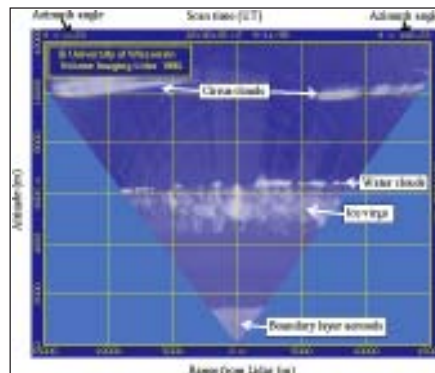


### UW Isentropic Analysis and Modeling Group—<http://www.ssec.wisc.edu/theta/>

The group develops a singularly capable numerical model to simulate climate. The model focuses on hydrologic processes (movement of water in all its forms) and the exchange of ozone and other gases between the stratosphere and troposphere, the two atmospheric layers closest to the earth. Professor Emeritus Donald R. Johnson directs their efforts.

### UW Lidar group—<http://lidar.ssec.wisc.edu/>

Under principal investigator Edwin Eloranta, the group designs and fabricates advanced instruments that use laser light to image portions of the sky. By analyzing computer-controlled scans and pulses, researchers provide precise information on wind speed and direction, trace gases and aerosols, for fine-scale numerical models of the atmosphere.



Volume Imaging Lidar image shows cloud layers (top and middle) and haze (bottom).

## Facilities and Services

### General Facilities

SSEC maintains a clean room, electronics assembly laboratories, and machine, wood, and sheet metal shops to serve a variety of projects.

### The Schwerdtfeger Library

<http://www.ssec.wisc.edu/library/>

This campus special library supports research goals with a multimedia working collection. The Library is noted for its unique collection of satellite photographs dating to 1966, from both polar and geosynchronous satellites, as well as the definitive collection of W. A. Bentley's snow and ice crystal photomicrographs.



Snowflake classified as an ordinary dendritic crystal

### McIDAS Users Group (MUG)

<http://www.ssec.wisc.edu/mug/>

Through interaction among its members, the MUG maintains and upgrades McIDAS software and documentation. The group of users from around the world meet annually to discuss issues and exchange information.

### Ice Coring and Drilling Services (ICDS)

<http://www.ssec.wisc.edu/a3ri/icds/>

Led by Charles Bentley, Emeritus Professor in the Department of Geology and Geophysics, the ICDS provides their services primarily to scientists funded through the National Science Foundation to do work in polar regions. It is a part of A<sup>3</sup>RI.



Drilling in Antarctica for AMANDA project

## Education and Outreach

### Higher Education Opportunities

As a research center within the Graduate School, SSEC does not grant degrees nor does it have an education program or curriculum. Scientists and professors from the Departments of Atmospheric and Oceanic Sciences and Physics and occasionally others collaborate with SSEC in research allowing SSEC to support the activities of some 25 graduate students yearly. SSEC's CIMSS annually presents the Verner E. Suomi scholarship to several outstanding high school seniors who have demonstrated excellent achievements in the physical sciences. This scholarship is a one year, one time opportunity to be used during the freshman year at any University of Wisconsin campus.

### SSEC's Office of Space Science Education (OSSE)

<http://www.ssec.wisc.edu/outreach/>

Directed by SSEC planetary scientist Sanjay Limaye, OSSE creates and delivers workshops to middle school science teachers, and interactive workshops and projects for middle-school students, Project WISE, GLOBE, WINNERSS and other projects.

### Other Outreach and Public Service

#### SSEC's Public Information Office

<http://ssec.wisc.edu/media>

This office provides tours and information to interested members of the general public and the media.

#### CIMSS Outreach

<http://cimss.wisc.edu/>

In cooperation with the World Meteorological Organization, SSEC's CIMSS organizes the International TIROS Operational Vertical Sounder (TOVS) Conference and develops teletraining modules for National Weather Service forecasters to learn to use satellite data in their forecasts. CIMSS also holds summer workshops on atmospheric earth and space sciences for high school students and teachers.

#### The IceCube Education Resource Center

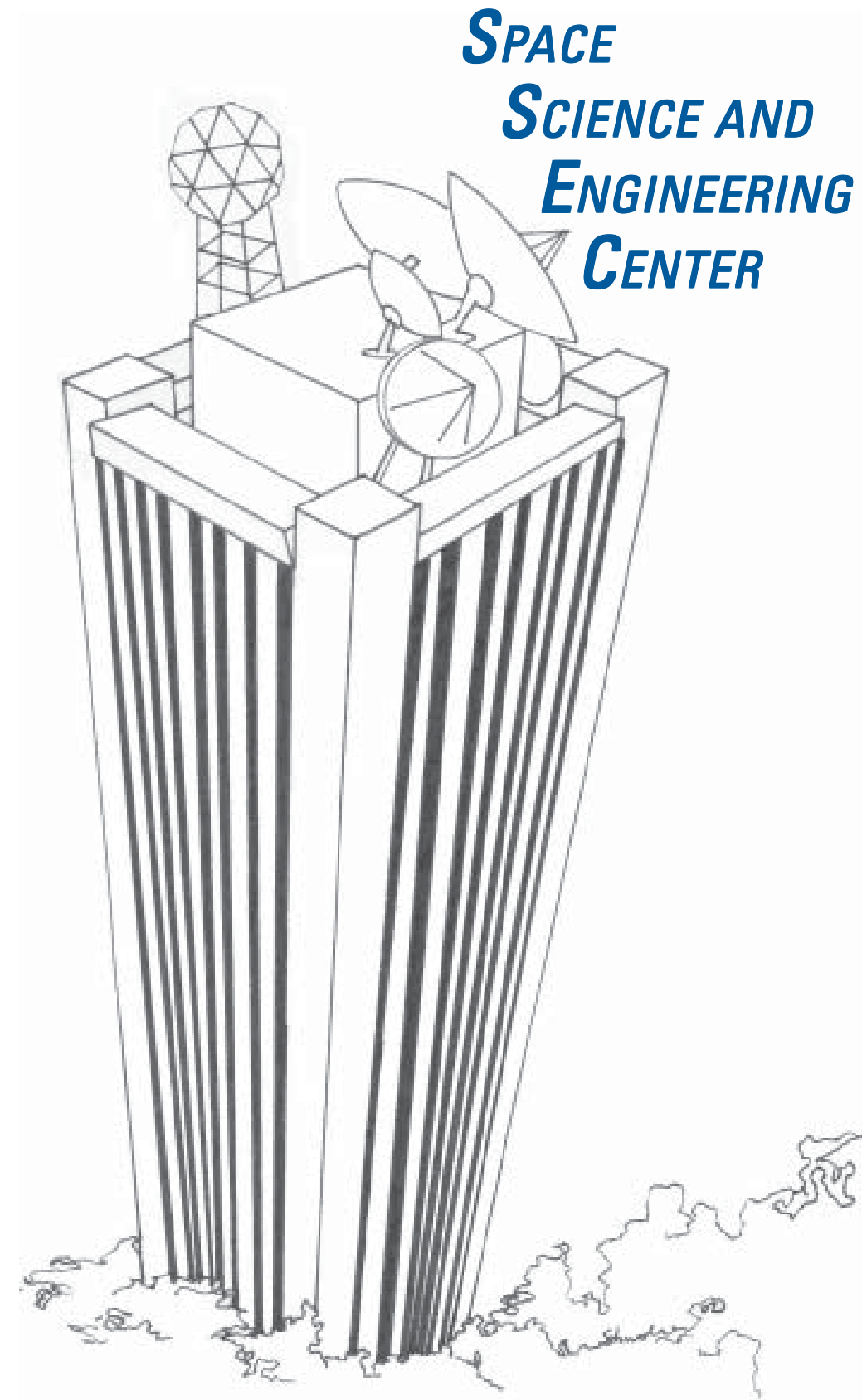
<http://icecube.wisc.edu/outreach/>

The center supports AMANDA and IceCube neutrino telescope project scientists in developing educational resources and generating meaningful ways to communicate with the public.

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Teachers Akeda Isaacs, Lynne Nowakowski and Ronald Engelbrecht take hydrological measurements in Madison's Yahara River during a GLOBE teachers' workshop.



Graduate School  
University of Wisconsin–Madison



Space Science and Engineering Center

<http://www.ssec.wisc.edu>

1225 W. Dayton St., Madison, WI 53706



**The Space Science and Engineering Center (SSEC)** is an internationally respected multidisciplinary research and development center in the University of Wisconsin–Madison’s Graduate School and is located in the Atmospheric, Oceanic and Space Sciences Building. SSEC is noted for its pioneering efforts in the atmospheric and space sciences, and creates techniques and instruments to obtain, archive and utilize scientific measurements.



Wisconsin, received via rooftop antennas

SSEC studies the Earth, the planets and the cosmos. We strive to gain information and insight into weather, climate and other aspects of the global environment. We develop new observing tools for spacecraft, aircraft and ground-based platforms, and we model atmospheric phenomena. We receive, manage and distribute huge amounts of geophysical data and develop software to visualize and manipulate these data for use by researchers and operational meteorologists all over the world. We seek to define cosmic truths with astrophysical instruments we develop. We provide services to scientists in the center and elsewhere to bring their projects to life.



Professors Verner Suomi (Meteorology) and Robert Parent (Electrical Engineering), SSEC founders, with heat budget instruments in the 1950s

## Administration

SSEC director, atmospheric physicist Henry E. Revercomb, leads and coordinates scientific direction. Three executive directors provide administrative leadership: John Roberts, for Administration; Thomas Achtor, for Science; and Fred Best, for Technology.



Henry (Hank) Revercomb, SSEC director

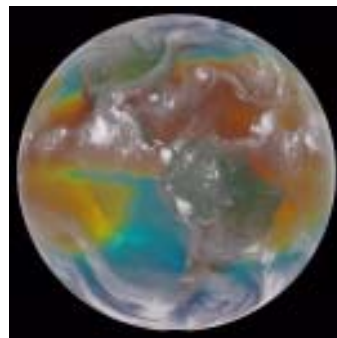
We work on a project basis, providing expertise in a variety of areas—computing, networking, engineering, administration—to principal investigator scientists to realize their ideas. SSEC facilities and staff are available as a resource to principal investigators in the university; SSEC scientists initiate many of their own research programs.

SSEC is funded primarily by federal contracts and grants from the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Department of Energy, the National Science Foundation, other federal agencies, and by private corporations and government agencies world-wide. SSEC receives no state funding, yet adds to the economy of Wisconsin through purchasing power and taxes on its employees.

## Where We Excel

### Weather Satellite Data

Via antennas on its building’s roof and nearby on the ground, SSEC receives geostationary and other weather satellite imagery in real time. The information is archived and analyzed with SSEC tools such as the Man computer Interactive Data Access System (McIDAS). Since 1970 McIDAS has been used worldwide for research and weather forecasting. McIDAS is a vast resource of image processing and meteorological application programs and subroutines used to forecast tornadoes, hurricanes and other severe weather, saving lives and reducing property damage through improved techniques.



Satellite image showing water vapor and sea surface temperatures

SSEC’s advanced Data Center supplies weather researchers around the world. SSEC is the national archive for U.S. geostationary weather satellite data and is a direct broadcast facility for high-resolution data and imagery from NASA’s Earth Observing program.

## Advanced Technologies

Since heat-budget experiments on the earliest weather satellites, SSEC has designed and built instruments for atmospheric research, including lidar and interferometers. SSEC continues to push the envelope of what can be deduced about the atmosphere with instruments like the Atmospheric Emitted Radiance Interferometer and Scanning-High resolution Interferometer Sounder. Their detailed measurements enable more accurate prediction of severe storms like tornadoes. The next generation satellite instrument, GIFTS, will provide in two weeks more data than the entire archive of geostationary weather satellite data.



Fred Best with the AERI, a ground-based instrument in SSEC’s arsenal of instruments to study the atmosphere.

## Spaceflight Hardware

Among SSEC’s spaceflight projects are orbiting solar observatories and the High Speed Photometer, a Hubble Space Telescope scientific instrument. The photometer was designed and built with the Space Astronomy Laboratory for Professor Robert Bless of the UW’s Astronomy Department. SSEC researchers have also designed instruments for Venus and Jupiter.

## The Adiabatic Demagnetization Refrigerator

(ADR) can cool X-ray detectors on astrophysics satellites down to almost absolute zero. At such low temperatures, the heat generated by a single X-ray photon can be detected and measured.



Tony Wendricks fabricates the ADR, under magnification.

## Planetary Meteorology

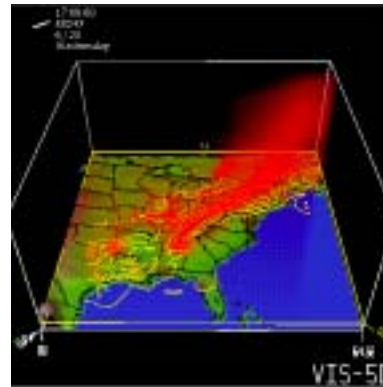
SSEC’s planetary meteorologists use the data from planetary probes (Voyager, Pioneer Venus, Mariner) to analyze the atmospheres of the planets Jupiter, Neptune, Venus, Saturn (and its moon, Titan). With each new planetary mission, new data is added to the information storehouse.

## Scientific Visualization

### The Visualization Project

<http://www.ssec.wisc.edu/~billb/vis.html>

Through Vis5D and VisAD, the project makes advanced visualization techniques useful to scientists in their daily work freely available over the Internet. These two software programs help scientists understand very large datasets, containing billions of numbers, by changing those numbers into pictures, and by giving scientists interactive tools to develop their own visualization programs.



Vis5D image shows sulfur dioxide (red) with iso-lines of nitric acid.

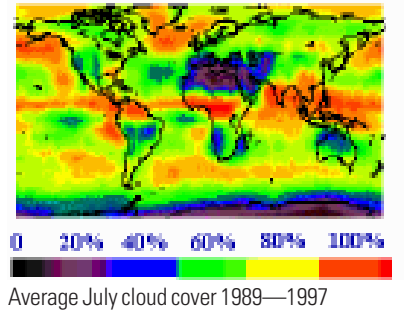
## Numerical modeling

Long-term studies provide vital information on the energy balance, momentum exchange, hydrology and critical weather events for various scales of atmospheric motion. Models developed at SSEC include the CIMSS Regional Assimilation System, the global isentropic-sigma coordinate hybrid, and the Precision Agricultural Landscape Modeling System.

## Cloud Climatology

<http://www.ssec.wisc.edu/~domw/PAGE/CLIMATE.HTM>

The High resolution InfraRed Sounder on NOAA’s polar orbiting weather satellites is sensitive to high altitude cirrus clouds, which are difficult to detect but trap infrared radiation from the earth, thus affecting our climate.



## Groups within SSEC

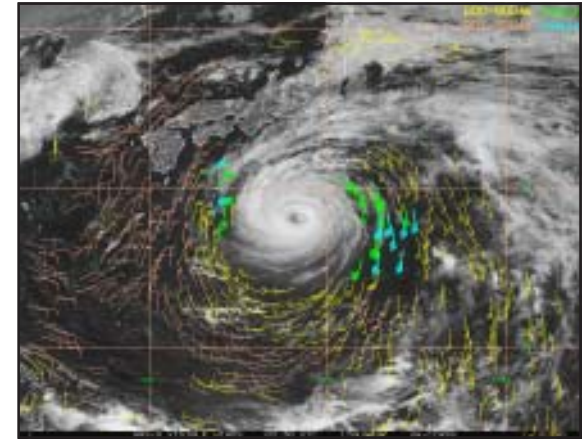
Some groups within SSEC work independently toward specific goals under SSEC administration, including two institutes.

### CIMSS

<http://cimss.ssec.wisc.edu/>



The Cooperative Institute for Meteorological Satellite Studies (CIMSS), founded in 1980, extends the range of weather forecasts and develops a better understanding of our complex atmosphere and its interactions. University staff scientists and federal employees from NASA and NOAA develop techniques and research ideas that they share with other scientists. Internationally, CIMSS is considered the premier source of not only satellite data, but the best ideas in the field.



CIMSS’s Tropical Cyclones group regularly produces winds from several levels in the atmosphere, like these around Typhoon Phanfone (August 17, 2002).

Areas of analytical specialty include clouds, tropical storms, biomass burning, remote sensing for agriculture, numerical modeling and developing new satellite instruments. Steven Ackerman, professor in the Department of Atmospheric and Oceanic Sciences and an SSEC scientist, directs CIMSS.

### A<sup>3</sup>RI

<http://www.ssec.wisc.edu/a3ri/>



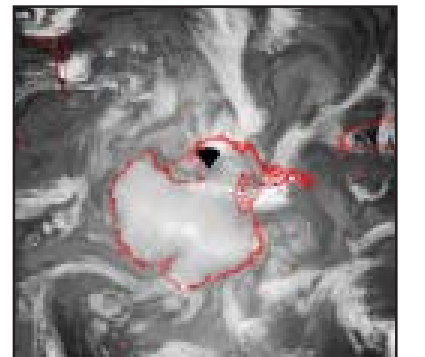
The Antarctic Astronomy and Astrophysics Research Institute (A<sup>3</sup>RI) conducts research in high energy neutrino and gamma ray astronomy, nuclear and particle astrophysics, cosmology and related fields, primarily in Antarctica. Its first project was AMANDA, the Antarctic Muon and Neutrino Detector Array, located at the South Pole. John Gallagher III, professor in the Department of Astronomy, directs A<sup>3</sup>RI with SSEC’s Robert Paulos as executive director.

## Other Research Groups

### Antarctic Meteorological Research Center (AMRC)

<http://amrc.ssec.wisc.edu/>

The AMRC, with the Automatic Weather Station program and NOAA’s polar-orbiting satellites, provides Antarctic data to researchers and others, especially scientists in polar programs funded by the National Science Foundation. Principal Investigator is Antarctic pioneer, Charles Stearns.



Antarctic image composited from geostationary and polar-orbiting weather satellite data on November 5, 1998 at 2100 UTC