDUSTRY RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2876

Research—Meteorology

UIR SCIENCE WRITING PROGRAM
(Graduate Student Science Writing Division)

Further Information: James Weinman (608/262-1905) May 23, 1978

# UW RESEARCH LIDAR PROBES ATMOSPHERE

by Larry Arbeiter
UW Science Writer

Madison, Wis.--Five-foot-long pulses of pure blue laser light are probing the skies of Madison.

A light detection and ranging (lidar) device, newly developed by University of Wisconsin scientists and located on the 19th floor of the tallest campus building, is being employed to study the effect of dust, smoke, and other suspended particles in the atmosphere.

The lidar experiment is the result of the work of six scientists--meteorologists Scott Shipley, Ed Eloranta and James Weinman, and physicists Dave Tracy, John Trauger and Fred Roesler. They devised the experiment to study how atmospheric aerosols--particles suspended in the air--affect the atmosphere's temperature and rainfall patterns.

Aerosols affect the weather by absorbing sunlight, according to Weinman, director of the project. Solar radiation that would warm the earth's surface if aerosols were not present may warm the aerosols instead. The aerosols can give up some absorbed heat to the air; this changes the circulation of the atmosphere and modifies weather patterns.

add one--lidar

A particular value of the lidar instrumentation is that it can be used to measure the distribution of aerosols in the atmosphere remotely. The lidar system, for example, can be flown over large regions of the earth in a short time, gathering information from different geographical areas almost simultaneously.

The lidar system is a composite of instruments; two lasers, a powerful spectrometer, and a computer. The first laser energizes the second, which sends the pulse of blue light through a telescope and into the atmosphere. When air molecules or aerosols reflect a small portion of the light back toward the source, the telescope focuses it into the spectrometer.

The spectrometer sorts the aerosol and molecular reflections and passes each separately to the computer. By measuring the intensity of the returned signal, the computer indicates the density of the aerosols in the air column traversed by the light.

The precise distance from the lidar to the reflecting aerosols is given by measurement of the time elapsed between the emission and return of each laser pulse.

The University of Wisconsin lidar will be tested from a research jet this summer over the Arizona desert and the industrial east coast. The results should prove that aerosols can be measured remotely. In that case, the lidar will be a forerunner for more advanced systems that may measure aerosols and their effect on the weather from satellites in earth orbit.

# # #

# On, Wisconsin

MJ 5/22/78 An Editorial

## An Undisturbing Dip in Med School Applicants

Medical schools are somewhat less flooded with applicants now than they were a few years ago, but the trend is no cause for worry.

In fact, the change obviously is good news to applicants, because there aren't quite as many of them scrambling for the coveted positions (and in Wisconsin the drop in applications is more pronounced than in some other states).

As for possibly adverse effects, there's still no shortage of highly qualified applicants and no reason to think there will be in the future, so admission standards aren't likely to be lowered much, if at all.

And if you're worried that the dip in applicants may indicate a doctor shortage in the years ahead, relax. If anything, the number of doctors and slots for medical students are continuing to increase.

The real problem is that the country soon may have more doctors than it requires (with many of them still bunched in the areas of least need). That oversupply may cause unnecessary expansion of medical service and a further acceleration of health care expenses. In medicine, the law of supply and demand has failed to operate; expansion of the doctor supply has been followed by an expansion of expenditures, not by competitive pricing.

Yet the law of the marketplace *is* likely to keep attracting young people to the lucrative profession of medicine. Indeed, it's probable that the present decline in applicants is only temporary, reflecting a withdrawal by some students from competition that only recently had been extremely intense. As the medical school market becomes more favorable, applications are likely to rise again.

# UW Prof Involved in Venus Shot

MJ 5/19/78

By Jerry Lipman
Special to The Journal

**Cape Canaveral, Fla.** — Saturday's launching here of a spacecraft to orbit Venus, the first in a two pronged US scientific study of Earth's nearest planetary neighbor, will set the stage for three copies of an instrument built by the University of Wisconsin to go to Venus' broiling surface next December.

The device, called a net flux radiometer, was developed through the work of Verner Suomi, professor of meteorology and director of the UW Space Science Center in Madison.

Suomi, an internationally known expert on atmospheric circulation, was involved in interpreting photos of Venus' atmosphere returned by the Mariner spacecraft that swept within 3,585 miles of the planet Feb. 5, 1974.

*Jerry Lipman began space coverage with the Surveyor 5 unmanned soft landing on the moon in 1967. He went to Cape Canaveral in 1970 and wrote for the newspaper TODAY in Cocoa Beach. He has written as a free lancer since 1971. He has covered lunar missions, Skylab, Apollo-Soyuz and Viking.*

The photos, first ever taken of Venus from space, clearly showed contrasting cloud bands girdling the mysterious world, now believed to be a hellhole rather than the romantic garden the name suggests.

### Sulfuric Acid Clouds

Outer clouds are believed to be sulfuric acid, inner clouds carbon dioxide — which composes up to 97% of the planet's atmosphere.

Surface temperatures range between 807 and 1,060 degrees fahrenheit, and atmospheric pressure may be over 1,400 pounds per square inch (it's 15 pounds on Earth).

For the $250 million Pioneer Venus mission being readied, Suomi will be principal investigator in a study aimed at locating and mapping points in Venus' atmosphere that absorb unusual amounts of heat energy from the sun or radiate unusual amounts of heat into the swirling clouds that permanently cloak the surface.

Heat distribution powers the atmospheric circulation on both Earth and Venus.

Three of the 2.4 pound devices built under Suomi's direction will begin their four month, 220 million mile journey to Venus Aug. 7 aboard a lander unit called the Venus Multiprobe, to be launched by NASA on an Atlas-Centaur booster from Cape Canaveral.

### 3 Modules to Separate

After reaching Venus Dec. 9, the Multiprobe will separate one large and three small instrumented modules, each carrying one of Suomi's devices, to descend for almost an hour through the torrid atmosphere, taking measurements all the way to the surface.

Two of the small units should land in the southern hemisphere, with the third one aimed at Venus' north pole. They can operate equally well in sunlight or darkness, but are not built to survive on the surface, with its high heat and pressure.

Because of weight and other constraints, the orbiter and lander elements of the mission are traveling to Venus in separate flights, with the orbiter being launched at 8:13 a.m. (CST) Saturday, 2½ months ahead of the landers.

The orbiter will circle 482.8 million miles around the sun in a 6½ month flight to reach Venus Dec. 4, five days ahead of the landers. The earlier arrival will allow the orbiter's instruments to establish data on the Venus environment, to be compared with atmospheric measurements taken by the landing probes.

The orbiter also will act as a radio relay station for the data from the landers. And it will engage in an eight month science study of the planet from space.

The goal is an overall picture of the plant's global weather structure.

American and Soviet space scientists will meet in Innsbruck, Austria, June 10 to discuss exchanging data between the two nation's Venus probes this year.

NASA officials believe the Soviets will launch two spacecraft toward Venus in August, with each craft to place a lander on the surface and a separate probe in orbit. The Russians are believed to be most interested in the surface of Venus, while the US is most interested in the atmosphere.

FACT SHEET -- PIONEER VENUS PROBES

5/26/78

Research - Meteorology

KEY QUESTIONS

Why did Venus, in many ways the Earth's twin, evolve into a world of searing heat and deadly atmosphere while the Earth luxuriates in a climate friendly to life?

What can the atmosphere of Venus tell us about the future of our own atmosphere? For example, as we pump more and more carbon dioxide (from burning fossil fuels) into our atmosphere can we expect serious permanent rises in temperature (the "greenhouse effect")?

If Venus is as dry as it seems, where did the planet's oceans go, if any ever existed?

How does the Venus "weather machine" work, and how is it similar to Earth's?

What are Venus' clouds made of?

What is Venus' lower atmosphere made of, and why is it so hot?

WHY VENUS?

Scientists think Venus may be an unusually good place to study the mechanics of atmospheres because its atmosphere appears to be a relatively "simple" weather machine. The important atmosphere circulation motions appear to be global. There are no tides or season changes on Venus. Therefore the continuous measurements from the spacecraft being sent to study various parts of the atmosphere may provide a rough picture of how the Venus "weather machine" works.

PIONEER VENUS I (ORBITER)

Launched May 20, the "orbiter" will circle more than 482 million miles around the sun in a flight designed to reach Venus on Dec. 4, five days ahead of the "multiprobe" package of Pioneer Venus II. The earlier arrival will allow the orbiter's instruments to establish data on the Venus environment while in the first spacecraft orbit of the planet. The measurements will be compared later with those taken by the "multiprobes."

The orbiter will act as a radio relay station for the data from the multiprobe, which will be sent for about an hour. It will then return to sending its own observations of the planet's atmosphere and surface during an eight-month (one Venusian year) period of orbiting Venus.

PIONEER VENUS II (MULTIPROBE)

Although launch will be 2½ months after the orbiter (on Aug. 7), differences in weight and other constraints will cause the "multiprobe" spacecraft to travel the 220 million miles to Venus by Dec. 9.

Shortly before reaching the planet, the package will split into three small probes, one large module, and a transport "bus." The bus will burn up soon after entering the atmosphere, while the four remaining probes descend toward different targets in Venus' atmosphere. The devices will transmit back data for about one hour, before crashing into the planet's surface. They are not expected to survive impact.

- more -

SOVIET PROBES

The Soviet Union is expected to launch two Venus probes of its own in August, which are expected to make soft-landings on the planet in late 1978 or early 1979. American and Soviet space scientists will meet in Innsbruck, Austria, June 10 to discuss trading information gathered from the various probes.

The Soviet Union has led the way in the exploration of Venus, with 10 flights that have included five soft landings on the planet's surface. The U.S. has had three "fly-by" missions, however Pioneer I and II are described as the "most sophisticated looks yet" at Venus.

THE UNIVERSITY OF WISCONSIN'S ROLE

Three identical "net flux radiometers," developed at the UW Space Science Center in Madison, will be aboard each of the small probes which will pierce Venus' atmosphere Dec. 9.

The radiometers will operate for about 58 minutes, beginning about 43 miles above the planet. The atmospheric data they send back will be recorded by receiving stations in Chile and Australia, before being transferred to the University (among others).

Space Science Center director Verner Suomi will be principal investigator in an analysis aimed at locating and mapping points in Venus' atmosphere that radiate unusual amounts of heat or absorb unusual amounts of energy from the sun. Such heat distribution powers the atmospheric circulation on both Earth and Venus.

Dr. Suomi is an internationally recognized authority on atmospheric circulation. He was involved in the study of photos of Venus' atmosphere taken in a "fly-by" of the planet in 1974.

That probe revealed the atmosphere of Venus to be made up mostly of carbon dioxide, apparently containing many sulphuric acid droplets. The atmospheric pressure on the surface of Venus is thought to be 100 times that on Earth, a crushing 1400 pounds per square inch. The surface temperature, which changes little from day to night or pole to pole, is from 800 to 1060 degrees Fahrenheit.

Selection of the UW proposal to build as well as design the radiometers is quite unusual. NASA usually contracts with outside companies to construct instruments after they are designed by university scientists. The main reason for this is that few universities have the technical personnel and equipment to carry out such complex work.

Design work on the Venus probe instrumentation began in October 1973. The completed radiometers were delivered in April 1977.

Principal Investigator:
Prof. Verner E. Suomi (608) 262-6172
Acting Program Manager:
Evan E. Richards (608) 262-5938

NASA audio report on status of mission:
(415) 968-5600

--University of Wisconsin News Service
19 Bascom Hall, 500 Lincoln Drive
Madison, WI 53706
Telephone (608) 262-3571

## VERNER E. SUOMI

Prof. Suomi is one of the nation's leading space scientists and an internationally recognized authority on the dynamics of the atmosphere. He is currently the Harry Wexler Professor of Meteorology and director of the Space Science and Engineering Center at the University of Wisconsin-Madison.

Among his awards is the National Medal of Science, which was presented to him by President Carter in a White House ceremony last November. The citation termed Suomi "a major driving force in the application of space systems for improved weather service to the public."

A native of Minnesota, Prof. Suomi joined the UW-Madison faculty in 1948, with a joint appointment in meteorology and soils. He was chairman of the department of meteorology from 1950-1952 and from 1954-1957. He organized the Space Science and Engineering Center in 1966.

Prof. Suomi's work with satellites began in 1959, when Explorer VII carried aloft instruments that he designed to measure the earth's heat budget. Results showed the great importance of cloud systems in controlling the earth's heat loss. He has also been involved in developing instrumentation for subsequent earth satellites, as well as Jupiter and Venus space probes.

Suomi's invention, the spin scan camera, provides the basis for accurate measurements of cloud movements from satellites, a process vital to the improvement of long-range weather forecasting.

Suomi is currently vice chairman of the U.S. Committee for the Global Atmospheric Research Program (GARP), a councilor of the American Meteorological Society, and vice chairman of the National Academy of Sciences Committee on Atmospheric Sciences.

## EVAN E. RICHARDS

Since 1977 Richards has been the acting program manager for the Pioneer Venus Net Flux Radiometer Experiment. He is also the instrument manager of the High Speed Photometer aboard the NASA Space Telescope, being developed at the University of Wisconsin-Madison for use in future space investigations.

Richards also has held the position of product assurance manager with the UW-Madison Space Science and Engineering Center since 1970. In that role he has been responsible for establishing and implementing reliability, quality assurance and configuration management for space flight hardware contracts.

Richards obtained his master of science degree in electrical engineering from the UW-Madison in 1970. He has worked as a design engineer for the Collins Radio Co. and a development engineer for the missile systems division of the Raytheon Co.

Prof. Verner E. Suomi (608) 262-6172

Evan E. Richards (608) 262-5938

FACT SHEET -- PIONEER VENUS PROBES

5/26/78 Research Meteorology

KEY QUESTIONS

Why did Venus, in many ways the Earth's twin, evolve into a world of searing heat and deadly atmosphere while the Earth luxuriates in a climate friendly to life?

What can the atmosphere of Venus tell us about the future of our own atmosphere? For example, as we pump more and more carbon dioxide (from burning fossil fuels) into our atmosphere can we expect serious permanent rises in temperature (the "greenhouse effect")?

If Venus is as dry as it seems, where did the planet's oceans go, if any ever existed?

How does the Venus "weather machine" work, and how is it similar to Earth's?

What are Venus' clouds made of?

What is Venus' lower atmosphere made of, and why is it so hot?

WHY VENUS?

Scientists think Venus may be an unusually good place to study the mechanics of atmospheres because its atmosphere appears to be a relatively "simple" weather machine. The important atmosphere circulation motions appear to be global. There are no tides or season changes on Venus. Therefore the continuous measurements from the spacecraft being sent to study various parts of the atmosphere may provide a rough picture of how the Venus "weather machine" works.

PIONEER VENUS I (ORBITER)

Launched May 20, the "orbiter" will circle more than 482 million miles around the sun in a flight designed to reach Venus on Dec. 4, five days ahead of the "multiprobe" package of Pioneer Venus II. The earlier arrival will allow the orbiter's instruments to establish data on the Venus environment while in the first spacecraft orbit of the planet. The measurements will be compared later with those taken by the "multiprobes."

The orbiter will act as a radio relay station for the data from the multiprobe, which will be sent for about an hour. It will then return to sending its own observations of the planet's atmosphere and surface during an eight-month (one Venusian year) period of orbiting Venus.

PIONEER VENUS II (MULTIPROBE)

Although launch will be 2½ months after the orbiter (on Aug. 7), differences in weight and other constraints will cause the "multiprobe" spacecraft to travel the 220 million miles to Venus by Dec. 9.

Shortly before reaching the planet, the package will split into three small probes, one large module, and a transport "bus." The bus will burn up soon after entering the atmosphere, while the four remaining probes descend toward different targets in Venus' atmosphere. The devices will transmit back data for about one hour, before crashing into the planet's surface. They are not expected to survive impact.

- more -

**University News Service**

19 Bascom Hall
500 Lincoln Drive
Madison, Wisconsin 53706

5/23/78

WILL THE 'GREENHOUSE EFFECT' TURN EARTH INTO ANOTHER VENUS?
UW-Developed Equipment Is Aboard Latest Space Probe

EDITORS:

Some scientists fear that the increasing amount of carbon dioxide being added to the Earth's atmosphere may some day make our planet as inhospitable as Venus. It is generally assumed the carbon dioxide atmosphere of Venus acts as a "greenhouse," allowing solar radiation to reach the surface but keeping it from being radiated back into space. Experts believe the thick Venusian clouds rain sulphuric acid on a planet with a surface hot enough to melt lead, tin and zinc.

A major goal of the nation's new Pioneer Venus probe will be to learn why Venus and the Earth, though similar in size, density, and proximity to the sun, have such different environments.

The important role of the University of Wisconsin-Madison in the NASA-sponsored project will be discussed in a news conference to be held this Friday (May 26) at 11 a.m. in Union South, 227 N. Randall Ave. The exact room location will be posted at the entrance to the building on Friday.

National Science Award winner Verner Suomi, director of the Space Science and Engineering Center, will discuss the mission, using scale models of Pioneer Venus I and II, the two spacecraft being used in exploration. Research scientist Evan Richards will also participate.

Equipment on board the spacecraft, the first of which was launched May 20, will probe the planet's gas blanket and gaze into its clouds beginning next December.

Besides helping solve the puzzling questions about Venus, the investigation could provide clues to the future evolution of our own atmosphere and tell more about the basic workings of a planet-scale weather machine.

The University of Wisconsin research team developed a device designed to collect information about the temperature, wind, and clouds of Venus. The "net flux radiometer" will be used to map the planetary positions of sources and absorbers of heat and sunlight and their vertical distribution. The distribution of such energy powers the planet's weather machine, just as it does on Earth.

The device, which weighs a little less than two and one-half pounds, will start operating about 45 miles above the planet and continue until the spacecraft crashes.

The Wisconsin-developed equipment will be aboard Pioneer Venus II, which will be launched Aug. 7. Pioneer Venus II will reach its destination in early December, when it will separate into five spacecraft for descent into the Venusian atmosphere. The Pioneer Venus I craft will reach Venus about the same time, but will go into an orbit around the planet for a Venusian year.

--Richard Mahler (608) 262-0065

Parking for the news conference will be available in Parking Lot 14, approximately one block west of Union South, next to the Engineering Research building. Your vehicle should display your news media "B" parking permit.

uw news

From The University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: (608) 262-3571

Research Petrowsky

Release: Immediately 7/28/77 cmb

CONTACT: J. T. Young (608) 262-0118

McIDAS SHOWS 'EM HOW TO SCAN NORTH TO SOUTH POLES IN 18 MINUTES

MADISON--There's a 99 per cent chance of 50 meteorologists leaving town Friday with plenty of notes on the University of Wisconsin-Madison's weather computer.

The meteorologists, representing universities, television stations, airlines, NASA, NOAA (National Oceanographic and Atmospheric Administration) and private meteorologists nationwide, have been attending a workshop on "McIdas," the "Man-Computer Interactive Data Access System."

Designed and built in 1972 by UW-Madison scientists, the system is a "general purpose image processor" for, among other things, analyzing the atmosphere of Venus and the spectra of stars, or photographing temperatures and heat loss from buildings.

McIdas's dominant use in collecting data and photographing cloud movement from a satellite situated over the Colombia/Peru/Ecuador border. The system is a "real time" data access machine, able to scan about one-third the globe from the north to south poles in 18 minutes and then have the data visible on the screen 30 seconds later.

The satellite pictures, transmitted to dish-shaped antennas atop the Space Science and Engineering Building, can photograph objects down to one-half a mile, so even Lakes Mendota and Monona and Picnic Point can be charted. It's also possible by looking at the video screen to pinpoint the position of a nearby cloud and then look out the window and find it in the sky.

The workshop's purpose is to discover what would best suit the other universities' and institutions' future needs, according to UW-Madison scientist J. T. Young.

###

uw news

From The University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone: (608) 262-3571

Release: Immediately 12/23/76 rt

CONTACT: Reid Bryson (608) 262-5957

FIVE MORE YEARS OF DRY WEATHER EXPECTED BY METEOROLOGIST BRYSON

MADISON--While the drought that hit most of the midwestern United States in 1976 may be over, its effects may still be felt next spring, and the long-term outlook for rainfall is not good, according to a University of Wisconsin-Madison meteorologist.

Prof. Reid Bryson, director of the Institute for Environmental Studies, pointed out that due to the serious lack of soil moisture throughout much of the Midwest, the ground is already frozen to an unusual depth of seven feet in many places, including Wisconsin. That could cause problems next spring, according to Bryson.

"Once the ground is frozen, it's pretty hard to get the melted snow into the ground. If you get enough snow, then the heat from the earth will gradually take the frost out. So if we had very deep snow right now, then the soil would actually start thawing from the bottom up, and that would be good," Bryson explained. But he cautioned that a return to normal amounts of rain next spring and summer won't be enough to solve the dry soil problem.

"If we want to be lucky next spring, in terms of how this drought business goes, we're going to need a combination of events; an early spring in terms of melting the soil; and then some rain, and a lot of it, because it takes a lot of rain to get that soil moisture replenished." Bryson added that the rain can't come all at once because the earth is only able to absorb moisture at a certain rate, and if there's too much water at one time, much of it will evaporate.

- more -

While scientists can't predict temperatures and rainfall several months in advance, Prof. Bryson does have a theory of what kind of weather there will be in the next few years. Climate is now going through a relatively rapid change, he said. Climate changes because of variations in both the amount of sunlight reaching the ground and the amount of heat escaping into space.

"The main cause that we've found for variations in the amount of sunlight reaching the ground is variations in how transparent the air is--in other words how much smoke and dust there is in the air, and how much heat gets back out to space depends on how much carbon dioxide man puts in the air."

Putting together his best estimates of how much dust, smoke, and carbon dioxide will be in the air during the next decade, Bryson concluded that the next five years will be much like the last five.

"The last five years were very pleasant, climatically--after all, what is a drought? It's too many nice days. We've had a major drought in the corn belt two years ago, and half of that in 1976; two Russian crop failures; failure of the Chinese monsoon and the Indian monsoon; 70 per cent of the Brazilian coffee being frozen in one night, and things like that going on around the world. So another five years like the last five years, to me, doesn't sound very good."

Bryson admitted that some scientists criticize his analysis of climatic changes, saying it's too simple, and therefore his predictions may not be accurate.

"I hope our analysis is wrong. Many scientists find it strange to hear a fellow scientist say he hopes he's wrong--I don't think I'm wrong, but I hope I am. Because if I'm right, I don't like the answer," Bryson said.

###

uw news

From The University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone: (608) 262-3571

Research Meteorology

Release: Immediately 10/7/76 rt

CONTACT: Prof. Donald R. Johnson (608) 262-2827/262-2538

SCIENTIST SAYS INTERCONTINENTAL TRIPS NOT UNUSUAL FOR RADIOACTIVE MATERIALS

MADISON--It's not unusual for radioactive material to travel thousands of miles through the atmosphere after a nuclear explosion, according to meteorology Prof. Donald R. Johnson of the University of Wisconsin-Madison.

Radioactive particles fell to the ground recently in several Eastern states, including Pennsylvania. The fallout occurred about nine days after a nuclear test blast in China.

"It's not unusual at all," Johnson says. "In fact, it's expected. During the 1950s, when there were numerous explosions by the Russians and the Americans, this was a fairly frequent occurrence." Since then, Russia and the United States abandoned above-ground nuclear testing after both sides signed a nuclear test ban treaty. China has signed no such agreement.

Radioactive material is injected into the atmosphere following a nuclear explosion, according to Johnson. The radiation is carried to altitudes of 30,000 to 50,000 feet.

"When it reaches these altitudes, it's embedded in a belt of high winds that move from west to east--the Westerlies of the Northern Hemisphere. These winds have average velocities on the order of 50 to 100 miles per hour, so that in a matter of days, it (the radiation) can move from a place like China to the United States."

Johnson says scientists can track the radiation as it moves through the atmosphere by keeping track of weather patterns. The radiation leaves the atmosphere and falls to the ground during a rain storm.

- more -

"This is what occurred in Pennsylvania and the Eastern United States. The weather patterns became favorable for precipitation, and with the rain there, it simply washed the contaminants out of the atmosphere."

Radiation from nuclear explosions in the Northern Hemisphere is contained in that hemisphere by the westerly winds. Similar winds would do the same thing in the Southern Hemisphere, according to Johnson.

###

UIR / RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON

UNIVERSITY-INDUSTRY RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2876

UIR SCIENCE WRITING PROGRAM
(Graduate Student Science Writing Program)

Further Information: Thomas Haig (608/262-0544)

October 21, 1975

Research in Paleontology

by Robert Ebisch
UW Science Writer

Madison, Wis. --A super-human machine named McIdas is fomenting scientific revolution at the University of Wisconsin-Madison.

McIdas, short for the brain-stunning title, "Man-Computer Interactive Data Access System," unites man's qualitative judgement with the computer's speed and analytical abilities.

The machine was developed slowly from a seven-year effort by Wisconsin scientists to accurately measure winds from satellites.

It includes a computer, a teletype through which the operator can talk to the computer, and a color television screen through which the computer can talk back.

McIdas also controls a number of specialized electronics packages which color the TV-picture, choose appropriate views of earth, filter image data, and help the human operator get along with McIdas.

-more-

A serious problem in many research fields is that satellite data pouring in at rates of up to one TV picture every three seconds, 24 hours a day, produces an information glut totally beyond the grasp of those who need the information.

McIdas assimilates the avalanche of data with ease. The scientist sitting before McIdas' screen can scan thousands of electronic pictures quickly and efficiently.

From instant to instant he can order up visual displays from the computer's vast information stores, manipulate the picture, and view changes as he commands the machine to make complicated mathematical analyses.

The results can be amazing.

In a month-long test during August and September, for example, McIdas used pictures from a satellite 20,000 miles in space to measure wind speeds on the earth's surface within two miles per hour.

"This is more accurate than the resolution of the camera that took the pictures," says Tom Haig, director of Wisconsin's space science and engineering center. "McIdas made 1,100 measurements of the wind's speed, direction and altitude every six hours and automatically distributed them to forecast centers.

"And each wind measurement costs us only 28 cents," he adds. "This is remarkable when you consider that the conventional method of measuring winds with a balloon costs $15 or $20 per reading."

Haig also points out that the balloon system is limited because the world is mostly water with no weather stations on it.

"The conventional monitoring systems are doing well if they keep track of 15 to 20 per cent of the earth," Haig continues. "We have to make it 100 per cent if we're ever going to forecast effectively.

"You have to look to the Pacific Ocean to see what kind of weather Wisconsin will have in four or five days."

########

research news

TEMPORARY NEWS SERVICE LOCATION:
115 Science Hall
550 North Park Street

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Release: Immediately 10/29/75 gf

SCIENTISTS SCORE ADVANCE TOWARD MORE ACCURATE FORECASTS

MADISON--A significant step toward accurate five-day weather forecasts has been completed by scientists at the University of Wisconsin-Madison.

An extended test recently proved efficiency and reliability of McIDAS (Man-Computer Interactive Data Access System), a network of computers and human operators essential to making long range weather forecasts.

McIDAS compiles and analyzes satellite information about the movement of clouds. From this information, it is possible to measure velocity and direction of winds.

Project researcher Fred Mosher says the test was successful but not flawless.

"We've developed a system that can do the job," he said. "We'll retest it in January to get out the few remaining problems."

The test successfully completed a seven-year program begun by Prof. Verner Suomi, director of the UW-Madison Space Science and Engineering Center. His goal was to accurately measure winds at a low cost. Prof. Thomas Haig, executive director of the center, says that each wind measurement using McIDAS costs only 28 cents as compared to $15 or more per measurement for a conventional method such as balloons.

McIDAS will be used in an international effort known as the Global Atmospheric Research Program (GARP), scheduled to begin operation in the late 1970s. The program is sponsored by the United Nations.

- more -

GARP will use information from satellites, weather balloons, aircraft, ground stations, ships and ocean buoys to feed into a computer model of the earth's weather. From this information, the model should be able to predict weather at least five days in advance.

Mosher describes the program as "weather's equivalent of going to the moon" because of the great expenditure of time and effort. It requires five specially designed weather satellites, a data system capable of coordinating satellite information, and world reports from sources already available such as balloons and ground stations.

The program began in the early 1960s when Pres. John Kennedy asked for international cooperation in weather forecasting.

###

research news

TEMPORARY NEWS SERVICE LOCATION:
115 Science Hall
550 North Park Street

Research - Meteorology

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Release: Immediately 10/21/75 gf

MULTIPLE FUNNEL TORNADOES TAKE SHAPE OVER FLAT LAND, METEOROLOGISTS FIND

MADISON--Rays of blue light pierced the darkness of a University of Wisconsin-Madison laboratory. They focused on a thin trail of smoke rising lazily from the bottom of a huge cylinder.

A shadowy figure in a corner of the room slipped a switch and turned a dial. Pumps sucked air through the cylinder, a metal screen rotated around the base of the tube and the smoke swirled into funnels of wind.

This was one of many "tornadoes" created by meteorology Prof. C. E. Anderson and graduate student Jerry Blechman to study an unusual characteristic of some twisters--multiple funnels.

Anderson and Blechman began their research after Oshkosh and other Wisconsin towns were ravaged by tornadoes in 1974. Pictures of the actual twisters showed multiple wind funnels. The existing theory did not account for the phenomenon, so the scientists used the tornado simulations and information from the scenes of the twisters to develop a theory of their own.

They believe multiple funnels form when tornadoes move over smooth, flat land. Blechman explains that these tornadoes are more dangerous than single funnel twisters because they tear buildings apart in two or more directions with extreme force.

The two scientists say tornadoes of this sort can be avoided by "roughening up" the landscape around vulnerable installations. Trees, man-made hills and 25-foot fences may lessen the danger.

- more -

Anderson says nuclear power plants are the biggest concern because they may cause radioactive contamination if hit by a twister. However, he says schools, auditoriums, and assembly plants also are vulnerable because of the large surface area they cover.

"The biggest benefit this study provides is information on areas to avoid when constructing such installations," he explains.

The scientists are in Norman, Okla., this week for a conference on severe storms. Blechman is to present a research paper to the American Meteorological Society.

###

UIR / RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON

UNIVERSITY-INDUSTRY RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2876

UIR SCIENCE WRITING PROGRAM
(Graduate Student Science Writing Division)

Further Information: Randolph Ashby (608/262-0792)

September 23, 1975

Research Meteorology

Do Chemicals Threaten Earth's Stratosphere?

by Robert Ebisch
UW Science Writer

Madison, Wis.--Will chemicals from aerosol sprays and supersonic transport jets' exhaust deplete the earth's atmospheric ozone layer, the only shield against harmful ultraviolet radiation from the sun?

Or is this an alarmist nightmare?

The answer is still under heavy debate due to a lack of information on stratospheric chemistry.

But a powerful tool for providing this information has now been developed and put to work at the University of Wisconsin-Madison and other institutions.

Meteorologists Randolph Ashby and James Weinman have simulated the ozone region, from six to 24 miles up, in a mathematical computer model that can predict the consequences of any change in the region's chemical composition.

"Such a model is necessary to predict what lasting effects nitrous oxide from the SST and chlorine gas from aerosol sprays will have on the ozone," Ashby explains, "because interactions of chemicals in the upper atmosphere are very complex.

-more-

"There is no doubt that chlorine and nitrous oxide destroy ozone," he continues. "The critical question is how much do they destroy and how much more ultraviolet radiation will reach us as a result?"

Ashby and Prof. Weinman built their model to include the 96 most important reactions among the stratosphere's 27 major chemicals.

The model is unique because it describes how the chemicals change from day to night.

Since many reactions are driven by solar energy, concentrations of many chemicals change as the sun moves, some disappearing completely at night.

Ashby is now studying the impact of reflected and scattered sunlight on ozone-layer chemistry. He plans next to investigate the effect of cosmic rays on the production of nitrous oxide.

Numerous scientists have used models to confirm the predictions by Harold Johnston of the University of California that the exhaust from a world fleet of 500 SST's would weaken the ozone by 12 per cent.

"But we have a special opportunity to regulate the SST before its pollutants become a problem," Ashby says. "There are only 16 SST's flying or in production, as yet, and we know exactly what gases their engines produce.

"Aerosol sprays are a different problem," he says. "It takes many years for aerosol fluorocarbons to reach the stratosphere where sunlight releases their chlorine. Since fluorocarbons didn't really boom until the late sixties, we need several more years to see the impact."

Natural chlorine plays only a minor role so far in the ozone layer, but Ashby hopes soon to include natural chlorine in the computer model.

Chlorine is three times more destructive of ozone than nitrous oxide, and man's chlorine pollution could have a major impact on the ozone layer.

######

UIR / RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON
UIR SCIENCE WRITING PROGRAM
(Graduate Student Science Writing Program)

UNIVERSITY-INDUSTRY
RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2876

Further Information: Louis Uccellini (608/262-0798)

September 18, 1975

Research Meteorology

Huge Air Waves Trigger Storms

by Tom Anderson
UW Science Writer

Madison, Wis.--Recipe for tornadoes and severe thunderstorms:

Take a mile-wide layer of warm air and suspend it below the cold upper atmosphere to form an inversion stretching from Kansas to Michigan at a 2000-foot altitude. Use the inversion to trap at ground level the warm moist air that would normally rise into the atmosphere.

Then, if the inversion is suddenly weakened, the result is severe weather.

Huge atmospheric air waves that heave and buckle large inversions have recently been identified by University of Wisconsin-Madison meteorologist Louis W. Uccellini. The waves affect formation and behavior of storm systems.

When an inversion rises rapidly, warm ground air also rises and may burst through the inversion into the cool, dry upper atmosphere, Uccellini says. The result is a severe atmospheric instability, seen as cloud columns that may crest at 55,000-foot heights.

These columns unleash the most severe storms because rising updrafts encourage torrential rains, large hail, severe wind gusts, and even tornadoes, according to Uccellini.

-more-

add one-- air waves

"Until recently it was believed that waves large enough to cause these disturbances didn't exist," Uccellini says. "How often these waves occur, and if they have a regular effect on the weather, is unknown."

The waves--called gravity waves by meteorologists--can exist only along an inversion, Uccellini notes, because waves not contained between two such air layers will disperse naturally. The wave crests can come minutes or hours apart, and what wave length is required for storm formation is unknown.

Uccellini documented the existence of these waves in a storm system that battered the Midwest in May, 1971. A great wave of air, similar to a wave in the ocean but 250 miles long, undulated along the inversion from Kansas to Michigan. Curiously, individual storms within the system pulsated in intensity over identical two to four hour periods.

A subsequent atmospheric pressure analysis of the region showed that local pressures changed in cadence with storm intensity, indicating that gravity waves initiated severe weather, Uccellini claims. High pressure corresponds to the wave crest, which lifts a high column of air. The trough corresponds to low pressure, Uccellini explains.

The wave crest allows the inversion to rise sufficiently for low level air to rush into the upper atmosphere. The following trough again flattens the inversion and traps low level air. The sequence accounts for the cyclical fluctuation in the storms.

If an inversion is not strong enough to trap ground air, or if a gravity wave does not buckle the large inversion sufficiently, then storms will not form, Uccellini says.

#######

# feature story

Research Meteorology

From The University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone: (608) 262-3571

Release: Immediately 7/24/75 meb

WEATHER FORECASTERS HOPE TO GET BETTER DATA, IMPROVE LONG-RANGE PREDICTIONS

MADISON--Chances are one out of three that anybody's guess whether the average temperature during the next month will be normal, above normal or below normal will be correct.

So how do professional meteorologists using complicated maps and charts and jet stream data do on their 30-day forecasts? Not much better. They were right about 35 per cent of the time, according to a university professor who kept track of the forecasts and compared them with actual temperatures.

Meteorologists say the chief barriers to accurate forecasting are that they can't get any information about weather over the oceans where there are no stations to collect data, and that information from Africa and South America is scarce and unreliable. But meteorologists hope to close the data gaps.

The 24-foot dish antenna mounted atop the University of Wisconsin-Madison meteorology and space sciences building will be used in a test of data systems that one day may provide more accurate long-range forecasting.

The antenna here collects pictures of clouds transmitted from a weather satellite every half hour. A series of pictures taken over a period of time show which way and how fast the wind is blowing. The information is fed into a computer.

During the two-month long test which begins in August, the UW-Madison system's wind data will be correlated with information about atmospheric temperatures and moisture collected by other U.S. scientists from weather satellites and balloons.

- more -

What the meteorologists do here is imaginatively called "wind getting" and Fred Mosher, who will be coordinating this part of the test, believes the University has the most sophisticated system for gathering wind information. He says use of meteorological satellites and computers will take some of the guess work out of forecasting:

"The difficulty in accurately predicting weather is that the rules of physics don't apply. In physics, if you drop a pencil you can use an equation and find out what direction it will go and how fast it will be traveling when it hits the floor. But in weather forecasting the equations are of the nonlinear, differential type. They can't be solved. The only answer you can get is by using a computer to make approximations based on a numerical model."

Mosher said the numerical models, consisting of temperature, moisture, and wind data on a grid, are now only good for a couple of days before the model breaks down and another must be constructed. Meteorologists believe models would last longer and be more accurate if more complete global weather information was available.

Meteorological satellites can fill in the gaps over the oceans if the data gathering systems can be perfected. Mosher said models based on more complete global weather information might last a week or two before breaking down.

Although satellites can gather information where there are no weather stations, Mosher thinks they will never completely replace weather balloons. Satellite-gathered information on winds is very good, but the satellite is not as accurate as balloons in collecting data on atmospheric temperatures and moisture levels.

"The satellite can get temperatures at only about 10 levels (distances from the earth's surface). The weather balloon can get temperatures at 30 to 40 levels. And the satellite's temperatures are accurate to about two degrees while the balloon temperature readings are accurate within one degree."

The UW-Madison antenna, severely damaged in a wind storm in May, has been repaired and remounted. It will be fully operational again before tests begin Aug. 18.

###

UIR / RESEARCH NEWS

UNIVERSITY OF WISCONSIN-MADISON

UIR SCIENCE WRITING PROGRAM
(Graduate Student Science Writing Division)

Further Information: Jerome Blechman (608/262-0794)

UNIVERSITY-INDUSTRY RESEARCH PROGRAM

WARF Office Building
610 Walnut Street, Rm. 1215
Madison, Wisconsin 53706
Telephone: 608/263-2876

May 6, 1975

Research Meteorology

by Robert Ebisch
UW Science Writer

Madison, Wis.--In April, 1974, the worst Wisconsin tornado of the year plowed into Oshkosh, doing $3 million damage and killing two people.

Now, one year later, a meteorologist has certified this tornado to be the first documented instance of a phenomenon previously classified with sea monsters and leprechauns: the multiple tornado.

"The classic tornado," says University of Wisconsin-Madison meteorologist Jerry Blechman, "has a single funnel, smooth-walled and powerful. These are by far the most common.

"Multiple tornadoes are more rare; a lot of scientists insist there is no such thing. They are wider and more diffuse and turbulent, with several funnels revolving like tops around their common center."

Working closely with Prof. Charles Anderson, the university's resident expert on severe storms, Bleckman has studied the Oshkosh tornado for the past year.

He now postulates that the multiple tornado becomes a single tornado when it hits rough terrain.

Like a wandering torpedo, the large tornado cluster moves over open country until a collision with trees or buildings condenses its energy into one compact and viciously powerful funnel.

-more-

"You can see this in the Oshkosh tornado," Blechman points out. "The multiple tornado traveled for nearly an hour across marsh country and bare corn and soybean fields as it approached Oshkosh from the southwest. The minute it hit the city it became a single tornado."

Tornadoes are characteristically born in that warm nest of wet air that lingers just before a cold front.

The cold front that assaulted the Midwest a year ago caught Wisconsin with 70-degree temperatures and about 70 per cent humidity.

"But there were no humidity readings from Oshkosh's airport tower that afternoon," Blechman recalls. "All the weathermen could tell us was that there was heavy sky cover, they'd sighted a funnel, and they were clearing out."

Four miles due south of Oshkosh, local businessman David Sennholz saw a spinning bulge of cloud scouring the earth to the southwest. Standing on his front porch he filmed the tornado for three or four minutes as it moved north. Fifteen minutes later it hit Oshkosh.

"The Sennholz film is remarkable," Blechman says. "It is a cornerstone of our study, clearly showing about five secondary tornadoes revolving around the center.

"Before this," he continues, "multiple vortices had been observed only in dust devils, and inconclusively in one of Wisconsin's Palm Sunday tornadoes in 1965."

Yet, even the tracks of such previous tornadoes show more impressive evidence. In aerial photos Blechman notes looping gouges in the ground where secondary funnels had swirled like gigantic drill points dancing across the landscape.

Blechman's work will support theoretical studies done recently at the Universities of Chicago and Oklahoma, explaining the existence of multiple tornadoes and predicting their habit of flowing together when they hit a rough surface.

####

uw news

From The University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone: (608) 262-3571

Research Meteorology

Release: Immediately 8/22/74 jeh

'NOW CASTING' TO HELP STATE INDUSTRY, AG, WORK AROUND WEATHER

MADISON--To help industries and farmers to work around the weather, meteorologists at the University of Wisconsin-Madison have begun a specialized forecasting system called "now-casting."

Personalized forecasts with specific information--moisture, sky conditions, hour-by-hour temperature predictions, for example--are made up daily for the Department of Natural Resources, the UW's Experimental Farms, and six canning companies: 3-F Canning Co., Waupun; Green Giant Canning Co., Beaver Dam; Oconomowoc Canning Co., Waunakee; Fall River Canning Co., Fall River; Baker Canning Co., Theresa; and The Larsen Co., Green Bay.

Terry Kelly, meteorology specialist working with now-casting, said the Madison Gas & Electric Co. and the Madison Street Dept. will be likely clients when winter comes. Both, along with J. H. Findorff & Son, Inc., a local construction company, were involved in a three-month now-casting experiment last winter.

"We possess information about forecasting that we haven't had in previous years, and we have the ability to go out and make better short-range forecasts than ever before," Kelly said.

He explained UW meteorologists have access to experimental equipment available nowhere else in the country, including the McIDAS (Man-Computer Interactive Access System) computer, which was developed by the Space Science and Engineering Center here. Weather information is taken from teletype wires and a satellite, and put into a computer which comes up with television generated images only a few minutes old. Also used is radar from the National Weather Service Office in Madison and the meteorology department.

- more -

In addition, Kelly said the meteorology department hopes to begin a now-casting program on a local radio station for the 1,700 dairy farmers in Grant county. He said a recent pilot project involving one Grant county farmer resulted in savings of between $3,000 and $4,000 because the farmer knew how to plan around the weather.

Other UW meteorologists working on now-casting include Prof. Donald R. Johnson, principal investigator and chairman of the meteorology department, and graduate students Stephen Kachelhoffer, Madison; Wayne Kober, Kenosha; and Glenn Simonsen, Morton Grove, Ill.

###

research news

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Release: Immediately

6/6/73

UIR SCIENCE WRITING DIVISION
UNIVERSITY-INDUSTRY RESEARCH PROGRAM
(608-263-2876)

UW RESEARCHERS STUDY HAIL

By Robert Ebisch
UW Science Writer

Madison, WI--Hail does $300 million in crop damage to the United States annually.

Dropping unexpectedly, an avalanche of hail can shred a crop faster than any machine or plague of insects, stripping off leaves, breaking stalks, and smashing stems.

Learning to understand this natural hazard and reduce its destruction is the objective of the National Hail Research Experiment (NHRE), a government sponsored five year program in which the University of Wisconsin-Madison is taking part.

NHRE's main thrust will take place over "hail alley," a 2,100 square-mile area of northeastern Colorado.

"Although participation by the Wisconsin team in this field effort is limited to a few experiments, we will have access to all the data generated by the entire NHRE program," says meteorologist Charles Anderson. "We also take our own data where we feel the Colorado program is leaving out things that are important to us."

One result of Wisconsin work will be high-grade photographic mapping of storms. In 1969 Anderson set up and operated a time-lapse camera to record the growth and development of thunderstorms in hail alley. The following year the same camera inspected Madison-area storm development from the roof of the University's Space Science and Meteorology building.

-more-

A similar but more sophisticated technique using five cameras will be used this summer to provide valuable supporting information for the data that comes from NHRE.

"The observing tool that NHRE uses is radar," explains Anderson, "which doesn't see anything until precipitation-sized particles form. This means that they miss one or two hours during which the all-important building of the storm starts. Our cameras will record these hours."

Another Wisconsin enterprise will be an attempt to monitor the special atmospheric waves that a storm generates.

"These are compression waves, somewhat like those we call 'sound' but also somewhat different," says Anderson.

"We want to find out what is going on inside a storm by learning to understand these sounds that it makes. This would help, for example, by revealing the level of turbulence inside a storm without a plane having to fly into it."

Wisconsin also hopes to lay the groundwork for studying electric field effects of storms--how lightning and charge buildup are connected with hail--by using electric field recording equipment which will be set up in a network near Fort Morgan, Colorado.

One area in which Wisconsin excels is building and observing weather situations on a computer. The meteorology department will contribute to NHRE by developing computer models for hail-producing storms as an additional tool in their study.

Because the Wisconsin computers cannot handle so large a task, the work will be done on the largest computer available--the CDC-7600 at the National Center for Atmospheric Research in Boulder, Colorado.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research Meteorological

Release: Immediately 5/26/71

UIR Science Writing Division (608-263-2811)

By ROBERT HORVAT
UW Science Writer

MADISON, Wis.--The paths of Wisconsin's often devastating tornados may be determined by the lay of the land.

Tornados seem to shy away from relatively rough terrain and downslopes, two University of Wisconsin scientists have discovered.

These killer-storms are known to spring from certain combinations of large-scale weather patterns, the scientists say. But distribution of tornados in Wisconsin suggests other factors, like terrain, also influence a twister's path.

Meteorologist Heinz H. Lettau and graduate student Robert G. Gallimore jr., traced "outstanding Wisconsin tornados" recorded during the past 100 years. These twisters, with path lengths greater than 25 miles, caused extensive loss of life, and property damage.

The researchers noted several tornado alleys as well as "shunted" regions of lower frequency. Using topographic maps, Lettau and Gallimore found the shunted regions had much greater variability in height than the alleys. The scientists checked these observations from a specially-outfitted plane flying along the tornado alleys and shunted strips.

Two major alleys exist in Wisconsin, Lettau says. The first, in west central Wisconsin, cuts through Pierce, Dunn, Chippewa, Taylor, and Clark counties and seems to be an extension of a high tornado region in central Iowa.

- more -

A secondary southern alley passes through LaFayette, Green, Rock, and Jefferson counties.

The scientists also studied two shunted regions lying in southwestern Wisconsin. These areas have significantly greater terrain variability than do the tornado alleys.

The researchers got their first clue to the relationship between frequency and terrain by looking at tornado frequencies reported in flat and mountainous areas of Arkansas.

"Arkansas has several distinct topographic regions," Lettau explains. "We saw tornado alleys located in river plains, while mountainous areas reported many fewer tornados."

Wisconsin terrain is more gentle than mountainous Arkansas, but Lettau and Gallimore saw a similar relationship between twister frequency and terrain variability. Tornados may act this way, Lettau thinks, because rough terrain offers more frictional resistance to high-speed winds, thus breaking up twisters.

Many factors about tornados are still poorly understood, says Lettau.

"For example, we don't know why the two alleys in Wisconsin have maximum tornado frequency at different times of the year. The west central alley has its heaviest tornado traffic in June, while the southern path attracts tornados in April and May."

The project was partially funded by the U.S. Army.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research, Meteorological

Release: Immediately 5/26/71 rh

UIR Science Writing Division (608-263-2811)
For further information contact Robert Horvat

MADISON, Wis.--The paths of Wisconsin's often devastating tornados may be determined by the lay of the land.

Tornados seem to shy away from relatively rough terrain and downslopes, two University of Wisconsin scientists have discovered.

These killer-storms are known to spring from certain combinations of large-scale weather patterns, the scientists say. But distribution of tornados in Wisconsin suggests other factors, like terrain, also influence a twister's path.

Meteorologist Heinz H. Lettau and graduate student Robert G. Gallimore jr., have traced the paths of the most destructive tornados recorded in Wisconsin over the past 100 years. They noted several alleys as well as "shunted" regions of lower tornado frequency.

Using topographic maps and direct observations from a plane, the researchers found the shunted regions had much greater variability in height than the tornado alleys.

Two main alleys exist in Wisconsin, Lettau says. The first, in west central Wisconsin, cuts through Pierce, Dunn, Chippewa, Taylor, and Clark counties. This seems to be an extension of a high tornado region of central Iowa.

A secondary southern alley passes through LaFayette, Green, Rock, and Jefferson counties. Tornados may act this way, Lettau thinks, because rough terrain offers more frictional resistance to high-speed winds, thus breaking up twisters.

More studies of these severe storms may lead to improved prediction of a tornado's path as well as prevention and control.

The project was partially funded by the U.S. Army.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research—Meteorology

Release: Immediately 4/22/71 tb

UIR Science Writing Division (263-2875)
For further information contact Thomas Burroughs

MADISON--A major cause of severe thunderstorms has been isolated for the first time by two University of Wisconsin-Madison meteorologists.

Storms in the middle latitudes are triggered by cold, dry air of the polar jet stream descending from the high to the middle portion of the atmosphere, according to Profs. Donald R. Johnson and Frank S. Sechrist.

"The polar jet ordinarily meanders around the globe at very high altitudes," Johnson says. "While this jet produces atmospheric disturbance throughout the year, only during spring and summer with the gradual warming of the lower atmosphere will its effect reach down far enough to cause storms."

As the jet descends, its force causes air of the lower atmosphere -- warm and moist during these seasons -- to pile up in front of the jet, he explains. As more air bunches up, much of it is forced upward, and if the air that rises contains enough moisture, thunderstorms will begin.

The study, primarily funded by the National Science Foundation, is still continuing.

"This theory provides a better way to analyze conditions favorable for severe weather," Johnson says. "And if we can improve our analysis of these conditions, hopefully we can develop better models for predicting the weather."

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research Meteorology

Release: Immediately 4/22/71

UIR Science Writing Division (263-2875)

By THOMAS BURROUGHS

MADISON, Wis.--A major cause of severe thunderstorms has been isolated for the first time by two University of Wisconsin-Madison meteorologists.

Storms in the middle latitude are triggered by cold, dry air of the polar jet stream descending from the high to the middle portion of the atmosphere, according to Profs. Donald R. Johnson and Frank S. Sechrist.

The men are the first to describe the basic mechanics of how the polar jet stream destabilizes the atmosphere, making conditions favorable for severe weather.

"Up until now, quite a few factors were thought to be necessary for severe weather to develop, but our theory provides a more direct explanation," Johnson says. "This doesn't actually enable us to predict the weather, but we have now isolated what is necessary for storms to occur."

Their theory, which uses a complex set of mathematical equations, describes the destabilization of the atmosphere by the polar jet in terms of the shifting of the total air mass, instead of the usual high and low pressure areas.

The polar jet ordinarily meanders around the globe at very high altitudes, Johnson says. While this jet produces destabilization throughout the year, only during spring and summer with the gradual warming of the lower atmosphere will its effect reach down far enough to cause storms.

- more -

As the jet descends in the destabilization process, its force causes air of the lower atmosphere -- warm and moist during these seasons -- to pile up in front of it, he explains.

As more air bunches up in front of the jet, much of it is forced upward. And if the air that rises contains enough moisture, thunderstorms will form and a squall line will begin.

The Wisconsin meteorologists originally got their idea in 1968 from studying cloud pictures taken every 13 minutes by a weather satellite.

"We noticed on the pictures that before a storm began, a small wedge of clear sky would start to protrude into a cloudy area from the southwest," Johnson explains. "Gradually, this clear area would grow into a long finger, and the storm would break out to the southwest of the finger."

They subsequently determined that the clear area was actually the polar jet stream descending into the middle atmosphere, destabilizing the air at lower levels ahead of the jet and causing the storm.

The study, primarily funded by the National Science Foundation, is still continuing.

"This theory provides a little better way to analyze the conditions favorable for severe weather," Johnson adds.

"And if we can improve our analysis of these conditions, hopefully we can formulate better models for predicting the weather."

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research Meteorologist

Release: ADVANCE FOR PMs OF THURSDAY, NOV. 12 11/11/70

UIR Science Writing Division (262-5984)

By J.D. SCHREMSER

MILWAUKEE, Wis.--(Advance for pms of Thursday, Nov. 12)--Climatic change in Wisconsin in the last 8,000 years has been small compared to that in Minnesota.

Meteorologist Thompson Webb III told a meeting of the Geological Society of America Thursday that 5,000 to 8,000 years ago east central Minnesota was much drier for most of the year than Wisconsin.

During the summer months of this period, Minnesota experienced an increase in dry westerly air that did not spread into Wisconsin. But about 5,000 years ago, as the frontal boundary separating the westerly air from the southerly air moved westward, the Minnesota climate became more similar to that of Wisconsin.

But, he added, the climate was still somewhat different from what the two states have today. The mean summer temperatures, for instance, were slightly warmer.

Another definite climatic change, Webb reported, occurred about 11,000 years ago when there was a 6°F. increase in the July mean temperature. "This change marked the beginning of the postglacial climatic period in this area."

- more -

Webb, who did his climatic studies at the University of Wisconsin in Madison, explained that he obtained the information by studying pollen fossils. Pollen remains are often preserved under the earth for tens of thousands of years, he said.

By examining the pollen and using other measurements such as radiocarbon dating, scientists can discover what kinds of plants were growing in different places at different times, and thus what the prevalent climate was like.

###

The University of Wisconsin Institute for Environmental Studies 1225 West Dayton Street Madison 53706 Telephone: (608) 262-2860

news release

FOR RELEASE SATURDAY, OCTOBER 24 10/23/70 mel

DEKALB, Ill.--Climate marks not only the beginning and end of growing seasons but also the rise and fall of civilizations.

A University of Wisconsin climatologist has gathered evidence of vast environmental changes in the past 12,000 years, and has found that throughout the northern hemisphere many cultures of people underwent drastic changes--all at about the same time.

Wayne M. Wendland, assistant professor in the Institute for Environmental Studies and meteorology and geography departments, used all the radiocarbon dates associated with some 470 various cultures to chart the existence of these cultures.

He explained his findings at the Association of American Geographers meeting at Northern Illinois University.

Past cultures were influenced by their environment, and were limited in extent by a climate favorable to their life style. When the environment changed, these cultures changed as well.

"Evidence suggesting environmental change over the past few thousands of years can be found in the sagas of past cultures. The written record from the sagas lends even greater credence to the information in radiocarbon dates," Wendland explained.

- more -

"Our knowledge of global climate and wind systems suggests that major climatic shifts should be synchronous throughout the hemisphere. Some areas will become cooler and others warmer, but all these changes should occur at about the same time," he said.

Wendland used radiocarbon dates associated with given cultures to determine the mutual times of cultural discontinuities. He has charted these dates on a large-scale contingency table, or graph.

"This table reveals about five or six periods in the last 10,000 years with rather obvious cultural discontinuities. At these times it appears that a significant number of cultures either emerged or declined," he explained.

"These dates for various cultures are very similar to the radiocarbon dates Wisconsin researchers have previously studied from environmental records, such as pollen cores, maximum sea level heights, and glacial moraine limits.

"These two sources of information about past climates--cultural information and environmental factors--correlate very well."

The most recent major climatic change occurred around 800 years ago, Wendland said, adding:

"This period marked the end of the Viking expansion period, and the Vikings abandoned their three settlements in Greenland. During this same time some Eskimos and American Indians experienced trouble surviving. Eskimos on Greenland migrated from the Thule region toward the southern tip of the island. The Mill Creek Indian culture in Iowa suddenly disappeared.

"The European peoples experienced similar cultural changes. From the years 900 to 1200 Britons were growing grapes in quantity and quality, but around 1200 the vineyards simply disappeared.

"The radiocarbon dates from this period in the study agree with the written record of the Icelandic Sagas."

Add two--climatic changes

Wendland described another major climatic change occurring around 2,700 to 2,800 years ago. This climatic shift has been recognized in pollen records from northern Europe and Canada. This shift took place about the time of the beginning of the Greek-Roman period, when the Mediterranean climate became cooler and more moist than it is now.

The earliest dated climatic change in Wendland's study occurred around 9,700 to 9,800 years ago, near the beginning of the post-glacial period when climates in the northern hemisphere warmed considerably from what they had been.

The Wisconsin study has shown that climatic shifts are highly correlated with people's living habits in various areas of the world, as growing seasons for crops change drastically with even slight changes in climate. The environmental changes documented in the study also affect wildlife, as shown in dates of extinction of various species.

Wendland's research is supported by the National Science Foundation.

###

(Contact: Prof. Wayne Wendland, 608-262-0773 or 262-1954)

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research Meteorological

Release: Immediately 12/9/69

By BRUCE INGERSOLL

CHICAGO--From over the Atlantic came a series of bleeps--low-powered radio signals to a ship adrift along the Equator.

The bleep-bleeping came from a new device known as the WINDAV, developed at the University of Wisconsin's Space Science and Engineering Center in Madison.

WINDAV stands for wind (WIN) direction (D) and (A) velocity (V), UW electrical engineer Theodore Bernstein explained at the National Electronics Conference meeting here this week.

This device is a mechanical hybrid, created by crossing the farmer's weather vane with the weather man's anemometer (wind speedometer). Its innards are encased in an aluminum cylinder only slightly larger than a woman's lipstick.

WINDAV was designed for use with balloons tethered by thin cables to ocean-going research vessels, Bernstein said,

The anemometer part of the device has three protruding spokes. These have wind cups at their tips and spin in the breeze. The stronger the wind, the faster they revolve.

The revolving anemometer is mounted on a triangular frame. This triangle is attached to the balloon cable so it is free to swing like a weather vane and indicate the wind's direction, Bernstein told his colleagues.

- more -

It is the detection of wind direction in relation to the earth's magnetic field that makes WINDAV unique. The radio bleep-bleeping relays the information on wind to ship-board scientists below.

The bleeps are produced by a Sony magnetodiode, a small transistor-like device which uses less than one-twentieth as much battery power as a flashlight.

Bernstein and Joseph G. Miller, a UW specialist on instrumentation, developed WINDAV at a cost of $37,000 for the federal Environmental Science Services Administration's $22.5-million BOMEX project.

The Barbados Oceanographic and Meteorological Experiment (BOMEX) was conducted last May, June, and July east of Barbados to learn more about the mysterious interactions between the tropical sea and the air.

It required an armada of 10 ships, 24 airplanes, several earth-orbiting satellites, and a dozen buoys all equipped with sophisticated instruments. Balloons were tethered to four of these ships, keeping the WINDAVs aloft for round-the-clock readings on wind speed and direction.

The WINDAV-supplied data will be used to create computer models of global weather patterns, Bernstein said. It is the hope of meteorologists that a "world weather watch" system can be developed within the next decade, using the models to predict the weather for any spot in the world two weeks in advance.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Research Meteorological

Release: Immediately 10/23/69

UIR Science Writing Division (262-5984)

Contact James A. Larsen

MADISON, Wis.--The single most important fact of life for this generation--and for those to come in the foreseeable future--is the population explosion, Prof. Reid A. Bryson, University of Wisconsin climatologist, has warned.

Bryson spoke at an American Meteorological Society Symposium held this week at the University of Wisconsin in celebration of the dedication of the University's new Meteorology and Space Science building.

He said world population levels by the turn of the century will have reached saturation--the point at which the population will go up and down in accord with the success or failure of the world's crops. Poor crop years will be followed by mass starvation.

"Understanding of climate will, under these conditions, be of even more importance than it is today," he said, referring to the fact that thousands of lives and millions of dollars can be saved through a single accurate storm forecast.

He said atmospheric scientists must accept their social responsibility for undertaking studies of climate related to the crucial needs of mankind apparent in the foreseeable future. Climatic knowledge related to improved agriculture and all areas of human health and welfare will become matters of life or death for millions of people throughout the world.

- more -

The symposium attracted nearly 200 scientists from throughout the country. At the banquet, Bryson outlined the history of the department of meteorology at Wisconsin from its beginnings in 1948 when he was chairman and Verner Suomi was the only other professor. Suomi subsequently developed the meteorological satellites for gathering climatic information, and Bryson has become a world authority on climatology and climatic change.

Kenneth Hare, climatologist from the University of Toronto and former president of the University of British Columbia, also advocated expansion of the scope of the science of climatology to take in the interactions of the atmosphere with the entire biota of the world.

Interactions between life and atmosphere are so complexly interwoven that it is impossible to consider the one without the other, Hare said. The effect of life on the atmosphere--particularly the effect of man's activities--may critically affect the climate of the future.

He ridiculed the prevailing popular attitude, labeling it a political posture, that it will ever be possible to "restore the original quality of our environment." He said it is manifestly impossible to restore lands, forests, and atmosphere to the condition they were in before man spread across the face of the earth.

"Our only hope is that we can keep the environment from deteriorating to a condition intolerable for life," Hare said. "We can anticipate for the foreseeable future a long term and enduring lack of equilibrium that we will have to find means of dealing with."

He said knowledge was now sufficient to indicate that climates can change quickly from one state to another--for example, from the kind of climate we now have to one more characteristic of the glacial ages. What triggers these changes, however, is not yet known.

There may be unsuspected triggering mechanisms that can be tripped by air pollution or any number of other consequences of increasing industrialization and expanding human populations, he stated, adding:

"There may exist potentially explosive and self-amplifying changes that can be brought about by the condition of the biosphere. Climatologists must now begin to take this possibility into account and expand their studies to include such things.

"Meteorologists must not do only the things that come easy to a physical scientist--they must become truly environmental scientists."

A warning pertinent to the possibility of climatic change was voiced by Lauriston Marshall of the department of physics at Southern Illinois University. He said some studies have indicated that DDT affects not only animals but photosynthesis in plants as well. Since it is photosynthesis in the plant life of the world's lands and oceans that maintains the oxygen balance of the atmosphere, there is a chance that DDT is endangering not only the physiological health of animals but also the oxygen supply of the world.

###

# FEATURE STORY

Research - Meteorological

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

2/27/63 gr

RELEASE: Immediately

By GENE RODGERS

MADISON, Wis.--Weather satellites and balloons seem to be attracting most of the attention these days, but a group of down-to-earth University of Wisconsin meteorologists have their ears to the ground, so to speak.

They are known as micrometeorologists, men who study the climate at the surface of the earth--and below--and consider a height of 10 feet their ceiling. (A micrometeorologist is not necessarily a small meteorologist!)

They measure in detail the significant changes in temperature, pressure, wind, velocity and the like which occur every few inches above ground and water surfaces.

As part of a long term micrometeorological program, a group working under Prof. Heinz Lettau, chairman of the meteorology department, has set up a number of instruments on the ice of Lake Mendota. The ice surface provides a simpler and less obstructed environment than could be found on land, and allows greater control of experimental variables.

The scientists can also pursue their special interest in interactions between air and bodies of water. Similar experiments are made during warm weather on the unfrozen lake, and results compared.

The UW men hope to describe details of freezing and thawing processes, relations among sun, water, and wind, and the mechanics of lake currents. They are being assisted by biologists at the UW Hydrobiology Laboratory, who are interested in the data on currents for their own studies on the distribution of nutrients in a lake.

-more-

"In a sense we are experimenting in a natural wind tunnel," according to Project Associate Chuck Stearns, who is in direct charge of field operations. "Our data should help to explain how snow fences and wind breaks operate and how soil erodes. They will also be useful in oceanographic studies, since a lake is a model of an ocean."

The experiments attracting the most attention from curious ice fishermen are two to measure effects of obstructions on force of the wind. A miniature forest of discarded Christmas trees has been "planted" on the ice, and wind force is recorded on the windward and leeward sides. The difference between the two readings indicates the energy absorbed by the mock forest.

The other experiment entails placing on the ice rows of bushel baskets, each painted black or white, and conducting similar measurements. The scientists suspect that black baskets, which radiate more heat from sunlight than white ones, may have greater effect.

Another experiment related to wind force involves a block of ice 15 feet on a side floating in a slightly larger square hole. Gauges anchored to the sides of the hole are tied to the block to measure the drag force of the wind. Warm water is pumped from the lake bottom to keep the hole from freezing.

Various measuring devices are scattered over and under the ice, including four 10-foot high masts with weather instruments spaced every few inches from top to bottom to give a profile of conditions. Another mast has an instrument-laden boom which sweeps automatically up and down to fill in the gaps of the other masts. Buried within the ice are instruments to measure its heat conduction.

Data from all these instruments are fed by cables under the ice to a shack on shore at the site of the former Camp Gillistela, the UW tent colony. They are recorded automatically every 15 minutes day and night on punch cards for computer analysis.

Even a telescope is used in the project. It is kept focused on a building across the lake, changes in the shape of the image reflecting changes in the density gradient of air over the lake.

The UW project is being sponsored by the U.S. Army.

###

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

Research
Meteorology

11/19/62 jl RELEASE: Immediately

MADISON, Wis.--A leading meteorologist has advocated establishing a global satellite weather-observing system.

Sverre Petterssen, speaking at a satellite meteorology conference held at the University of Wisconsin, said data obtained by weather satellites, along with data from weather stations and from balloon and rocket soundings, would greatly aid research leading to better basic understanding of the atmosphere, better predictive ability, and possibly eventual control over some weather events.

Practical advantages can be gained at once by developing an observation network in space, Petterssen added. Exploitation of these potentialities will result in "immediate and substantial improvements" in meteorological service, he said.

Petterssen is a member of the University of Chicago's Geophysics Institute and was one of a number of scientists attending a conference at Wisconsin last week concerned with satellite data now available to scientists for research.

"Recent studies by the World Meteorological Organization indicate that the maximum density of sounding stations needed for studies of the large-scale weather systems corresponds to a separation between stations of about 300 miles," he explained. "When seen against these minimal requirements, the existing network of sounding stations is grossly inadequate."

Most important phenomena to be studied, he said, are those related to atmospheric energy budgets, extent and character of cloud systems, earth-surface and cloud-surface temperatures. Global satellite coverage would also provide information on meteorological conditions needed in routine forecasting, such as position and movement of weather systems and storms and the temperature and height of clouds.

-more-

Petterssen added that future developments hold promise of ability to delineate precipitation areas with the aid of satellite-borne radar and thunderstorm areas with the aid of sferics detectors and other remote-sensing devices.

Development of communication between satellites would permit monitoring of the entire satellite network simultaneously, to provide researchers with gradients and integrated values over large areas of the globe.

Verner Suomi of Wisconsin, who devised radiation-measuring instruments carried by the Explorer and Tiros series of satellites, reviewed radiation data now available for meteorological research.

The Suomi radiometer has obtained data on radiation in the 4 to 40 micron wavelength band which provides detailed information of great value in efforts to calculate accurately the heat budget of the earth--the energy input and output which is the basic driving force behind changes in atmospheric conditions.

Peter Kuhn, another member of the Wisconsin research team, said that balloon observations will continue to be useful as a check against data telemetered to earth from the satellites, and will assist scientists in determining what the satellites are capable of achieving in the way of accuracy and sensitivity.

William Nordberg of the National Aeronautics and Space Administration said research meteorologists will have data available in the next few months providing good photographic and meteorological coverage obtained during certain periods of 1961.

This information, to be made generally available to researchers throughout the country, was obtained during orbits over the United States, Europe, and Australia.

There is also complete coverage of the globe for a single day, and a record of infra-red radiation "tracking" of Hurricane Anna by satellite. The data from Tiros Four has not yet been processed into form for general use.

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

Research
Meteorology

10/30/62 jl

RELEASE: Immediately

MADISON, Wis.--The first $200,000 of a grant to establish a Center for Climatic Research in the department of meteorology at the University of Wisconsin has been received by the UW from the National Science Foundation.

The grant will finance a greatly expanded program of research in the UW department of meteorology, largely around a nucleus of the department's already active interdisciplinary research program.

"Climatology deals with the atmospheric elements that give a region its character and individuality," Reid A. Bryson, professor of meteorology and center director, points out. "The initial emphasis of this group will be upon extension of our understanding of the present global climate, especially polar, oceanic, and desert areas, and upon a study of the climates of the past."

Bryson adds that much of the research now underway in the department would be expanded under the new program, including development of automatic processing systems for handling the large masses of weather data now becoming available, study of oceanic climates and influence of the seas upon world climate, extension of knowledge of polar regions, studies of albedo, emissivity, and moisture balances, and a search for evidence leading to a better understanding of the past climates over the world.

Studies will also be undertaken of the feasibility of utilizing satellite data for world climatology and of extending terrestrial climatic principles to studies of the climates of other planets.

-more-

Add one--climatic research

During recent years, studies of world climatology have not kept pace with the rapid expansion of physical studies of the atmosphere, and the new Center for Climatic Research will greatly expand research possibilities in this field.

"Recently climatology has been underdeveloped in terms of its importance, undermanned in our teaching programs, and underestimated in terms of its potential value to mankind," Bryson points out.

He adds that establishing the program at Wisconsin was at least partly the result of Wisconsin's strong tradition of free interdisciplinary cooperation.

"The department of meteorology contains within its own faculty competence in meteorology, geography, geophysics, zoology, oceanography, botany, geology and chemistry," Bryson adds. Additionally, the UW meteorology department is now the largest in the nation in terms of numbers of graduate students currently enrolled.

Bryson points out that facilities and personnel of the new research center will be available to aid the large numbers of individuals in State government and the University who are engaged in research with meteorological aspects.

The grant will be presented to UW regents for acceptance at their Nov. 9 meeting.

###

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

Research
Meteorology

10/25/62 jb

RELEASE: Immediately

MADISON, Wis.--Two University of Wisconsin scientists will head for the Antarctic Nov. 5 to study physical and chemical conditions in two lakes not far from the South Pole.

Prof. Robert A. Ragotzkie, meteorologist and oceanographer, and Gene Likens, a research project assistant in zoology and limnology, expect to be gone three months, working in the polar regions under a National Science Foundation grant.

They plan to spend most of their time at Lake Bonney and Vanda Lake, located in Victoria Land, some 60 miles from McMurdo Bay. Both lakes are permanently frozen bodies of water, with some 12 feet of ice at the surface. The lakes are approximately 10 miles square, and are unique in that they are both salt and fresh water bodies.

Of particular concern to the investigators will be the thermal factors of the lakes because Vanda has been known to have a temperature of 80 degrees Fahrenheit at its bottom at this time of year, and Bonney warms in its central levels to 45 degrees.

Prof. Ragotzkie and Likens will measure water currents, heat flow and sources, the chemistry of the water, heat budgets, light, amount of evaporation and conduction, as well as other physical, climatological and biological characteristics. Likens also intends to take a look at the manner in which the green plant life in the lakes is able to produce carbon with the limited amount of available light under the heavy ice cover.

-more-

Add one--Ragotzkie/Likens

Their tools will include a motorized ice drill, radiation devices, and specialized electronic equipment. They will be in touch with authorities at McMurdo via radio, and travel from one location to another by helicopter. Some time has been reserved for exploration of other areas.

Upon his return, Likens will join the faculty of the Dartmouth College department of biological sciences. He was awarded his Ph.D. in zoology at Wisconsin last June, his M.S. here in 1959, and his B.S. at Manchester (Ind.) College two years earlier. A native of Sidney, Ind., he served two years as a teaching assistant in the UW department of zoology and two years as a research project assistant under Dr. Arthur D. Hasler, director of the UW Hydrobiology Laboratory.

Prof. Ragotzkie came to Wisconsin in 1959 after serving three years as director of the University of Georgia Marine Institute. He received his B.S. and M.S. degrees at Rutgers University and his Ph.D. in meteorology and zoology at Wisconsin in 1953. He is a native of Albany, N.Y.

##

research news

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Research - Meteorology

Release: Immediately 9/28/73

UIR SCIENCE WRITING DIVISION
University-Industry Research Program (608-263-2876)

For further information: Contact Prof. Frank Sechrist (608-262-0778)

By KEITH HAGLUND
UW Science Writer

MADISON, Wis.--Public television station WHA-TV 21 is presenting television's first computerized up-to-the minute weather forecast.

The broadcast, part of a new "Target" current events show, will actually "show" weather happening. A new weather sensing system based on radar, a satellite, and a computer named McIDAS (Man computer Interactive Data Access System) will make the presentation unique.

McIDAS will consolidate weather information and present it as maps of local developments. The computer will initially use standard U.S. Weather Service data and local radar.

Conventional broadcasts depend on facts 6 to 24 hours old, but McIDAS can prepare and deliver information collected as little as 20 minutes beforehand.

McIDAS's speed will allow meteorology professor Frank Sechrist to tell viewers exactly what weather they will experience in the next few hours.

The weather spot is presented daily at about 6:50 p.m., beginning Monday, Oct. 1. Eventually WHA-TV will also offer a five to eight minute morning show and two shorter updates during the day.

The broadcast will become more complete in about a month when the computer is linked to a larger radar facility in Neenah, Wis.

- more -

Although he has taught at short seminars, this is Woiwode's first experience as a member of a university faculty, and he says he likes it.

"I was intrigued by this position because I'm interested in what young writers are doing. There are some very talented people here."

Each of his students submitted a manuscript before being admitted to his class and he works with them "as kind of an editor.

"There are certain basic mistakes that writers make and I can teach them not to make the mistakes. But the way to learn to write is just to write. And write you when you/eventually get a backlog of material and things will start selling."

Woiwode is the author of "What I'm Going To Do, I Think," the novel that won the Faulkner award. He is now finishing a second novel, "Beyond the Bedroom Wall," which is scheduled for publication in 1974.

###

research news

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Research Meteorology

Release: Immediately 7/13/73

UIR SCIENCE WRITING DIVISION
University-Industry Research Program (608-263-2876)

By BOB EBISCH
UW Science Writer

MADISON, Wis.--University of Wisconsin-Madison space scientist Verner Suomi and Feodor Ostapoff of Miami's Sea-Air Interaction Laboratory will spend the first 10 days of August working on a Russian research ship.

The Wisconsin scientists will be traded temporarily for two Russian scientists as part of the preparations for next year's Atlantic Tropical Experiment (GATE).

The study is part of the Global Atmospheric Research Program (GARP), an international project aimed at increasing understanding of the atmosphere and laying the bases for long range weather prediction by monitoring weather on a global scale.

First conceived more than a decade ago, GARP has grown to vast proportions. Although exact figures on its size are unavailable, one of its co-sponsors, the World Meteorological Organization, lists 132 member countries, according to Doug Sargeant, deputy director of the U.S. GATE Project Office in Washington.

"GARP itself has many other programs besides GATE," Sargeant says, "and it will be in action through at least the end of this decade. But the GATE field work will climax next summer, involving ships, planes, and satellites from about 15 countries."

- more -

The purpose of this summer's testing program is to compare American and Russian equipment that will measure the earth's boundary layer--that part of the atmosphere near the ground.

The boundary layer is important as the area where heat energy is passed from the earth to the atmosphere.

"Most of the sun's energy hits the earth in the tropics, where GATE is scheduled," explains Wisconsin space scientist Tom Haig, "and is transferred from the water through the boundary layer and into the atmosphere by heat convection. How it occurs is poorly understood and finding out is GATE's principal concern."

Part of the boundary layer measurements will be made using BLIS, the Boundary Layer Instrumentation System developed at Wisconsin's space science and engineering center.

Pretested last January and February near Miami, the system consists of five instrumentation packages deployed along a line running from a ship to a balloon suspended 1500 meters above. Each package will measure wind direction and speed, temperature, humidity, and pressure. It will have several internal devices to organize data and sensors to keep tabs on the unit's operation.

A Mexican research vessel, the U.S. ship "The Researcher," and Russia's "The Academician Korolov" will probably be alone at their meeting in the Atlantic west of Senegal.

The emphasis is on Russian-American intercomparison because ships contributed by these countries are most numerous and because they represent the extremes in instrumentation differences.

"Since we each have our own systems of data collection there will be problems with equipment and there will be problems in bringing all our data to a common standard," Sargeant says, "so it's only natural that we get together in advance of GATE, each to learn how the other does things."

###

research news

From the University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone (608) 262-3571

Research - Meteorology

Release: Immediately 6/8/73

UIR SCIENCE WRITING DIVISION
University-Industry Research Program (608) 263-2876

By ROBERT EBISCH
UW Science Writer

MADISON, WI.--A fleet of 400 balloon-borne weather stations will team up with NASA's Nimbus F satellite next year to gather meteorological information and to test the desirability of a permanent global armada of the floating installations.

Known as TWERLE (Tropical Wind, Energy Conversion and Reference Level Experiment), the project is a joint effort between the University of Wisconsin-Madison, Goddard Space Flight Center, and the National Center for Atmospheric Research. It will fill what Wisconsin space scientist Verner E. Suomi describes as an enormous gap in our ability to predict the weather.

"The earth's atmosphere is a closed system," Suomi explains. "To predict large scale weather patterns one must have information from all over the world.

"Conventional methods of observation cover only 15 per cent of this need and satellites alone are limited in their ability to help. A satellite can measure atmospheric temperature structure best in the polar regions where vertical temperature differences are large. Also it can follow wind motion by watching clouds but there are not enough clouds at most altitudes."

With a life expectancy of about six months before violent death in a thunderstorm or other disturbance, the balloons will keep constantly in touch with the weather satellite as they scatter around the world. Each balloon will regularly report its position and the atmospheric conditions it encounters, all to be relayed by the satellite to ground.

- more -

"Because balloons can go anywhere," Suomi points out, "they will be of especially great value in poorly monitored areas such as the southern hemisphere, where there are few ground stations because it's mainly water. And at whatever altitudes the balloons travel they will assume the role of clouds as floating markers of air motion."

Wisconsin's role in TWERLE primarily is the development and testing of special instruments that the balloons will carry, including radioaltimeters to measure altitude by bouncing radio pulses off the ocean, high-accuracy pressure sensors, and transmitters so precise that the satellite can measure the balloon's position and motion from apparent changes in the transmitter's frequency.

Having tested the devices on around-the-world flights, balloons sent up from Ascension Island in the South Atlantic last summer, the Wisconsin scientists are now overseeing manufacture of their instruments, preparing computer techniques to analyze data, and planning final testing of the weather stations prior to their 1974 launching.

###

# FEATURE STORY

Research
Meteorology

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

8/13/62 gr

RELEASE:
Immediately

By GENE RODGERS

MADISON, Wis.--University of Wisconsin meteorologists are investigating with scientific instruments what air travelers with sensitive stomachs easily detect--atmospheric turbulence.

Dr. John A. Dutton and Donald H. Lenschow, project associates, fly a twin-engine Cessna 310 leased by the University from the Morey Airport Co. and laden with scientific equipment over south central Wisconsin several times a month.

Their goal is to correlate turbulence with sunshine and its heating effects, and with surface features such as soil type and vegetation.

Meteorology department chairman Heinz Lettau directs the project, sponsored by the Army Signal Corps. It is part of the department's broad program of lower atmosphere research.

Dutton and Lenschow take off from Morey airport in Middleton and fly a 45 minute loop over Waunakee, Dane, Lodi, Sauk City, Mazomanie, Arena, and Spring Green.

The UW scientists seek detailed explanations of familiar phenomena. For example, pilots know that turbulence (vertical air velocity) is generally more intense over black, newly plowed land than over green pasture because dark fields absorb solar heat and warm the air above, causing updrafts.

-more-

Add one--turbulence

But lack of sufficient data has so far precluded mathematical description of relationships among the various factors. UW researchers hope to approach this more precise understanding.

The study of horizontal variations in climate over a small area represents a new meteorological field. Previous investigation has concentrated on height related differences at selected sites.

The UW airplane normally flies both at dawn and early afternoon to experience minimum and maximum heating conditions. The plane carries instruments to measure turbulence, incoming and reflected sunlight, and infra-red radiation (heat rays).

Included is an analog computer to translate various airplane motions into a continuously recorded graph of turbulence.

Infra-red studies will provide an integrated picture of temperature patterns over a wide surface area. Sensors under the planeglimpse rays emitted by the surface below, producing a continuous graph of ground temperature. Most previous analyses have relied on discrete readings by thermometers scattered at random points.

So sensitive is the procedure that UW experts can tell from the graph when the plane passed over hay, corn, plowed fields, pasture, woods, and water.

Agricultural science might benefit from the investigation, which may reveal how various crops and soils react to daytime heating and night-time cooling.

"Albedo" and total radiation from the ground are also calculated. Albedo, an indication of sunlight absorbed by the earth, is the ratio of incoming and reflected sunlight.

###

Research
Meteorology

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

2/8/62 jl RELEASE: Immediately

(with satellite)

The University of Wisconsin recording devices that went aloft with the Tiros.IV payload of scientific instruments today are designed to measure the amount of energy from solar radiation that reaches the earth's outer atmosphere as well as the thermal radiation leaving the earth and its atmosphere. They also measure the amount of radiation that the earth reflects directly back to space.

The earth's efficiency as a reflector varies from hour to hour and day to day depending on the cloud cover--and the relationships between kinds of clouds and rate of flow of heat to and from the earth are among the things that the Wisconsin scientists are specifically interested in.

The information on the total incoming and outgoing radiation is basic information of great importance to meteorologists attempting to understand the broad-scale energy and weather patterns over the entire earth.

"We are not interested specifically in prediction," says Prof. Verner Suomi, leader of the Wisconsin satellite research team. "We are interested in learning the radiation or heat balance of the surface of the earth and the atmosphere so that eventually we will be able to figure out how it all works."

Once meteorologists have an understanding of the basic processes at work in the atmosphere, then immensely practical applications in forecasting should be forthcoming.



-more-

The recording devices on Tiros IV are the same as those borne into space by the previous Tiros shots. Devices known as radiometers measure the earth's heat budget--the amount of energy received from the sun, and the amount reflected back. From this data, scientists can calculate the amount of energy involved in driving the earth's weather.

The earth loses more heat energy at the poles than at the equator, resulting in a giant and continual shift of energy from the equator to the poles. This continual flow of heat energy is one of the major generators behind the earth's climate and weather patterns.

The TV-record of cloud cover is extremely important to the Wisconsin scientists because clouds affect great variations in the amount of radiation reaching the earth from day to day. Prof.Suomi has said he believes that high clouds are the most important in the control of heat loss by the earth's surface.

"The higher clouds are, the colder they are," he points out. "It may seem strange, but the colder the cloud is, the more effective blanket it makes for keeping the heat in the atmosphere."

All but the first of the Tiros satellites carried TV cameras which have provided the meteorologists with detailed photographs of the cloud cover over large areas of the earth. By comparing the cloud photographs and the data obtained by the radiometers, it is possible to correlate cloudiness and radiation income for large areas of the earth.

While the Wisconsin meteorologists are interested primarily in the broad-scale measurements of total infra-red radiation, other experimental devices on the Tiros satellites are designed to measure narrow bands of the infra-red radiation, providing detailed information on the wavelengths most significant to the heat budget.

The delicate instruments for the Wisconsin part of the Tiros payload were designed by Prof. Suomi and Robert J. Parent, an electronics expert, and constructed by Harry H. Miller, a project associate in engineering. The data obtained by the instruments is collected at the monitoring stations and shipped on magnetic tape to Madison for processing and analysis on computers.

The Tiros satellites are largely a National Aeronautics and Space Administration effort and most of the instruments aboard the satellite belong to the NASA. They include two TV cameras--one a standby in case the other fails to work--and the heat-sensing devices, plus telemetry equipment to radio the information obtained back to the earth.

##

Research

# U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/22/61 gr

RELEASE: Immediately

By GENE RODGERS

MADISON, Wis.--More than Sputnik was rocketed by the International Geophysical Year (IGY), according to the University of Wisconsin meteorologists.

Student interest in meteorology, the scope of research and teaching, and availability of research funds have also zoomed since 1957, the beginning of the IGY, they say. The IGY was a period of 16 months of concentrated and coordinated investigation in the earth sciences by all nations.. The first artificial satellites were launched as part of this program.

"The IGY created a demand for meteorologists and demonstrated what a wide field for research the science of meteorology is," according to Heinz H. Lettau, chairman of the UW meteorology department.

The number of graduate meteorology students at Wisconsin jumped from the usual enrollment of about eight before the IGY to its current enrollment of 44. More than half of these students majored in allied fields, such as physics, as undergraduates.

There are 15 undergraduate majors in meteorology at UW, and the department instituted a freshman general meteorology course this semester. The course proved to be popular, attracting about 80 students, and many of these are expected to choose meteorology as their major field.

Altogether, UW enrolls about 10 per cent of all meteorology students in this country, making it one of the larger departments in the United States.

-more-

The sputnik era also boosted Wisconsin into the lead in the newest area of weather science--satellite meteorology. It is now the only university in the country with an active teaching and research program in this field. Its director, Prof. Verner E. Suomi, has had experiments aboard Explorer and Tiros weather satellites.

The department also plans to expand into a full scale program its work on oceanography, which stresses the interaction of air and water.

The funds available for research also started to rise at a great rate in 1957. From a constant level of about $50,000 per year before the IGY, the sum rapidly increased to a total of over $400,000 this year.

The meteorological explosion is outracing the present staff and building facilities. The department hopes to hire four new staff members next year and, jointly with the physics and astronomy departments, has asked the National Science Foundation to support construction of a new building.

The choice of staff members reflects the growing interests of the department. One of them will be Werner Schwerdtfeger, whose knowledge is needed for interpretation of the world-wide coverage of weather satellites. He is an expert in synoptic meteorology of the southern hemisphere (its general atmospheric circulation), and is presently employed by the Argentine Office of Naval Research.

The boom in meteorology is coming none too soon, according to Prof. Reid A. Bryson, former chairman of the department. "There is a great shortage of meteorologists. According to a national report, this country has been producing only about a dozen Ph.D. meteorologists each year, when it should be producing 60," he says.

Lettau explains, "The great demand for meteorologists now comes from the government, the armed services, private research organizations, and from industries which need consultants. Only about 20 per cent of our graduates now go into weather bureau forecasting."

###

# WIRE NEWS

Research Meteorology

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

12/11/61 gr RELEASE: Immediately

MADISON, Wis.--The establishment of a new national laboratory to probe basic weather and atmospheric processes will formally be celebrated at ceremonies Dec. 12 and 13 in Boulder, Colo.

The University of Wisconsin will share the operation of the laboratory with 13 other universities. UW Vice-President A. W. Peterson and meteorology Prof. Reid A. Bryson are members of the board of trustees of the administrating corporation, and have been active in planning for the laboratory since its inception.

High officials of the 14 member universities of the University Corporation for Atmospheric Research (UCAR) will meet for the ceremonies, together with national, state, and local representatives. Prof. Bryson will represent UW Pres. Conrad A. Elvehjem.

The mission of the laboratory, called the National Center for Atmospheric Research (NCAR), is the study of the earth's atmosphere and the influences on it from the ground and ocean, and from the sun and cosmic sources. It may lead to improvement of long and short term weather prediction, and to a realistic assessment of weather control on local, regional, and continental scales.

The NCAR resulted from a suggestion of the National Academy of Sciences. It recommended in 1958 that a national center be formed to tackle problems whose solution was beyond the ability of individual universities.

-more-

The National Science Foundation is supporting the center, which since last year has been located temporarily at the University of Colorado. Plans are being drawn for a permanent laboratory to be located on Table Mountain, near Boulder. It will house about 500 people when completed in six or seven years.

The Colorado ceremonies will also merge the UCAR with the High Altitude Observatory (HAO), which has operated solar and astrophysical research facilities in Boulder and Climax for the past 15 years.

The HAO is one of the leading observatories in the field of astrogeophysic which is the study of the sun, its atmosphere, and its effects on the atmospheres of Earth, Venus, and Jupiter.

Although the center is administered by UCAR, research will not be restricted to these universities. "On something as global as the atmosphere, the only sensible approach is an international one, and so the laboratory will be national and international in nature," according to Prof. Bryson.

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

Research Meteorology

11/21/61 jl

RELEASE: Immediately

MADISON, Wis.--University of Wisconsin meteorologists riding a four-engined Navy Neptune research bomber have been following the progress of winter as it closes in over the northern hemisphere.

The UW climatologists have been utilizing the long-range capabilities of the P2V Neptune to study the freeze-up pattern of northern lakes, a technique useful in determining the pattern of winter weather as it spreads southward.

Directing the project are UW meteorologists Reid A. Bryson and Robert A. Ragotzkie.

"The freeze-up pattern of lakes over a wide area gives us important clues to the nature of the annual cycle of heating and cooling of the earth's surface," says Ragotzkie, who headed the flying team of UW meteorologists on "Operation Freeze-Up."

The annual cycle of heating and cooling is short on heating and long on cooling in the north, as might be expected. Lakes at the northern end of the study area began freezing up during the first week in October. The freeze-line, as the scientists call the front of frozen lakes, has been followed by the scientists since mid-October.

The Navy Neptune patrol bomber is ideally suited to the purpose. It has exceptionally long range and can fly in all weather. This allowed the scientists to find the freeze-line and follow it in a criss-cross pattern to determine its exact location from day to day.

-more-

"It is of interest that in the far north the line is quite distinct and definite," says Ragotzkie, "with a relatively narrow transition zone between areas where all lakes are open to those where they are all closed. Farther south, this is not the case--the transition zone is very broad, extending several hundred miles north and south."

This difference between the early winter weather of the far north and that of the south has not been noted before, to the UW scientists' knowledge, primarily because this is the first time a fall freeze-up has been followed in such detail.

The scientists are employing the annual heat budgets of lakes in the various regions of the northern hemisphere as climatic indicators. It is, in a sense, as though the lakes serve as remote natural weather recording stations.

"Using this information, we can make certain inferences regarding climate," says Bryson in describing the research. "It is expected that the information will be important in studies--both at Wisconsin and elsewhere--of long-term climatic changes and broad weather patterns over the northern hemisphere."

For example, one of the team of flying scientists, James A. Larsen, UW science editor and project botanist, is using the climatic information to interpret differences in the natural vegetation of the earth's surface from prairie to treeline and into the far northern tundra; another scientist, Bernie Lettau, is studying the heating and cooling of soils and peat deposits throughout the vast area covered by the research.

Other UW scientists taking part in the research are James McFadden, who is developing methods of obtaining temperatures of land and water surfaces from an aircraft; Mark Shulman, who is utilizing growth rings of trees to obtain information on climatic changes of the past; and Ernie Sabbagh, a climatologist with Antarctic experience. Victor W. Sim, a geographer of the Canadian Department of Mines and Technical Surveys, participated in some flights as an observer.

###

Research
Meteorology

# U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/13/61 jl

RELEASE: Immediately

By JAMES A. LARSEN

MADISON, Wis.--University of Wisconsin meteorologists using an advanced statistical technique known as power spectrum analysis have disproved the theory that sun-spot cycles show up in the annual growth rings of trees.

The theory now shown to be untenable is that sun-spot cycles have an influence upon the earth's climate of sufficient intensity to show up in the annual growth rate of trees in the southwestern U.S. It had been postulated in this theory that variations in growth rate from year to year reflected varying sun-spot activity.

It is believed that the climatic history of the past millenium can be inferred from variations in width of the annual growth rings of the ancient trees. However, some scientists held that an 11-year, or 22-year cycle in the tree rings could be detected and that it was caused by the 11-year sun-spot cycle. There was, additionally, speculation on what sort of climatic change could be caused by sun-spot variation and how these changes could be reflected in the rate of growth of trees.

Now John Dutton and Prof. Reid A. Bryson of the UW meteorology department have shown that the supposed 11-year or 22-year cycles in the ancient trees are more apparent than real. Rigorous analysis of the tree ring data by the power spectrum--a statistical method to detect cycles--has shown that no 11-year or 22-year cycle exists in the tree ring data. Thus, there can be no correlation between the sun-spot cycles and tree growth.

The two scientists have found, however, that some cycles do exist in the annual ring thickness of these trees--but the question is open as to whether these cycles are significant.

-more-

Add one--tree rings

For example, instead of an 11-year cycle, the ancient sequoias show cycles at 2.1, 2.7, 3.4, 5.8, 13, 16, 20, and 30 years. The Wisconsin scientists point out, however, that the shorter cycles are not strong enough in any individual tree to be accepted unconditionally, but they show up quite often, though weakly, in many different trees.

The longer cycles, on the other hand, are quite strong, but the precision of the method declines with cycle length, and so these cannot be accepted without reservation. The conclusion at present is that no cycles of sufficient strength to be accepted without reservation exist in the tree rings, and none exist at an 11-year interval required by the sun-spot theory.

"Summing up the power spectrum evidence on cycles," the scientists say, "we must conclude that they are well hidden, if present at all. There is little evidence of important periodicities in the tree-ring thickness series that have been studied."

There is some indication, however, that the two-to-three-year cycles follow variations in July rainfall in the southwestern U.S. This would be expected, as the water available in the soils of this area is probably the most important thing affecting rate of tree growth from one year to the next, the scientists add.

###

Research Meteorologist

# U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/16/61 jb

RELEASE: Immediately

MADISON, Wis.--Dr. Verner E. Suomi, prominent University of Wisconsin satellite scientist, received a $5,000 grant from the U. S. Steel Foundation Thursday. The money will be used to improve the educational excellence of UW students in meteorology and to support Dr. Suomi's studies in atmospheric research.

R. O. Hawkanson, Duluth, Minn., vice president of U. S. Steel's Oliver iron mining division, made the presentation. It is to be offered to the UW Board of Regents for formal acceptance Friday.

Dr. Suomi is the leader of a University team providing instruments for the U.S. satellite program seeking quantitative and qualitative information on radiation balance between the sun and earth. He is a member of the committee on meteorological satellites on the Space Science Board of the National Aeronautical and Space Administration.

Born 46 years ago in Eveleth, Minn., Dr. Suomi earned degrees from Winona (Minn.) State College and the University of Chicago. He joined the UW faculty in 1948, becoming a full professor in 1958.

###

LAND GRANT COLLEGES 1862 1962 STATE UNIVERSITIES

Research Meteorology

# FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/30/61 rb

RELEASE: Immediately

By RICHARD BREWER

MADISON, Wis.--Two little circular discs of magnesium metal with miniature heat sensing devices called thermistors fastened to their backs are a vital part of the University of Wisconsin's contribution to the Tiros III weather satellite now in orbit around the earth.

Dr. Verner Suomi, the man in charge of Wisconsin's portion of the space satellite program, is already preparing a set of identical instruments for the next weather satellite.

The heat sensing instruments, called radiometers, were the heart of the last UW space effort in Explorer VII, the first U.S. weather satellite.

Radiometers provide information about heat loss from the earth's surface. The more information received about this daily change in the heat balance of the earth, the more accurate and complete a picture that can be constructed. Dr. Suomi wishes to understand just how heat is gained and lost through the presence or absence of cloud cover.

Information gained from the last satellite and now being borne out by the present satellite indicates that heat gain and loss due to cloud cover can be an important effect in forming our weather.

"There seems to be a large scale organization of cloudiness," Dr. Suomi pointed out in referring to how our weather is created.

-more-

Add one--weather satellite

The Tiros III is largely a National Aeronautics and Space Administration effort and most of the instruments aboard the 200 pound, drum-shaped satellite belong to NASA. They include two TV cameras and some other heat sensing devices plus telemetry equipment for radioing back to earth the information gained from these devices.

The TV cameras, one a duplicate of the other to act as a standby in case of failure, provide information about cloud size, type, and from these, the wind direction.

Special information about the amount of heat lost at night or day in a specific area is provided by the other heat sensors on board. The instruments put on by Dr. Suomi are non-directional and give a general or summary picture of the earth's heat loss.

NASA is in charge of receiving the information and provides tapes of the correct data to Dr. Suomi for interpretation.

With three tapes already in, Dr. Suomi and his fellow scientists are getting results to add to their picture of the heat balance of the earth.

"I'm not interested in prediction; I'm more interested in just understanding how this works," commented Suomi when asked about the possible use of this data for weather predictions. Once the entire effect is well understood, Suomi stated, it and other information can then be used in predicting the weather.

Some of the effects that have already been noted include the fact that higher cloud cover allows less heat to escape than low cloud cover, and large, clear areas cool more rapidly than cloudy ones.

###

Research Meteorology FILE

Jack Stevenson News Service

UCAR member

National Center for Atmospheric Research
Boulder, Colorado
HIllcrest 3-1960

For Release Wednesday P.M., October 25, 1961

NCAR 1-1-1

# I. M. PEI FIRM SELECTED AS ARCHITECTS FOR NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Boulder, Colo.-- I. M. Pei and Associates of New York City have been selected as architects for the National Center for Atmospheric Research (NCAR), Dr. Walter Orr Roberts, director of the laboratory, announced Wednesday.

The laboratory, dedicated to basic research on fundamental processes of weather and other aspects of atmospheric behavior, was established in June, 1960. A site just south of Boulder, selected last November, consists of 500 acres of mesa and rolling land directly beneath the Flatiron cliffs. The Colorado Legislature earlier this year, appropriated $250,000 to acquire the site, known as Table Mountain, for the laboratory.

The Pei firm was selected by NCAR's non-profit management corporation, the University Corporation for Atmospheric Research, after several months of research on and interviews with

architects from across the nation. Advising the Corporation was a committee of the deans of seven architectural schools from various parts of the country. The selection has been endorsed by the National Science Foundation, sponsor of the laboratory.

The Pei firm will first draw up a master site plan for the laboratory, which will ultimately house between 300 and 500 scientists and other personnel. The laboratory will be built in increments, the first of which will contain about 100,000 square feet, and will represent between one-third and one-half of the laboratory's ultimate size. Construction will begin in about a year. The remainder of the laboratory, as now planned, will be built in additional increments over the next five to six years. Until the first increment is complete, NCAR is being housed in buildings leased from the University of Colorado.

The first increment will include offices for scientists and administrative personnel, laboratories of various types, machine and electronic shops, space for a large-capacity computer, a library, and eating facilities. It will also include a conference center at which NCAR will host various

conferences dealing with progress in and plans for the atmospheric sciences and related fields.

The nationally-known Pei firm is no stranger to the Denver area, having served as architects for the Denver-U.S. Bank Center and the Zeckendorf Plaza developments in Denver. Prize-winning designs by the Pei firm also include the Pan Pacific Center in Honolulu, Hawaii; the Washington Square East Redevelopment Project in Philadelphia, and the Multi-Airline Terminal at New York International (Idlewild) Airport.

Other Pei projects now in process are the Green Center for the Earth Sciences of Massachusetts Institute of Technology (MIT) in Cambridge, Mass.; the U.S. Chancellery in Montevideo, Uruguay; the East-West Center of the University of Hawaii in Honolulu, and the School of Journalism building at the University of Syracuse. The firm is also engaged in site planning and design of large-scale urban development projects, both private and public, in many cities of the country.

"We have high hopes that the NCAR laboratory will be as close as possible to an ideal place for creative scientific

work," Dr. Roberts said. He added that NCAR would honor its commitment to the people of Boulder to develop the site in a manner in keeping with its natural beauty.

The basic purposes of NCAR are: (1) to conduct fundamental research on the processes of the atmosphere on a scope beyond that yet attempted; (2) to provide, or arrange for the provision of, research facilities, to be open to all scientists, that are beyond the capacity of universities or most research groups to acquire or maintain; (3) to provide a center at which various groups in the atmospheric sciences and closely related fields may meet to define goals and plan programs.

NCAR is part of an intensified national effort to realize the potential of the atmospheric sciences for mankind. Only when new fundamental knowledge of the atmosphere has been attained will more accurate weather prediction and a realistic assessment of the possibilities of weather control be possible, according to a National Academy of Sciences report which led to the establishment of NCAR.

-30-

Research
Meteorological

7/12/61 jfn

Immediately

(Original filed under Suomi)

MADISON, Wis.--University of Wisconsin scientists contributed one of the experiments aboard the Tiros III weather satellite which the United States fired into orbit from Cape Canaveral, Fla., Wednesday morning, it was reported by Prof. Verner E. Suomi of the meteorology department.

The UW instruments are designed to extend the Wisconsin satellite study of the earth's heat budget, which began with Explorer VII in October, 1959. Explorer VII is still in orbit and sending signals.

Prof. R. J. Parent, electrical engineering, reported by telephone from Cape Canaveral to Prof. Suomi that the Wisconsin equipment seems to be "working fine." Suomi monitored signals from Tiros III as it made its first orbit over the United States at about 7:15 a.m. on receiving equipment at the University's Pine Bluff Observatory.

The new satellite promises expanded scientific weather measurements over Explorer VII that should be a big boost for the Wisconsin study. "We won't be operating in the blind anymore," Suomi commented.

He explained that NASA instrumentation aboard Tiros III stores data for one complete orbit around the globe and discharges the information on its path over the U.S.

"We can get data from Explorer VII only when someone is monitoring. That means a number of gaps because of places where its signal is inaccessible," Suomi said.

-more-

In addition, television cameras aboard Tiros III will provide scientists with pictures of storms, clouds, and other weather conditions.

"I feel very good about this new satellite. It promises to be of major assistance to our study," Suomi said.

The delicate Wisconsin instruments for Tiros III were designed by Prof. Parent, an electronics expert, and constructed by Harry H. Miller, project associate in electrical engineering. Herman Weidenbeck built the sensors for the Wisconsin experiment.

Wisconsin data from the satellite will be collected by monitoring stations of NASA on the east and west coasts. The data will be shipped on magnetic tape to Madison for analysis by Suomi and his team on UW computers.

The heat budget experiment measures the amount of sunlight earth receives, the amount reflected back, and the heat energy which the earth absorbs and holds for a time, then gives back to the atmosphere.

The earth loses more heat energy at the poles than at the equator, Suomi explained, resulting in a giant shift of energy from equator to poles. This is a basic cause of world weather.

Suomi commented that "sweating out" the satellite firing from Madison is "worse" than being on the spot at Cape Canaveral, where he witnessed the Explorer VII shot.

"It's tougher when you're this far away and don't know what is going on. Oddly enough, in both cases we got out first word of the firing on an auto radio."

##

# Professors Take to Tundra to Learn of State's Climate

## Wisconsin Resembles Alaska in So Many Ways, They Seek to Find Out Why

By HARRY S. PEASE
Of The Journal Staff

**Madison, Wis.**—Madison and Milwaukee are as close to the arctic as Sitka and Ketchikan, Alaska, and a group of University of Wisconsin scientists want to know why.

By truck, float plane, canoe and rowboat they are edging into the Canadian far north, inventing a new subdivision of science as they go. Climatology used to be something that weathermen did by sitting in cozy offices and reading the reports of weather stations. It was unknown as a field endeavor.

Prof. Reid A. Bryson, chairman of the University of Wisconsin meteorology department, explained the project he heads.

The map testifies that Sitka and Ketchikan are 1,200 miles north of southern Wisconsin. But the evidence of things that matter—how far you have to go to find permanently frozen ground or the line beyond which trees will not grow, for example—argues that there is little to choose between our state and Alaska.

Heading north out of Madison you leave the prairie and enter the woods within 100 miles. The farther west you go, the farther north the prairie extends. Calgary, Alta., some 500 miles north of here is still in prairie country.

The forest land gives way to arctic tundra along a roughly parallel line that swings from the Arctic ocean at the mouth of the Mackenzie river to the southern end of Hudson bay.

### What Makes It So?

"This always has been described as an effect of climate," Bryson said. "But climate is a complicated thing. What is it about the climate that outlines the forest belt? What makes the climate what it is?"

Weather stations are spread so thin in the north country that their records fail to tell the complete story of climate. Bryson must learn to read the records kept by nature.

Since 1949 he has been interested in the effects of the weather on inland lakes. Among the things he has learned about them is that a really good average temperature—one based on 50 samples or so in various parts of a lake—represents quite accurately the average air temperature for the preceding month.

### Index of Heat

By taking soundings to determine the shape of the lake bottom, by maping its outline and by measuring temperatures at a number of depths, the total heat content of the water may be found. Bryson has learned that this is a pretty fair index of the total sunlight and solar heat that has hit the area for the last couple of years.

Tree growth may be a help. At the tree line in central Canada, where a 50 year old spruce may be only as tall as a man, the pattern of rings seems to give a pretty good measure of weather in previous growing seasons. In Alaska and Labrador the usefulness of the rings is much more doubtful.

Bog temperatures, below the surface, are a help. The thickness of ice on the lakes is an aid in winter.

### Planes Can Measure

Aircraft flying above the vast empty areas can make quite accurate findings of the amount of solar heat coming to the earth and the amount being reflected or radiated back to space.

Probably there are other indicators, which is why Bryson's scientific team is one of the most diverse to join in a single effort in the history of the UW meteorology department.

Bryson himself says, "I don't usually think of myself as a meteorologist. Rather, I'm an earth scientist. It's perfectly natural for me to think of soils and rocks and plants and lakes and air all as a unit."

But a meteorologist he is by definition, as are two graduate students in his department and his project. They are Jon Scott and Bernard Lettau.

Robert A. Ragotzkie, assistant professor of meteorology, is an oceanographer. Walter Baily is a geographer on a year's leave from the office of naval research. James A. Larsen, science editor of the university news service during the regular school year, is a plant ecology graduate student.

John W. Thomson, assistant professor of botany, is a world authority on the description and classification of lichens. Lichens are the plantlike communities of algae and bacteria that form the major vegetation north of the tree line.

Robert J. Muckenhirn, professor of soils, is assistant director of the university's agricultural experiment station. Erwin Hiebert is an assistant professor of the history of science.

### Navy Budget High

William Irving is a graduate student in anthropology who slips away from weather observations now and again to study primitive Eskimo tribes that live near the observing points.

The project was born in the fall of 1957 under the unimposing title, "A Reconnaissance Study of the Heat Budgets of Lakes." It has grown into a more general study of high latitude field climatology.

The importance the navy sees in such studies for both air and sea operations in polar areas is indicated by the funds it has provided. So far the total is about $135,000, including $45,000 this year. The tentative budget for next year is $69,000.

### Planes Move Farther

In the summer of 1957 the field parties moved by truck, and were limited to the more southerly areas accessible by road. Last summer, chartered bush aircraft increased the observers' mobility and carried them to the Arctic ocean at Chantrey inlet, inside the arctic circle opposite the west side of Hudson bay.

This year the navy has provided a surplus army liaison plane, a three place, single engine Cessna, which is being fitted with floats.

Ragotzkie and Scott are experienced pilots and Bryson has started to take lessons. Expedition members will do their own bush flying because the plane is so small. A professional pilot would take up space needed for scientists and their equipment.

### Conclusions Reached

Some of the party is headed north by truck and some by commercial air. The group will meet at Ennadai lake, a Hudson's Bay Co. post about 200 miles west of Hudson bay, and observations will spread out from there.

**Members of a University of Wisconsin team studying characteristics of the arctic posed with Eskimos. In the western hat is Prof. Reid Bryson, project director. Behind him are pilot Rocky Parsons and Prof. John Thomson.**

U. W. NEWS
FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

Research

8/8/60 ml

RELEASE: Immediately

By MACK LAING

MADISON, Wis.--Two University of Wisconsin scientists flew north on the weekend to join a research team that is attempting to read a book nature has written across the Canadian sub-Arctic.

Robert Ragotzkie and Walter Bailey packed camping gear and instruments into the UW meteorolgoy department's Cessna 195 seaplane, taxied across University Bay, and headed north. Ragotzkie is an assistant professor in meteorology; Bailey is a geographer on leave from the Office of Naval Research.

Most of the questions being asked by the group they are joining begin with words WHAT and WHY and are associated with climate: What climatic influence causes the distribution of different kinds of plants? Why do trees stop growing north of a certain line? What effect does the heat-holding power of the lakes have? And what about sunlight coming in--some being soaked up by the ground, some being reflected?

The Wisconsin team believes the answers to these and dozens of other questions have been set down by nature across the far north. The answers lie in the temperatures of lakes and bogs, the thickness of ice, growth patterns of vegetation, measurement with both airborne and ground-based instruments, of sunlight coming in and going out.

Because the northern summers are so short, living things must grasp for growth. Small variations in temperature, moisture, or any of the other necessities for growth produce striking effects in vegetation. Where life is so hard, this exaggerated evidence of the struggle for life is easier for the scientist to spot, enabling him to read the records nature has left.

-more-

Prof. Ragotzkie is the pilot for the project, but his scientific interest lies in mapping Arctic lakes and studying their temperatures. Walter Bailey is concerned with airborne radiation measurements and aerial photography.

The fliers expect to meet graduate meteorology students Jon (correct) Scott and Bernhard (correct) Lettau at The Pas, in northern Manitoba. Lettau and Scott left earlier, drove a truck across Canada to Alberta, and flew into Yellowknife in the Northwest Territories. Their part of the project involves recording bog temperatures.

Meteorology Chairman Reid A. Bryson, the project director, will not join the men in the field this season. He has gone north for the last two summers of the continuing project which the office of Naval Research is supporting.

Jim Larsen, a research associate in botany and science editor of the UW News Service, has been in the north on the field research since the beginning of June. His plant studies and the lichen collection of John Thomson, UW associate professor of botany, are part of the project's plant ecology research. Prof. Thomson recently returned to Madison after a month in the sub-Arctic.

Another member of the diversified science team is Bill Irving, an anthropologist. He is doing independent research on primitive Indian and Eskimo cultures. Irving joined Larsen the last part of June and they have been waiting for the rest of the group at Lake Ennadai, near the Arctic Circle. Most of the group is expected back in Madison within a month.

##

Research
Meteorology

# FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/12/60 ml

RELEASE: Immediately

By MACK LAING

MADISON, Wis.--"KC4USN calling.....KC4USN calling W9HCR Madison, Wisconsin... ...come in, Elmer...KC4USN here.."

"This is W9HCR, Madison...you're coming in all right, KC4USN...coming in fine, Al..."

One night last week University of Wisconsin meteorologists talked with the South Pole by short-wave amateur radio.

In an important static-free 55-minute conversation the University men settled some scientific business of a joint UW-U. S. Weather Bureau research project that would have taken days through the heavy traffic of official Pole-to-Washington teletype channels.

The conversation was made possible by amateur radioman Elmer Zindars. By day he runs Monona's A-1 Television Service Co., Inc., but by night he talks with and listens to the world with his one-man, 1,000-watt amateur station W9HCR in the sunroom of his home at 3529 Sargent St., Madison.

Elmer makes radio contact almost every other night with the South Pole station, but it is often weak or distorted. When a calling time can be prearranged and the signal comes in strongly, Elmer can set up what he calls a "phone patch" so the meteorologists can hear the radio message and talk back through a link between Elmer's radio and the home telephone of the scientist.

Two calling dates were arranged last week but the contact failed. Elmer found later that giant sunspots--the worst since 1947--had blotted out radio circuits all over the world.

-more-

The third night Peter Kuhn, U. S. Weather Bureau research, meteorologist at UW, was at home in suburban McFarland. Bob Bushnell, a meteorology graduate student also on the research project, was in his home on Jefferson Street, with his own amateur radio. Kuhn's phone rang and the contact was made.

"This is W9HCR Madison...Al, Pete Kuhn and the fellows at the University are standing by on the phone patch... you're coming in all right, tonight Al...you can put Ed Flowers on the line anytime you're ready, KC4USN... this is W9HCR, Madison."

Ed Flowers is the senior U. S. meteorologist for the Antarctic Continent. He and 18 others, including navy communications men like Al, who run the amateur station KC4USN for fun, are living in several Quonset-type buildings, half-buried in the snow of a plain 10,000 feet above sea level, 8,300 miles from Madison.

The buildings and their connecting tunnels sit just outside a ring of empty oil drums about 400 yards across. In the center of that oil drum circle is the geographical South Pole, the bottom of the world.

The temperature there last week was 92 degrees below zero--134 degrees colder than Madison was that night. The southern sun had set on March 24, leaving Antarctica blind for the next six months. Only emergency planes could land in the winder darkness now. Equipment that may be needed but is not in the giant storehouses is occasionally dropped by parachute.

Ed Flowers that night was a man with problems. His most immediate worries concerned balloons, colored wires and scientific accuracy. He spoke quickly in the language of weathermen.

The joint project is a measurement of infra-red radiation. The goal of the work is to measure thermal radiation, the same kind of rays you feel coming from your house heater, or your electric iron. At the pole the radiation is measured with height above the surface of the earth. The measuring tool is a radiometer carried aloft to 20 miles by a balloon. A tiny radio transmitter sends back information about

changes in the atmosphere's heat balance.

The project has a link with UW's heat-budget satellite project and UW satellite man Prof. Verner E. Suomi, is principal investigator for the University on this project. The whole business is an attempt to learn more about the earth's atmosphere in the hope that better weather prediction may eventually be possible.

From the Pole, Ed Flowers seemed convinced that he could combine two balloon flights in one without the loss of scientific accuracy. He presented Kuhn with his evidence for this--that he was getting no error when he reduced the flights. Flowers outlined a few difficulties of balloon launching--that in the extreme cold the inflating hydrogen gas was hard to produce with chemicals, messy, harder to control, that a balloon launching at the South Pole is not a balloon launching at Madison, Wis.

Kuhn told him he would speak with the Weather Bureau's central office in Washington and see what could be done. Both scientists were well aware that the balloon data had to be accepted by the World Meteorological Organization as correct and that despite difficulties they must be as sure as humanly possible of its accuracy.

The next problem was the colored wires. The instrument the balloon carries with it is the UW-developed radiometer-sonde. In manufacture the color coding had been mixed up due to a wire shortage and the instruments were not working properly.

So 8,300 miles apart, two weather scientists sat, each with one of the instruments before him. Pete Kuhn traced the wires and told Ed Flowers where they should be. Flowers put them in the right place and would correct the rest of the 50 instruments he had.

"It would have been almost impossible to have done it any other way without great delay," Kuhn said later. "In the regular way, by teletype, it would have just taken too much time and messages from the Pole have to take their turn under a priority system.

"It's obvious," said Kuhn, "that this readily available radio link spelled the difference between success and failure for us. We just couldn't have done these things without Elmer Zindars. The line was as clear as if I had been talking to somebody in Janesville."

The Madison transmitter also solved another communications problem. South Pole weather station had been unable to reach Hallett station, about 1,000 miles away on McMurdo Sound. It was a radio signal problem known as "skip." However, Zindars, at eight times the distance, could reach both weather stations. The Madison station served as the third point in the triangle, in effect transmitting information across the Antarctic. This particular time it was technical information relating to other instruments.

At the end of the 55-minute conversation, goodnights were said all around. It was just after midnight in Madison, and just after 6 o'clock Greenwich Mean Time in the south. And Elmer Zindars signed off:

"This is W9HCR, Madison saying goodnight Ed and Al...we'll see you around in the very near future...good night from W9HCR, Madison."

# FEATURE STORY

Research Meteorology

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

12/23/59 ml

RELEASE: Immediately

By MACK LAING

MADISON, Wis.--A special airplane is flying an interesting mission these days from a busy little airport near here.

It has a "restricted" sign on it and if you looked closely, you could spot some unusual bumps on its belly and back.

It's a flying meteorological observation station. The pilot and crew are University of Wisconsin scientists.

Several times a week the blue and yellow twin-engined Cessna 310 with the big numbers N4884 on its starboard wing leaves the field and zigzags around the Madison area---over Lake Mendota, Waunakee, Lodi, Lake Wisconsin, Sauk City, Mazomanie, Arena, Cross Plains and back to its Middleton base.

On a typical day last week, the pilot was calling off the turns and his assistant was writing down time and location as they flew the roughly rectangular course.

Every few minutes, another time and location was called and written down. Wisconsin River slipped by below, another turn was made. Now over a range of low hills, again over an iced-in lake, then over flat farmland, always with occasional turns, new courses, more writing.

It's part of one of the projects conceived in the University's meteorology department. It's under the direction of Prof. Heinz H. Lettau and department chairman Prof. Reid A. Bryson.

-more-

add one--weather plane

The pilots in the flying program are: project assistant John Dutton, a meteorology graduate student who flies the Cessna 310 and Prof. Robert A. Ragotzkie, who will fly the department's newly-acquired Cessna 195.

Other researchers are: Capt. Kenneth Bauer, an Air Force meteorologist doing graduate work at UW; Walter H. Bailey, of the Office of Naval Research who is with the meteorological department for a year, and Bruce Giese, an electrical engineering student who helps to keep the instruments in working order.

Sponsored by both the Army and Navy, these University scientists have taken to the air for research on the planetary boundary layer of our atmosphere. That's the part of the atmosphere that lies between earth's surface and a height of about 5,000 feet.

In this atmospheric layer, many processes are going on. Sun rays are hitting earth--partly being absorbed, partly being bounced off--and temperatures, winds and turbulence are changing in relation to the "roughness" of the earth below.

It is obvious to scientists that these processes must be related. The Wisconsin researchers are trying to find the exact relationships. They also hope to know more about how these processes relate to the earth's surface--its roughness, its lakes, forests and farmland. Another part of the question is how the relationships change through the seasons and how they change from one area to another.

Before, the meteorologists put up towers and took measurements from them at a fixed location. Now, using an aircraft, the department can not only take its measuring instruments higher and over wider ranges, but can also pinpoint places of special weather interest where other towers might be useful.

The University's single-engined Cessna 195 is still being instrumented. Some of the instruments on the Cessna 310 were designed by UW meteorologists.

As the plane goes over its regular flight pattern at 2,000 feet, several measurements are taken.

-more-

add two--weather plane

Two pyrheliometers, which look like 150-watt light bulbs sticking out a few inches from the top and bottom of the plane's body, measure sun energy.

The top pyrheliometer measures short-wave energy coming toward the earth. The bottom one measures the amount of that energy reflected by the earth's surface. The ratio is called the albedo, and it gives a measure of the percentage of the sun's heat reflected by the earth.

The seasonal and geographic variations of the albedo are something no one knows much about. As far as the Wisconsin researchers know, they are among the first to measure these variations in such a broad program.

Another pair of instruments on the top and bottom of the aircraft are devices called economical net radiometers. These measure total incoming and outgoing radiation. This means both the sun's visible rays and the long, invisible infra-red waves from earth--the kind of radiation you feel when you stand in front of a fireplace.

By subtracting the pyrheliometer measurements from the radiometer measurements, the scientists can determine the heat transfers between the earth and the atmosphere.

Another instrument, soon to be added to both planes, takes a direct measurement of temperature at the earth's surface.

A recording machine sits on the back seat of the five-passenger 310, flipping white blips of light onto a roll of light-sensitive paper. This gives a permanent record of what the outside instruments "saw" on the ground and provides the detailed information that goes toward the total picture. The clipboard jottings of the pilot's assistant refer the recorder's information to time and location.

The weathermen on wings have several different flight patterns. One is a short hour's hop around Madison. Another takes them on a longer jaunt into the northern half of the state. Because Wisconsin is a "melting-pot" of terrain and vegetation--lakes, fields, forests, flatlands and bluffs--the researchers are able

-more-

add three--weather plane

to study in detail the interaction of the atmospheric processes, ground features and the seasons in many different environments, but still be conveniently within 50 miles of home.

Another part of the project, in which the Navy is interested, is an overall environmental study from Madison to the Arctic Ocean. A lot of planning and field-work has gone into this northern project and flight investigations will probably begin next summer.

Again, this will be an attempt to answer the question: With all the interacting processes in our environment--atmospheric, lake, and vegetation--what are the few dependable measurements out of all the possible ones, which will allow us to make an accurate approximation of the big picture of our total environment?

The budget of energy--how much sun energy comes in and how much goes out--and how much is used to heat the ground and the air, or to evaporate water--is perhaps the best total description of the environmental processes.

As an example of seasonal change, meteorologists know that a lake absorbs roughly 95 per cent of the summer sun's energy but in the winter 50 per cent is bounced back.

A similar example of geographic change is a lake absorbing 95 per cent in summer, next to farm fields which are absorbing only about 85 per cent of the sun energy.

This causes a transfer of heat through the earth's atmosphere from the equator toward the poles. Heat transfers are what meteorologists want to know more about--for the whole world, for Wisconsin or for a lake or cornfield.

For this movement of heat is one of the basic causes of weather.

###

# WIRE NEWS

Research Meteorological

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/16/59 ml

**RELEASE:** Immediately

MADISON, Wis.--The Ford Foundation Monday announced a $60,000 grant to the University of Wisconsin for development of personnel in the atmospheric sciences.

The money will be used for fellowships and loans for promising graduate students during the next five years, said Prof. Reid A. Bryson, UW meteorology department chairman.

The fellowships will be $3,000 a year plus tuition, with up to $3,000 additional available for loans if needed, Prof. Bryson said.

"The big thing about this program is its flexibility," Bryson said. "Under it we could study anything from the climate of one room to the complex study of satellite meteorology. We could even study the atmosphere of the planet Venus, if someone interested enough came along and it looked worthwhile.

"It's a realistic figure, this $60,000, because we don't get many more than three really topnotch men a year.

"We're really excited about this. For meteorology, this is significant support," Prof. Bryson said.

###

U. W. NEWS

[Research - Meteorology Dept of]

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

7/3/59 eda

RELEASE: Immediately

MADISON, Wis.--The State Public Service Commission Thursday granted University of Wisconsin scientists permission to erect a small tower on the bed of Lake Mendota for investigation of climatic factors over the lake and their effect on lake circulation.

The triangular steel structure, much like a television antenna, will be located 1,000 feet west of Second Point at a site 2,000 feet from the lakeshore. It is to be anchored on a shoal 10 feet below the water's surface and will rise 20 to 30 feet above the water.

Charles R. Stearns, meteorology department project assistant, said Thursday that it should be in operation by Aug. 1. Stearns, together with Prof. Reid A. Bryson, meteorology chairman, and Prof. Heinz H. Lettau, principal investigator, secured Army support for the project and mapped out plans for the new research facility. It will be used cooperatively by University meteorologists and zoologists.

Total cost of the tower and its instruments is expected to be $10,000. Another $15,000 worth of equipment for recording instrument measurements will be located in a small building on shore near the Tent Colony, linked with the tower by two cables along the lake bed.

The tower will be illuminated by a permanent white light and a flashing red light. It will be removed when the lake closes, but may also operate from the ice surface during the winter.

The tower is designed for continuous measurements of wind velocity and direction, sunlight falling on the lake and reflected from it, heat radiated from the lake, light penetration below the water's surface, air and water temperature,

-more-

water level, wave height, and sub-surface currents.

Data on these variables will be available at all times for use in other meteorological and zoological studies as well.

Zoologists hope to find in the new information a clue to how microscopic foods for white bass and perch--algae and daphnia--are spread through the lake.

Even more important to them is the opportunity to make cumulative records of environmental factors in the lake such as light penetration, temperature, and currents, as an aid to all lake biology projects.

Sub-surface currents will be measured at six different levels. And photo-cells will be used to record the penetration of light below the surface of the water at three different depths.

Meteorology department scientists are principally concerned with how air flows over the lake. Previous observations have shown that wind patterns differ over land and water, making the "over water" observation point a necessity for current studies on the interaction between air and water.

Wind velocity and air temperature will be recorded when desired by anemometers and thermometers at five positions on the tower ranging from 20 feet to slightly more than a foot above the water's surface. Sonic enemometers will be used to measure vertical wind velocities.

Information on all these variables will be used to determine "wind stress"--a quantity which expresses the total force per unit area exerted on the lake surface by wind. It is this force which drives lake currents. Wind stress, lake and air temperature, underwater currents, and radiant heat all work together to account for the intensity of lake circulation, and the lake's heat budget--the sum of heat coming in and going out.

###

# U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/23/58 eda

RELEASE: Immediately

MADISON, Wis.--The second research report in a series of five on the agricultural climate of Wisconsin by University of Wisconsin meteorologists Jen Yu Wang and Verner E. Suomi was released recently by the Agricultural Experiment Station.

The report, titled "Temperature: Normals and Hazards," was preceded by "The Growing Season." The three remaining publications will deal successively with moisture, light, and phenology.

These graphical and statistical summaries of the climate in Wisconsin are based on observations for extended periods at over 240 stations scattered around the state, and are made available for use of Wisconsin farmers and growers.

Meteorological factors such as soil temperature which the weather bureau has never recorded are included in the second report, Since soil temperature is highly variable from place to place and present soil temperature data exists for only a few places, a technique has been devised for estimating soil temperature at any given depth.

Known as the controlled line and controlled point system, this scheme of graphical analysis based solely on maximum and minimum daily air temperatures.

###

# U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/10/58 eda

RELEASE: Immediately

MADISON, Wis.--The University of Wisconsin and 11 other large universities actively engaged in meteorological research, all members of the new University Committee on Atmospheric Research, (UCAR), made formal announcement of the committee's incorporation last night.

The occasion was the New York Board of Trade's annual Gold Award Dinner, this year honoring the field of meteorology.

Here in Madison UW Pres. Conrad A. Elvehjem said, "Incorporation of the University Committee on Atmospheric Research marks a significant step forward in putting the national effort in meteorological research in proper perspective to its importance to the people of the nation and the state.

"The University of Wisconsin is proud to join the other great universities who form the corporation, and to take part in this important development," Pres. Elvehjem said.

Prof. Reid A. Bryson, UW meteorology department, explained that plans are proceeding for establishment of a National Institute of Atmospheric Research, the first goal of the newly incorporated committee. Dr. Bryson and A. W. Peterson, UW vice president in charge of business and finance, are Wisconsin's representatives on the committee.

Selection of the site for the new institute can be expected early next year, Dr. Bryson believes. Wisconsin is among the universities under consideration as headquarters for the institute.

-more-

Noting the vast amount of new data made available by the IGY and satellite observations, the UCAR declared in its June report that the institute was necessary "to mount an attack on the fundamental atmospheric problems on a scale commensurate with their global nature and importance...and to provide facilities and technological assistance beyond that available at individual universities."

Another proposed investigation of major importance, understanding the large-scale dynamics of the upper atmosphere and its coupling with the lower atmosphere, would "inevitably result in an inbalance that would seriously affect the educational program" if undertaken by a single university.

Numerous data sources, including rockets, high-altitude balloons, ionospheric measurements, and observations on meteors, the airglow, aurorae, and the magnetic field, are needed in order to tackle this project.

The committee has high hopes that the proposed institute will serve "to attract scientists from contiguous fields and to dramatize atmospheric research to prospective graduate students."

###