THROUGH *the* ATMOSPHERE

RESEARCH WITH IMPACT

Winter 2026
Space Science and Engineering Center | Cooperative Institute for Meteorological Satellite Studies | University of Wisconsin–Madison

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WINTER 2026

Through the Atmosphere is an annual publication featuring atmospheric, space science, and engineering research and education accomplishments of the University of Wisconsin–Madison's Space Science and Engineering Center (SSEC) and its Cooperative Institute for Meteorological Satellite Studies (CIMSS).

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A thunderstorm downburst over Phoenix, Arizona in 2023

Credit: mdesigner125

Director's note


Credit: UW—Madison

2025 marked the 50th anniversary of NOAA's Geostationary Operational Environmental Satellite (GOES) which began with the launch of GOES-1 on October 16, 1975. SSEC scientists have played an important role in making sure that each of these satellites, including the most recent GOES-19, is able to provide the information that is necessary to save lives and property.

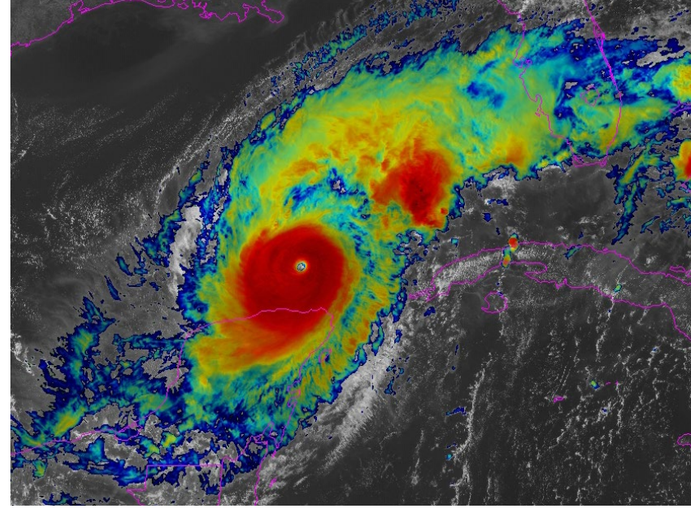
The Space Science and Engineering Center continues to be at the forefront of satellite meteorology, transforming satellite observations into actionable information for society. What began as pioneering work with early weather satellites has grown into a legacy of innovation that touches nearly every aspect of environmental monitoring and prediction.

Our research improves aviation safety by advancing the detection and forecasting of atmospheric turbulence, strengthens severe weather preparedness through satellite-based analysis of lightning and tornado-producing storms, provides tools to support wildfire detection and smoke monitoring, tracks hurricane structure and intensity, monitors sea ice extent, and delivers essentials atmospheric measurements that improve understanding of air pollution and public health impacts.

As we look ahead, SSEC remains committed to advancing satellite meteorology for the benefit of all.

R. Bradley Pierce
SSEC Director

◀ Two SSEC researchers ca. 1980 work at a 2nd generation McIDAS terminal. Started in 1973, McIDAS is one of the longest-running and continually-supported visualization software in the world. Credit: SSEC



▲ McIDAS software is used worldwide by researchers, universities, governments and non-governmental organizations. Credit: SSEC

McIDAS at 50 and beyond

Long-running and continually supported software with global reach

by Lindsay Giovannone

Among the many visualization tools available to remote sensing scientists, few go as far back as the Man computer Interactive Data Access System. Invented in 1973 at the University of Wisconsin-Madison Space Science and Engineering Center, McIDAS started as a single-user system that displayed information from geostationary meteorological satellites. More than 50 years later, it has developed into a suite of software packages used worldwide to display both weather satellite and geophysical data.

According to McIDAS Program Manager Becky Schaffer, the software is used by dozens of organizations and governments worldwide, including the Australian Bureau of Meteorology, the University of Quebec in Montreal (UQAM), La Agencia Estatal de Meteorología in Spain (AEMET), and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). In the US, McIDAS is used in launch support at Cape Canaveral and Johnson Space Center, as well as in research and operations at NOAA and NASA.

As one of the oldest software packages, several users from around the world shared with us how they use McIDAS and its variety of provided tools.

Ivan Smiljanic, who conducts remote sensing research at EUMETSAT, says they use McIDAS for case studies and in collaboration between scientists, as well as a training tool at places like the International Summer School in Italy.

"McIDAS provides a good picture of standard system for visualization of meteorological products. It is like having a full setup of classical meteorological workstations in one tool," says Smiljanic. He adds that the most useful parts are the varying ways visual data can be explored to a pixel level, "Which is crucial when it comes to analysis of certain features in the data or the data specs."

Christian Pagé, founder of the UQAM MeteoCentre and research engineer at the European Center for Advanced Research and Training in Scientific Computing in Toulouse, France says, "It is one of the best softwares to plot satellite images. We use it to generate several satellite images customized to our needs, and that are generated on-the-fly as soon as data is flowing in."

McIDAS-V is a popular 3D version of the software that is free and open-source, making it accessible to students and researchers everywhere. Schaffer noted that a World Meteorological Organization (WMO) Training Course in McIDAS-V at the China Meteorological Administration Training Centre (CMATC) in Beijing brought in scientists from all over the world. Two meteorologists approached her and were excited to discover they had access to this tool and that data that they could not currently access in their home country was available in McIDAS-V.

The original version of the software, now called McIDAS-X, has been in constant development at SSEC since 1973. McIDAS-X is used for visualizing and analyzing geophysical data in a wide variety of formats. Typical data comes from sources such as geostationary and polar orbiting meteorological satellites, NEXRAD radar, surface and upper-air observations, gridded numerical forecasts, NOAAPORT text products, and data from special observing networks. The McIDAS-X package is designed to work in both real-time operational and research environments and is available to members of the McIDAS Users' Group. Members of the group pay fees as part of a subscription service to access software updates and support; those fees in turn also fund maintenance and further development of the visualization software.

Looking back on the history of McIDAS, Schaffer says that one reason for its longevity is its simplicity. "McIDAS works well with very little overhead," she says. "It's powerful because you can do a lot with just a few steps. We hear it all the time from our users – nothing beats McIDAS for easily displaying satellite imagery at the highest quality possible."

Schaffer notes the McIDAS team at SSEC will continue to develop and maintain the McIDAS as new satellites and data formats come online, and they will continue to work with its many users worldwide.

50 years of GOES

Celebrating 50 years of Geostationary Operational Environmental Satellites

by Leanne Avila

The first Geostationary Operational Environmental Satellite (GOES-1) was launched from Cape Canaveral on October 16, 1975. Throughout the GOES program's 50-year history, the Space Science and Engineering Center (celebrating 60 years), and later SSEC's Cooperative Institute for Meteorological Satellite Studies (celebrating 45 years), played a pivotal role in its achievements and in shaping its future.

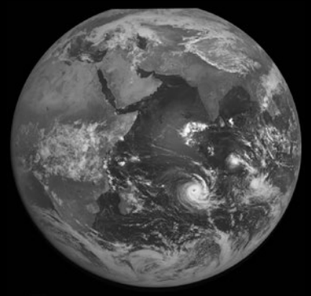
"In the family tree of satellite meteorology, we're direct descendants of the founder. Vern Suomi [SSEC founder] invented the field," says Mat Gunshor, CIMSS researcher.

Originally designed as the third satellite in the National Oceanic and Atmospheric Administration's Synchronous Meteorological Satellite series, GOES-1 owed its legacy not only to the SMS program, but also its predecessor, the Applications Technology Satellites, which carried the spin-scan cloud camera designed by Verner Suomi and co-founder of SSEC Robert Parent. That ATS experiment confirmed the benefits of a weather satellite flying in geostationary orbit.

Since those early days of the GOES program, SSEC and CIMSS scientists have worked to ensure its success and benefits. Starting long before launch, they have helped to determine the types of observations the satellite instruments should make – conducting tradeoff studies to support their recommendations. They also develop the algorithms that will turn the observations into useful information. Once the satellite is in orbit (~36,000 km away), they test and validate the accuracy of the data during a post-launch checkout period.

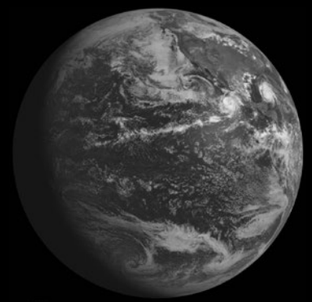
It is this geostationary satellite and sounding expertise that led to the formation of CIMSS in 1980. NOAA had sent a small contingent of US federal employees to SSEC to collaborate on remote sensing research in 1976. Led by William

◀ Full-disk image captured by GOES-1 in 1976, a year after its launch and marked the beginning of the Geostationary Operational Environmental Satellite program led by NASA, NOAA and numerous partner agencies across the US, including UW—Madison Space Science and Engineering Center.

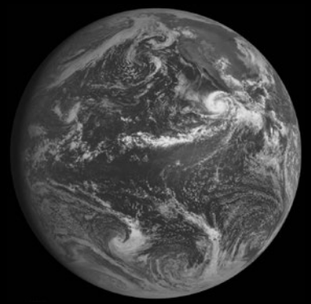


GOES-1 (1975)

GOES-2 (1977)

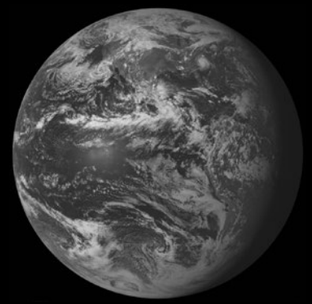


GOES-3 (1978)

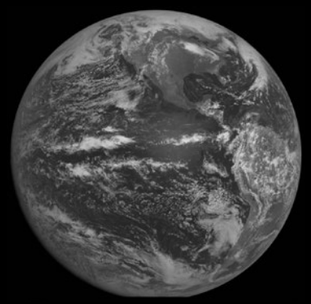


GOES-4 (1980)

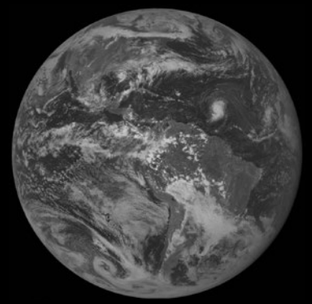
GOES-5 (1981)



GOES-6 (1983)



GOES-7 (1987)

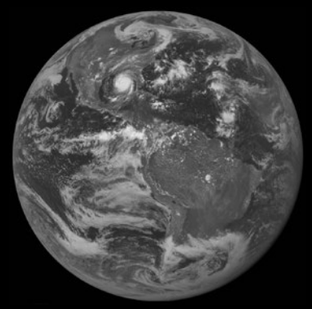


GOES-8 (1994)

GOES-9 (1995)

GOES-10 (1997)

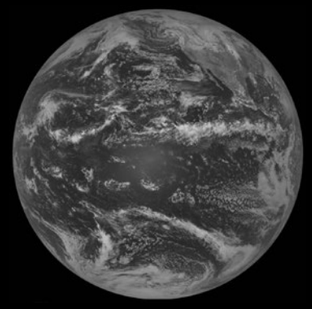
GOES-11 (2000)



GOES-12 (2001)

GOES-13 (2006)

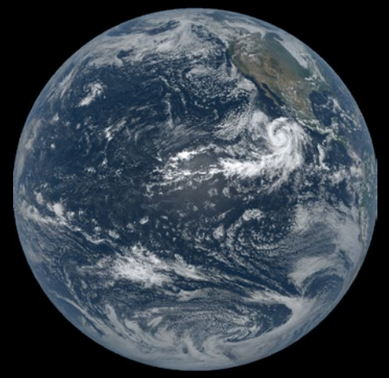
GOES-14 (2009)



GOES-15 (2010)

GOES-16 (2016)

GOES-17 (2018)



GOES-18 (2022)

GOES-19 (2024)

◀ GOES-16 launched in November 2016 and ushered in a new era of GOES satellite technology, featuring 16 channels and enhanced temporal resolution. Credits: SSEC

Opposite: GOES-1 through GOES-15

Smith, the federal scientists worked together with their university colleagues on processing techniques for the Visible/Infrared Spin-Scan Radiometer Atmospheric Sounder, the sounder first flown on GOES-4 in 1980. With each new generation of geostationary satellites, SSEC and CIMSS scientists developed and refined algorithms, creating new applications for the data. They tackled sounding retrievals, winds, fire detection, severe weather and tropical cyclone monitoring. Over time the National Weather Service and hurricane forecast centers began using these products derived from GOES, improving the timeliness and accuracy of their forecasts.

The GOES-R series is the latest of the GOES satellites. While GOES-R was launched in 2016, preparations began decades before. SSEC and CIMSS scientists helped to determine the bands that would feature on the Advanced Baseline Imager, the main instrument on this series. In addition to developing and refining science algorithms, SSEC and CIMSS created proxy datasets to help future ABI data users prepare for the significant increase in the number of bands available on the imager, which expanded from 5 to 16, and the associated increase in the amount of data. From this data, users could prepare their science algorithms to be ready the moment data would be available. Closer to launch SSEC and CIMSS produced real-time proxy data to simulate the data volume, allowing the NWS to adjust their systems to make full use of the new wealth in information; this phase included training forecasters. All these steps went towards preparing for a smooth transition to the new generation of geostationary satellite series.

"When GOES-R launched and data first started flowing to the Weather Service, it all worked. There were no days of outages. They were ready. And it's in a large part due to all the work that we did to help them get ready. It's a testament to all the work that people did here," says Gunshor.

◀ GOES-I weather satellite rests on a pallet at the Astrotech payload processing facility. GOES-I was a 3-axis, body stabilized meteorological satellite used by NOAA and NASA. Credit: NASA

Below: Installation of the fairing around the GOES-H weather satellite. GOES-H was launched by NASA on February 24, 1987. It became the seventh GOES spacecraft and the 10th meteorological satellite to be launched since 1974 for transmitting cloud images from a geosynchronous orbit. Credit: NASA

GOES-U, now known as GOES-19 and the last GOES satellite in the series, was launched by SpaceX in June 2024. SSEC and CIMSS participated in the formal checkout process, ensuring that the instrument was well calibrated and that the data were navigated properly and had the correct metadata. Data from the GOES-19 ABI were compared to data from other orbiting GOES ABIs, as well as from polar-orbiting satellites. These procedures allowed the data to transition from beta to provisional to operational.

Throughout the GOES-R series, SSEC and CIMSS increased their education and outreach efforts, including engaging K-12 teachers and students in new ways. Teachers were invited to attend workshops held in conjunction with satellite launches, learning more about the ABI instrument and weather concepts related to satellite meteorology before experiencing a launch from Cape Canaveral firsthand. Middle and high school students were encouraged to participate in GOES virtual science fairs, researching a science topic using GOES data and preparing a poster and short presentation. Researchers at SSEC and CIMSS also presented Short Courses to broadcast meteorologists and

▲ Cooperative Institute for Meteorological Satellite Studies researcher Mat Gunshor began working at CIMSS in 1997 and by 1999 was involved in GOES research, including preparations for the future GOES-R satellite. Credit: Eric Verbeten

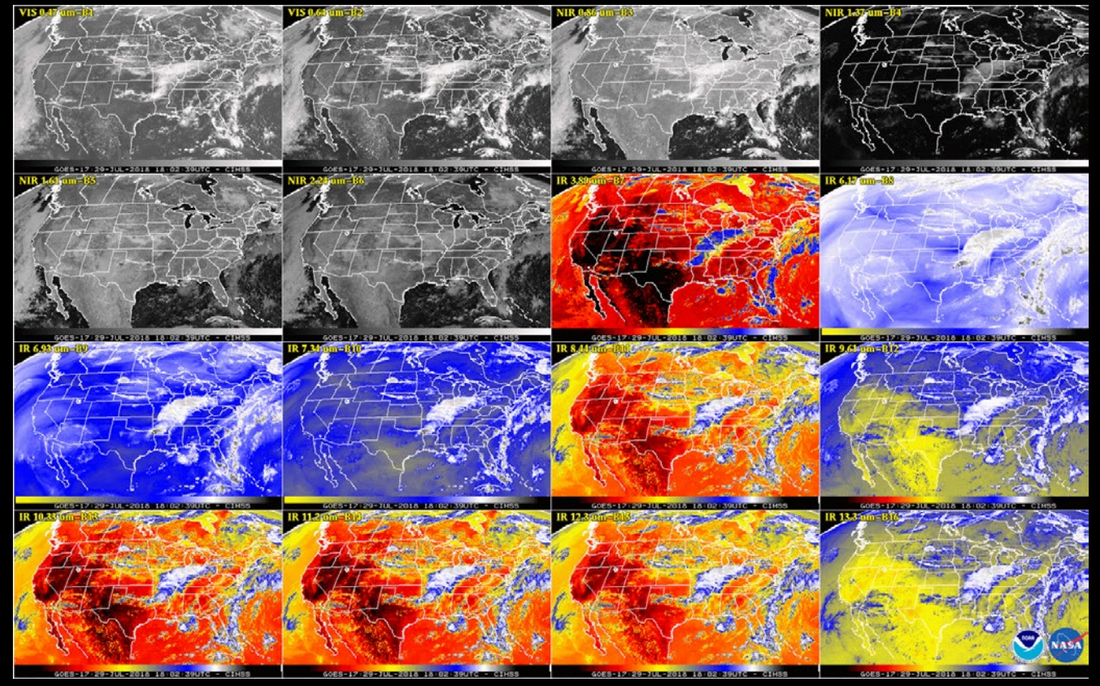
“I think satellite meteorology is a really wonderful example of the Wisconsin Idea. It was research done here. Does it benefit the state? Yes. Does it benefit the country? Yes. Does it benefit the whole world? Absolutely.”

military forecasters at American Meteorological Society meetings to update them on what to expect with each new GOES satellite in the series and to share the latest research.

While the GOES era is coming to a close, the legacy built during this time continues. SSEC and CIMSS scientists are already preparing for the future of geostationary satellites with the upcoming Geostationary Extended Observations satellites, known as GeoXO. Today SSEC and CIMSS are helping to determine which bands will be available on the satellite imager, which then dictates the type of observations that will be possible. In addition, SSEC and CIMSS have advocated for improved spatial resolution to help with fire detection; smoke from Canadian fires impacts not only air quality, but may affect weather and the ability to reliably predict it. Within the U.S., fires, such as those in Los Angeles in January 2025, cause loss of life and billions of dollars in destruction to homes and businesses.

While not scheduled to launch until the 2030s, GeoXO is currently planned to include a hyperspectral sounder, which SSEC and CIMSS have long championed. The concept for a sounding instrument, and in particular a hyperspectral version, was “born here in Wisconsin,” as Gunshor explained it, embodying the “Wisconsin Idea” in how it will dramatically improve weather forecasting not just here in the state, but far beyond Wisconsin borders.

“I think satellite meteorology is a really wonderful example of the Wisconsin Idea. It was research done here. Does it benefit the state? Yes. Does it benefit the country? Yes. Does it benefit the whole world? Absolutely.”



▲ A longtime favorite of "The GOES Guy" Tim Schmit, the 16-panel image demonstrates how the GOES Advanced Baseline Imager is able to capture a wide-range of spectral bands — giving researchers and forecasters in-depth views of Earth's complex atmosphere. Credit: Mat Gunshor

Reflections on 50 years of GOES

by Eric Verbeten

Tim Schmit has worked with the GOES satellite program since 1987 following the launch of GOES-7. Known as "The GOES Guy" for his expertise and enduring support, he has been a strong advocate of the satellite platform and spent his career working to improve its functionality, while educating others about its utility and the richness of the data collected by the geostationary satellite program.

Schmit began his career at the UW-Madison Cooperative Institute for Meteorological Satellite Studies and later transitioned to a role working with NOAA. He continued to collaborate closely with CIMSS researchers to improve each iteration of GOES that followed.

Schmit retired from NOAA in late 2024 and shared some of his reflections on the GOES mission and its far-reaching 50 years of operations.

What has GOES meant to you professionally?

I describe my career as covering GOES: Past, Present and Future. This has allowed me to work with many over the entire globe and all the corners of the United States. Each interaction, be it at international workshops or conferences, NWS trainings, and with broadcasters, private industry, teachers or students, has been an honor.

When I was hired by CIMSS, it was to help prepare for GOES-8 and I didn't stop helping with preparations and check-outs all the way through GOES-19 (mostly as a federal NOAA employee stationed in Madison).

Working with CIMSS/SSEC colleagues, as well as NOAA, NASA and others, we were able to shape what the GOES-R (GOES-16) series became. As one watches a powerful hurricane or thunderstorm with GOES images every minute, that's exactly what we envisioned decades earlier.

What is GOES biggest impact?

The greatest, most rewarding step was moving from GOES-15 (with data coming every 15 or 30 minutes, and with 4-8 km spatial resolutions) to GOES-16 that delivered full-disk scans every 10 minutes, contiguous US scans every five minutes, and small scale scans every 30 seconds — at spatial resolutions 4 times improved!

Years ago, after a powerful landfalling hurricane, the head of NOAA sent out an "everyone" email to thank all who helped monitor/forecast the storm. Many groups were rightly mentioned (NWS, NHC, aircraft, buoy center, etc.), but satellites were forgotten. At first this bothered me but then a wise colleague told me: "the fish is the last animal to notice the water." Translation: The GOES images are so frequent and dependable; some can take them for granted.

The GOES-R program was one I started working on in 1999 and it was launched in 2016! The improved data helps not only many weather applications, but also transportation due to the impacts of fog, atmospheric turbulence, etc.

What interested you personally to pursue a career working with GOES?

When I was 13 years old living in Minnesota, I took an aptitude test, and one possible profession was meteorology. I was already interested in remote sensing – in the 2nd grade I wanted to be a pollution fighter. So, I started looking at schools and dreamed of getting a master's degree in meteorology from the University of Wisconsin–Madison. (And that's what happened). I couldn't have asked for a better career.

RESEARCH WITH IMPACT

SSEC and CIMSS science make real world impacts

Weather affects everyone. Every year devastating weather conditions result in lives lost and billions of dollars of damage. To keep ourselves, our families, and our communities safe, we all depend on timely and accurate weather information.

At the University of Wisconsin-Madison Space Science and Engineering Center and the Cooperative Institute for Meteorological Satellite Studies we conduct innovative research to improve weather forecasts. For more than 50 years, SSEC and CIMSS science has helped improve our understanding in areas such as severe weather, wildfires, hurricanes, floods and aviation turbulence. We are committed to supporting NOAA's mission to protect property and save lives.

ProbSevere: Severe weather prediction

by Eric Verbeten

Each year severe weather costs the United States billions of dollars in damage, including tragic loss of life. Severe weather like thunderstorms, lightning, hail, floods and tornadoes are an ever-present risk affecting people, property and commerce.

Researchers at the Space Science and Engineering Center and the Cooperative Institute for Meteorological Satellite Studies have innovated new ways to improve severe weather prediction using AI and satellite data, called ProbSevere.

Since 2014, ProbSevere has been used by forecasters across the US to help predict severe weather. With warnings up to two hours in advance, ProbSevere can alert forecasters to dangerous conditions that cause lightning, hail, heavy rains, floods and tornadoes.

"Advanced image-AI techniques, along with high-quality satellite and radar data, have improved ProbSevere products in recent years, providing more accurate, more consistent, and more objective guidance to forecasters," says John Cintineo, a scientist with NOAA's National Severe Storms Laboratory who partners with SSEC and CIMSS.

Warnings informed by ProbSevere give time for people to make preparations and take shelter. ProbSevere has been used by emergency planners across the US for large events like state fairs, festivals, concerts, tournaments, sporting events and national conventions.

ProbSevere products such as ProbSevere version 3 and LightningCast leverage data received from geostationary satellites like GOES-East and GOES-West. With updated imagery being used every minute, ProbSevere uses AI to analyze developing storm systems in near real-time and help forecasters issue warnings.

SSEC and CIMSS Researchers found that the satellite information used in LightningCast can consistently provide 20-30 minutes of lead time before the first lightning flash occurs in a developing storm.

"Planned enhancements of observation networks, including the next generation of geostationary satellites, and a revamped radar network, will further improve lead time and accuracy for deadly severe weather hazards," says Cintineo.

Satellite data and AI keep passengers safe

by Eric Verbeten

Each year, more than 800 million passengers fly on US commercial airlines. Whether on the ground or in the air, keeping passengers and crews safe from severe weather and turbulence is crucial. Which is why researchers at the University of Wisconsin-Madison Cooperative Institute for Meteorological Satellite Studies have developed tools to help pilots and air traffic controllers better identify areas of turbulence and dangerous weather conditions.

To help aircraft and passengers arrive safely to their destination, the CIMSS Turbulence Product uses the latest in artificial intelligence technology along with near real-time data from geostationary weather satellites like GOES-East and GOES-West. The real-time feedback alerts users to the likelihood of turbulence in certain areas, preparing pilots and air traffic controllers.

"The CIMSS Turbulence Product is the result of training an AI model on more than three years of satellite and aircraft data," says Tony Wimmers, a CIMSS researcher who leads the effort. "We combined past incidences of turbulence reported by aircraft and paired those with geostationary satellite data to create a real-time tool that shows the likelihood of turbulence happening at cruising altitudes."

The model was trained on more than 400,000 recorded instances of turbulence over 3.5 years from a major US airline, demonstrating the ever-present risks for aircraft. Using these data, Wimmers and his team were able to combine geostationary satellite imagery to better identify the conditions that are most likely to result in moderate or greater turbulence.

The CIMSS Turbulence Product is used by forecasters across the US including the Aviation Weather Center, the Alaska Aviation Weather Unit, the Honolulu Forecast Office aviation weather desk and the Central Weather Services Units of the National Weather Service. Wimmers says the turbulence product provides flight hazard awareness over coastal areas and oceans where other atmospheric measurements may not be available.

Throughout the product's development the CIMSS team worked with aviation forecasters to refine the model based on their needs and the product is being made available to NOAA's National Environmental Satellite, Data, and Information Service.

Buena ventura mariano

Next Generation Fire System

by Leanne Avila

In January 2025, the Los Angeles area was devastated by a series of fires. As fires burned over 50,000 acres, more than 200,000 people were forced to evacuate their homes, more than 16,000 homes and businesses were destroyed and more than 30 people died.

Emergency managers, first responders, firefighters and fire suppression resources are critical to planning a fire response to prevent loss of life and property damage. Accurate and timely information of a fire's intensity and location are crucial in these moments.

In collaboration with the National Oceanic and Atmospheric Administration, a team at the University of Wisconsin-Madison Cooperative Institute for Meteorological Satellite Studies has developed the Next Generation Fire System to improve our ability to detect and monitor fires. Led by Principal Investigator and Associate Research Professor Jason Otkin, the team uses data from geostationary and polar-orbiting satellites in an automated system to identify fires, determine their intensity, alert users to these newly identified fires and track them.

Today's satellite instruments provide significantly more data than a human can view without additional tools. The NGFS uses AI to sort through the satellite observations, looking for key signatures indicating fire activity.

"Compared to other algorithms, the NGFS is more resilient to atmospheric obstructions, allowing it to detect fires even in the presence of clouds or dense smoke," says Otkin.

This capability is important not only for the initial detection, but for continued monitoring should clouds move into the area as fires continue to burn over several days. Cloud cover can obscure fires in other detection systems, which could delay an alert or make it more difficult to track the fire's behavior and impacts.

Another key component is sharing information with users, with a focus on accuracy, timeliness, and usefulness. The team developed an online dashboard to provide real-time alerts for new fires and information about the fire's location and intensity, as well as satellite imagery. They have also demonstrated the system and dashboard to users, including at the Fire Weather Testbed, to refine the system.

The team continues to make improvements to the NGFS, aiming to detect fires ever earlier. Whether the fire season is ending or just beginning, they don't have a moment to lose.

Tracking tropical storms with AI

by Lily Nothom

When tropical storms form, forecasters turn to tools developed at the University of Wisconsin–Madison's Cooperative Institute for Meteorological Satellite Studies. Since developing one of the first public tropical cyclone monitoring websites in the 1990s, CIMSS has become a trusted source of imagery and information. What began as a small set of satellite images has grown into a global hub that helps experts and the public track tropical storms.

Although CIMSS does not issue official warnings, its research plays a crucial role in improving forecasts.

"Forecasters do not just want an answer, they want to know why," says Derrick Herndon, CIMSS scientist. "Taking complex science and turning it into tools that help people stay safe during high-impact events is what excites me most about this work."

Long-standing tools like the Saharan Air Layer product, which highlights dry air that can weaken storms, remain key forecasting resources. At the same time, new satellites and experimental missions are revealing storm details that were once impossible to observe.

CIMSS researchers focus on one of forecasting's greatest challenges: predicting rapid changes in storm intensity. Locating a storm's center is often difficult when thick clouds obscure vital details. By combining multiple satellite frequencies, CIMSS helps forecasters separate what is happening in the upper and lower atmosphere. Microwave sensors, for example, can see through clouds to reveal rainfall patterns and eyewall replacement cycles — key indicators of a storm's severity and potential to cause deadly storm surge.

During Hurricane Beryl in 2024, CIMSS products were used by the National Hurricane Center to monitor the storm's core in real-time and detect shifts that could alter its path or intensity.

Artificial intelligence is also expanding forecasting capabilities. The DMINT tool, developed at CIMSS, uses multispectral imagery to provide accurate near real-time estimates of storm intensity. By training models on thousands of satellite images, AI can process data faster and across wider time scales.

Looking ahead, CIMSS is exploring new data streams from CubeSats and commercial partners to deliver even more frequent observations.

"Our job is to give forecasters the clearest view possible of what is happening inside the storm," says Herndon.

Ice from Space: CIMSS Sea Ice Research

by Lily Nothom

In 2024, Hudson Bay experienced an unusually early opening of sea ice. The bay, which usually remains ice-covered until late June, was largely ice-free by the end of May. In addition to impacts to the communities who rely on stable ice, rapidly changing sea ice conditions can pose dangers to those navigating the waters.

At the University of Wisconsin–Madison's Cooperative Institute for Meteorological Satellite Studies, scientists are using satellites to track these changes and turn complex data into tools that help communities, forecasters, and decision makers monitor sea ice conditions.

CIMSS researchers focus on creating real-time satellite products that measure sea ice thickness, concentration, temperature, and motion while also building long-term records used by NOAA and the global scientific community. By combining data from multiple instruments, such as passive microwave sensors and high-resolution imagers on the VIIRS and AMSR2 satellites, scientists can verify weather models and conditions affecting sea ice, cloud cover, and surface radiation.

In the Hudson Bay case study, CIMSS scientists traced the event to persistent east winds that pushed thinning ice westward, combined with slower ice growth during the previous winter.

"Hudson Bay sea ice is critical for local communities and ecosystems, and the early opening shows how sensitive the system is," says Yinghui Liu, a NOAA scientist stationed at CIMSS.

Examples like this are among many identified in polar regions, and those impacts extend to other parts of commerce, infrastructure and transportation. CIMSS shares its findings with NOAA partners, the National Ice Center, and regional weather offices around the Great Lakes, where the data support forecasting and shipping safety to help ships navigate rapidly changing sea ice conditions.

Basic research for a complex atmosphere

by Eric Verbeten

From a cliffside on the Caribbean Island of Barbados, researchers at the Space Science and Engineering Center set out to study the vast expanse of ocean between the island and the next nearest landmass, the continent of Africa.

From 2023 to 2025 the High Spectral Resolution Lidar, designed by SSEC researchers and engineers, collected valuable information about atmospheric boundary layer conditions over the Atlantic Ocean. Most notably, they observed specific patterns of how Saharan dust, mixed with aerosols like sea salt is transported thousands of kilometers across the ocean.

The scientific observatory on the Barbados eastern shore is an ideal location to understand how the ocean and atmosphere interact, without the signal noise of pollution. The HSRL uses a powerful laser to resolve and identify tiny atmospheric particles, including pollution aerosols.

"The Barbados Atmospheric Chemistry Observatory remains one of the best places to study and observe a vast and uninterrupted part of the atmosphere," says SSEC senior scientist Bob Holz. "From here we are able to see how things like aerosols, dust, the ocean and land interact with each other."

The HSRL arrived in Barbados in a custom engineered shipping container that allows for the transport and operation of the HSRL, while protecting it from the elements. Known as the SPARCLET, the container has traveled thousands of kilometers across the world and been deployed for ocean-faring field experiments over places like the Philippine Sea.

The study was done in partnership with the US Department of Energy, the Caribbean Institute for Meteorological Hydrology and the University of Miami which has maintained the research site for more than 50 years. As a result, the site is home to the largest aerosol filter archive.

"A surprising thing we observed with the HSRL is how Saharan dust becomes stratified in layers as it travels these vast distances over the Atlantic," says Holz. "We're seeing dust mixed into the boundary layer in interesting ways."

Data collected through this HSRL campaign are available to the public and help researchers better understand complex atmospheric interactions in the boundary layer and beyond.

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AWARDS

NASA Robert H. Goddard Exceptional Achievement for Science Awards

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2025 AOSS PHOTO CONTEST

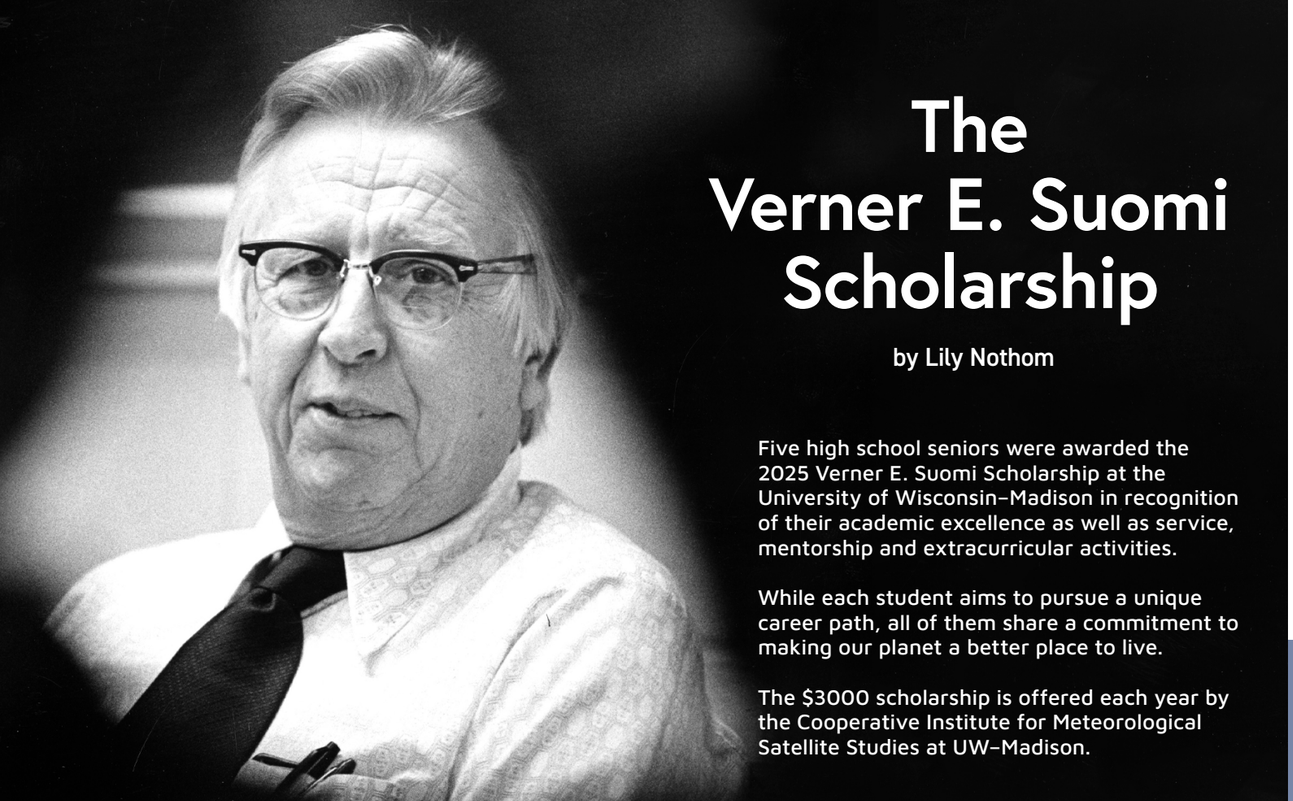
For the 15th year, the Atmospheric, Oceanic and Space Sciences Photo Contest at the University of Wisconsin–Madison showcases stunning photographs of weather phenomena around the world.

University students, scientists, staff and professors share what they see when they peer through the camera's lens.

1st place
David Mikolajczyk
Rainbow Lightning

2nd place
Dave Stettner
Foggy Sunrise

3rd place
Stephanie Kluge
Midwest Tornadic Machine Inhales Texas Dust



The Verner E. Suomi Scholarship

by Lily Nothom

Five high school seniors were awarded the 2025 Verner E. Suomi Scholarship at the University of Wisconsin–Madison in recognition of their academic excellence as well as service, mentorship and extracurricular activities.

While each student aims to pursue a unique career path, all of them share a commitment to making our planet a better place to live.

The $3000 scholarship is offered each year by the Cooperative Institute for Meteorological Satellite Studies at UW–Madison.

Kristina Thomas

Major
Atmospheric and Oceanic Sciences
Environmental Studies Certificate

Interested in
Understanding how climate trends affect tropical storm systems like hurricanes, cyclones and typhoons

"I've always loved researching hurricane activity each season and watching live updates of active storm systems. I see myself as a meteorologist focused on hurricane research and forecasting, helping people prepare for extreme weather."

Kylee VanPatten

Major
Atmospheric and Oceanic Sciences

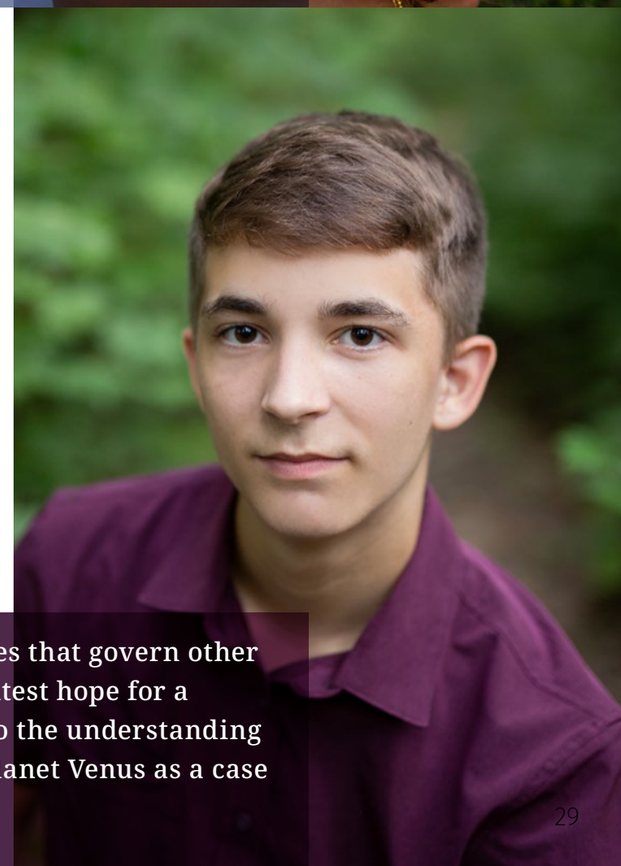
Interested in
Investigating severe weather systems, especially tornadoes, to better predict and understand extreme atmospheric events.

"Growing up in Wisconsin, I was always fascinated by tornadoes — not afraid, but drawn to watch how the atmosphere changed during storms. I hope to become a meteorologist and storm chaser, studying severe weather up close to advance forecasting and safety."

Ean Sautebin

Major
Astronomy and Physics

Interested in
Studying planetary systems and using astronomy to understand Earth's atmosphere and environment.



"I'm excited to learn about the dynamic processes that govern other planets in our solar system and beyond. My greatest hope for a future career in research is to contribute back to the understanding of our own world, much like scientists use the planet Venus as a case study for a runaway greenhouse effect."

Heather Drake

Major
Environmental Science

Interested in
Exploring connections between environmental science, conservation, biology, and botany to strengthen ecosystem protection.

"I want to understand how living systems work so we can care for them better. I'm still exploring paths across conservation, field biology, and restoration ecology to find where my skills and curiosity fit best."

Eve Vosters

Major
Engineering Mechanics

Interested in
Exploring the physics of space flight and uncovering the mysteries of the universe.

"I've always been intrigued by space and its endlessness, and I aim to find out more about the vast universe. My dream career would be working at NASA, taking part in exploratory space missions that allow us to make less of the universe unknown."

Make a gift

There are many ways to support SSEC and CIMSS. Gifts benefit our areas of greatest need and strengthen our areas of greatest opportunity. Targeted giving through the University of Wisconsin Foundation allows you to direct your contribution to a specific program.

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