JOINT POLAR SATELLITE SYSTEM PROGRAM

NEWSLETTER

2016 • QUARTER #1

FROM HARRY

During the first quarter of 2016, the JPSS team completed the final activities to be ready for major test campaigns in both the flight and ground segments. All instruments and components are now integrated with JPSS-1, and it passed pre-environmental testing review with flying colors. The ground team achieved readiness for its major verification test. Both test campaigns start in April to keep JPSS-1 on track for a 2nd Quarter FY2017 launch.

Many other efforts continue on plan. We completed Systems Requirements Review for the JPSS-2 spacecraft. Polar Follow-On (PFO) / JPSS-3 and JPSS-4 contract modifications were awarded to initiate instrument development.

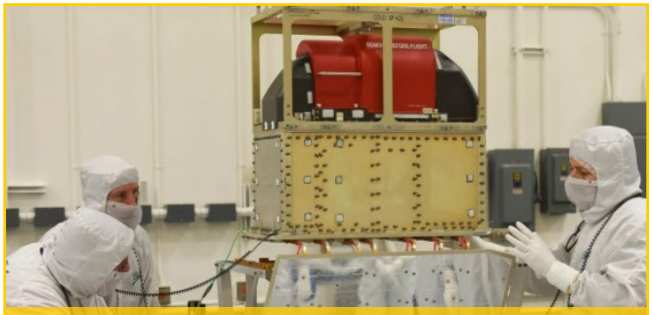
We continue to focus on our users. Imagery from the JPSS Proving Ground and Risk Reduction Program's River Ice and Flooding Initiative is currently being used in Alaska and Missouri as a critical resource to increase the timeliness and accuracy of public warnings and forecasts of severe flooding. Significant weather events that impact the American public remind us of the importance of our mission to deliver the valuable satellites in our constellation on schedule. I commend our team for their continued hard work to help us reach these goals.

ALL INSTRUMENTS NOW INTEGRATED WITH JPSS-1 SPACECRAFT

Satellite moves one step closer to launch in early 2017

The fifth and final instrument to be integrated with NOAA's JPSS-1 satellite is now complete, delivered and integrated, moving the spacecraft development towards launch as planned in early 2017. The Advanced Technology Microwave Sounder (ATMS) instrument follows the successful integration of Cross-track Infrared Sounder (CrIS), Ozone Mapping and Profiler Suite-Nadir (OMPS-N), the Clouds and the Earth's Radiant Energy System (CERES), and the Visible Infrared Imaging Radiometer Suite (VIIRS) instruments.

"This marks a very significant milestone for the JPSS program," said Harry Cikanek, JPSS Director. "Soon, the spacecraft will be prepared for the environmental testing phase which is the next step toward launch."



Ball Aerospace technicians lower the ATMS instrument onto the JPSS-1 spacecraft. Credit: Ball Aerospace & Technologies Corp.

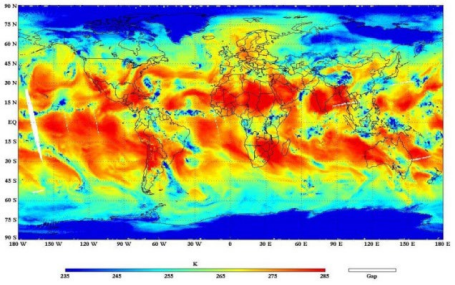
ATMS is built by Northrop Grumman in Azusa, California and was delivered to Ball Aerospace & Technologies Corp. in Boulder, Colorado where it was integrated with the spacecraft in January. ATMS collects microwave radiation from the Earth's atmosphere and surface all day and all night, even through clouds. It is one of the two sounders that provide information about the vertical temperature and moisture distribution of the atmosphere to the National Weather Service's numerical weather prediction models that are critical to predict severe weather three to seven days in advance. ATMS currently flies on the NOAA/NASA Suomi NPP satellite mission and will fly on the JPSS-1 through JPSS-4 satellite missions.

"We worked quickly to incorporate temperature and humidity based data from ATMS on the Suomi NPP spacecraft into NOAA's operational numerical weather prediction models, which has improved the accuracy of the model forecast," said James Yoe, Ph.D., NOAA's National Weather Service. "The JPSS-1 ATMS sensor will guarantee that this critical data stream remains seamlessly in place to support global forecasting in the future."

Compared to legacy NOAA microwave sounders, ATMS offers more channels, better resolution and a wider swath, improving the accuracy of short- and medium-term forecasting, storm tracking, and, with continued measurements over time, climate prediction models. ATMS helps collect essential data for accurate near-term weather predictions needed for farming, commercial and defense aircraft flight path planning, terrestrial extreme weather preparedness and oceanographic inputs for civilian and defense ships. ATMS measurements also provide rainfall rates, and snow and ice information. Historically, microwave sounders like ATMS have the greatest impact on forecast accuracy, so this next-generation instrument continues that key role.

Together, CrIS and ATMS primarily provide data on the hydrologic cycle, which includes water vapor, clouds and precipitation. Because clouds are opaque in the infrared part of the spectrum (measured by the CrIS) and largely transparent at microwave frequencies (measured by ATMS), operating them together makes it possible to cover a broader range of weather conditions. ATMS is able to view inside and below clouds and is used to produce images inside storms, including hurricanes.

The image below shows the ATMS channel 18data, which measures water vapor in the lower atmosphere. Tropical Storm Sean is visible in the data, as the patch of blue, in the Atlantic off the coast of the Southeastern United States.



Substantial flooding caused by river ice jams. Credit Anchorage Daily News, Bob Hallinen

SUOMI NPP KEEPS AN EYE ON HAZARDOUS RIVER ICE AND FLOODS

Ice jams along rivers are common occurrences during the winter and spring and can cause hazardous conditions for local residents.

When a frozen river begins to thaw and water levels rise, large ice chunks can break off and obstruct the natural flow of the river. When this occurs, the water that is held back can cause upstream flooding. If one of these ice jams breaks, the rushing waters can create flash flooding downstream.

That is why NOAA scientists with **JPSS** are working with experts in academia through the JPSS Proving Ground and Risk Reduction (PGGR) Program to help communities identify the risk of ice jams and prepare for these hazards. This effort is known as the River Ice and Flooding Initiative. The PGRR Program responds to this type of real-world environmental events using JPSS satellite data.

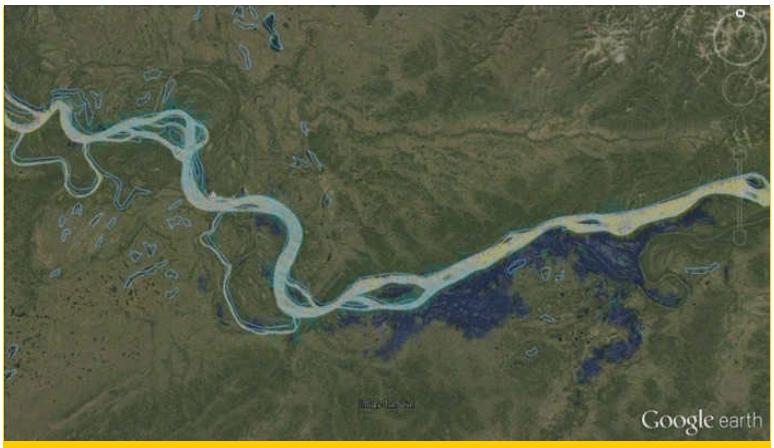
An Alaskan Community at Risk

In May 2013, an ice jam formed on the Yukon River downstream from the village of Galena, Alaska. Waters rose 6.5 feet above flood stage, the established point at which a body of water poses a hazard to lives, property, or commerce, for a three day period. The record level flooding caused half of Galena's occupied dwellings to be deemed uninhabitable.

Thankfully, two teams of scientists from City College of New York and George Mason University had been working on PGGR products to monitor and track ice and flooding conditions using data from Suomi NPP.

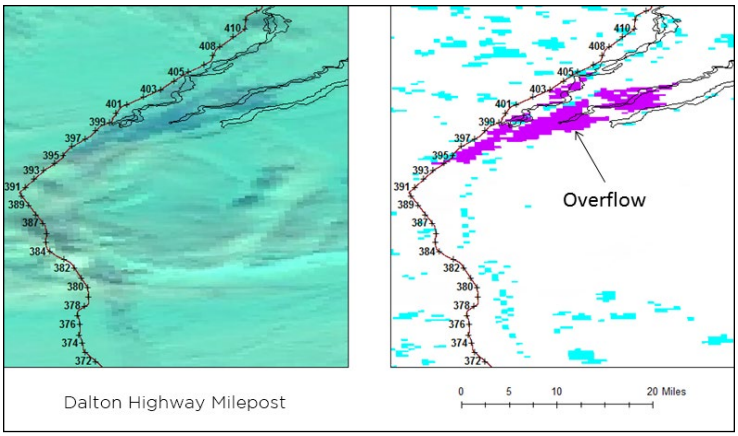
Working together, the teams were able to combine satellite imagery from multiple sources with river gauge data which was made available to Alaskan decision-makers to assist them in their response to the disaster.

Satellite data is especially crucial in the Alaska region where JPSS provides critical data for nearly all weather forecasting, filling gaps over areas that are not well covered by other observing systems.



Click On Image Above to Play Video Clip

Data and imagery from the Suomi NPP satellite VIIRS instrument aided in observing a major ice jam on the Yukon River that caused massive flooding in Galena, Alaska. Credit: Google + NOAA



(Above) Data from Suomi NPP satellite helps monitor the overflow on Dalton Highway. Credit: NOAA

2016 Brings Expanding Use of River Ice and Flooding Products

The George Mason University River Flooding Product was recently used in December 2015 to monitor and track severe flooding that impacted the Midwest River Basins and the Mississippi River Valley. This flooding was tied to an extensive period of heavy rain in Missouri, Illinois and areas south.

NOAA's National Weather Service (NWS) gave the product to the Army Corps of Engineers (USACE), which then used it to visualize flooding along sections of the Illinois River. Thanks to the University of Wisconsin- Madison's Space Science and Engineering Center (SSEC), the River Flooding Product is available on its **RealEarth website**.

These visualizations were so compelling that the USACE requested updates when JPSS's satellite passed over the area.

The River Ice and Flooding Product is a key component to this year's innovative Decision Support Services provided by the Alaska-Pacific River Forecast Center and Alaska Region Climate Services. The Alaska Region Climate Services is providing week ahead to seasonal guidance and Alaska-Pacific River Forecast Center forecasters and hydrologists are providing briefing packets to assist the state transportation managers with planning and resource allocation to help the Alaska Department of Transportation (DOT) and Public Facilities personnel as they work to minimize flooding impacts over the Dalton Highway. The Dalton Highway is a major transportation route between north of Fairbanks and a few miles from the Arctic Ocean and the **Prudhoe Bay oil fields.**

Within the guidance, the River Ice and Flooding product's very high-resolution post-processed imagery allow NWS hydrologists and forecasters to map the overflow and correlate on-ground observations with remote sensing products. Originally intended to detect flood inundation and river ice conditions, these products, are now being utilized to support emergency response to an essential economic corridor. Collaboration between NWS and DOT staff is expected to continue through spring breakup into mid-May.

The River Ice and Flooding Initiative is just one example of how imagery from JPSS satellites will remain a critical resource to increase the timeliness and accuracy of public warnings and forecasts of severe flooding, thus reducing the potential loss of human life, enabling better preparedness, and building more resilient communities.

FINAL DIRECT BROADCAST RECEPTION SITE COMPLETED IN PUERTO RICO

Polar-orbiting weather satellites are essential assets that provide data that enable forecasters to make more accurate weather predictions three to seven days in the future. In 2015 alone, there were 10 weather and climate disaster events with losses exceeding $1 billion each across the United States. Receiving accurate and timely warnings are of critical importance to protect lives and help prevent costly damage.

Direct Broadcast Reception Site at the University of Puerto Rico in Mayaguez, Puerto Rico. Credit: CIMSS

One way to expedite the way forecasters receive satellite data is through direct broadcast sites. Data is fed from directly from polar-orbiting weather satellites as they pass over reception antennas in locations across the country, allowing forecasters to have more rapid access to the observations made while the reception antenna is in view of the satellite. NWS and JPSS are demonstrating how direct broadcast antennas can improve data flow and allow rapid access to data, thus enhancing forecasters' ability to predict and monitor severe weather events.

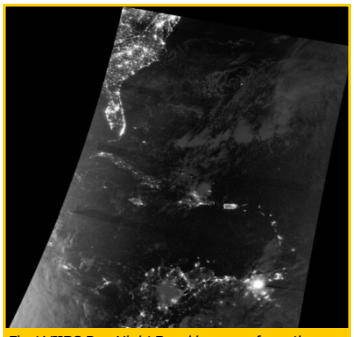
On October 23, 2015, the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin-Madison installed a direct readout ground station at the University of Puerto Rico in Mayaguez, Puerto Rico, which receives data from polar-orbiting weather satellites, like the NOAA/NASA Suomi NPP satellite, the first satellite of the JPSS constellation.

Data from the new antenna will be rapidly available, benefiting the National Weather Forecast Office in the capital city of San Juan and the wider Caribbean and South Florida area. On average, about a quarter of the annual rainfall for Puerto Rico occurs during tropical cyclones. Tropical cyclones form over large bodies of warm water and are capable of generating high waves, heavy rainfall and damaging storm surges. It is critically important to understand the strength of a tropical cyclone before it makes landfall, and having this immediate access to JPSS satellite data through the direct broadcast antenna will facilitate faster local forecasting.

High resolution imagery and data products from JPSS' VIIRS will allow forecasters to better monitor tropical cyclone activity, low cloud and fog, and precipitation, which are the primary hazardous weather conditions in their area. With these new capabilities forecasters can expect more accurate coastal flood predictions and improved weather warnings.

The antenna at Mayaguez expands the JPSS Direct Broadcast Antenna Network, which is comprised of sites in Alaska, California, Florida, Hawaii, Puerto Rico and Wisconsin. This Network covers all of North America providing reliable data to NOAA's National Center for Environmental Prediction (NCEP).

The direct readout sites are capable of receiving data from the sophisticated instruments from all heritage NOAA Polar-Orbiting Environmental Satellites, NASA Earth Observing Satellites, Japan Aerospace Exploration Agency's (JAXA) Global Change Observation Mission-Water, and European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) Meteorological Operational (MetOp) satellites. Using all of these satellites provide advanced data, refreshed at least every three hours, to forecasters enabling a more thorough picture of rapidly changing weather conditions. This direct broadcast antenna system will be well-placed to continue to receive all future JPSS satellite data.



First VIIRS Day Night Band imagery from the new direct readout station at University of Puerto Rico – Mayaguez in Puerto Rico. Notice the large coverage from the Mid-Atlantic States to north-central South America. Credit: CIMSS

JPSS leveraged funding from the Disaster Relief Appropriations Act of 2013—commonly referred to as the Sandy Supplemental— to support the acquisition of the Puerto Rico antenna and several other direct broadcast antennas. The purpose was to provide mitigation for any loss of the primary global stored mission data which is downlinked once or twice per orbit, while simultaneously providing overall enhancement to the forecast enterprise. This antenna network has proven important to providing a subset of the JPSS satellite data quickly to users for operational applications.

Areal coverage of satellite data captured by the direct readout stations.

The average time it takes to capture the subset of polar satellite data viewable by direct broadcast and turn it into a forecast has been reduced from more than 100 minutes to less than 20 minutes. This enables the use of JPSS data and other polar–orbiting satellite data in NCEP's regional model which require faster data streams.

"The amount of time required to previously retrieve JPSS data prevented our critical sounder data to be used by regional models, especially those that are updated hourly," said Mitch Goldberg, PhD., JPSS Program Scientist. "JPSS data will now be able to contribute shorter range forecasts, particularly since the new direct readout network now covers the entire spatial domain of NOAA's North American Mesoscale model."

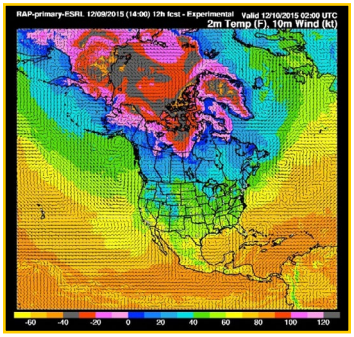
There are three types of NWS forecast systems: the Global Forecast System (GFS), the North American Model (NAM), and the hourly rapid refresh (RAP). The RAP and the NAM have the same model area, but has a shorter data cutoff time. The figure below shows time vs amount of data used in different models, which highlights the importance of the length of time it takes to get the data from the satellite and process it for users.

Next year, the direct readout network will be expanded to include data from Guam and Japan, allowing coverage from western Pacific region and data from EUMETSAT's regional network to cover Greenland and the remaining Northern Atlantic where the data takes an extended length of time to process.

Direct broadcast antennas are an essential tool providing essential data needed to meet the nation's environmental challenges. In addition to the local benefits, the new Puerto Rican antenna will provide a new vital, data source that is incorporated into our Nation's essential decision-making products to help secure a more "Weather-Ready Nation."

Learn more about ▶ **The Disaster Relief Appropriations Act of 2013**

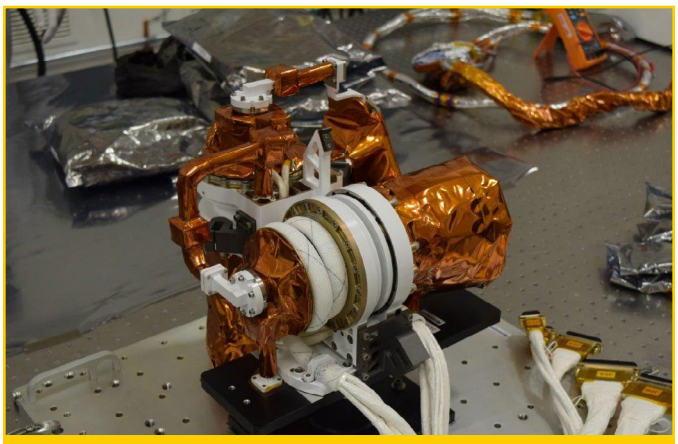
Learn more about ▶ **The Cooperative Institute for Meteorological Satellite Studies**



North American Model area

JPSS-1 GIMBALS NOW INTEGRATED

The JPSS-1 Ka band antenna gimbals have been delivered to Ball Aerospace & Technologies Corp. in Boulder, Colorado and integrated with the JPSS-1 spacecraft. The gimbals will steer the Ka-Band antennas so they can broadcast stored mission data to ground receiving stations like at Svalbard Norway, Antarctica, and sometimes Fairbanks, Alaska, and to the Tracking and Data Relay Satellite System (TDRSS).



JPSS-1 500 Nadir Ground Gimbal • Credit: Ball Aerospace & Technologies Corp.

NOAA'S POLAR FOLLOW ON / JPSS-3 AND -4 SATELLITES IN FINAL FY 2016 APPROPRIATIONS BILL

NOAA received funding and approval by the Congress in the FY 2016 appropriations bill for JPSS Program to initiate the Polar Follow-On / JPSS-3 and JPSS-4 satellites. With this funding, the JPSS Program now includes five polar-orbiting satellites, each with five instruments, and a versatile ground segment. The suite of satellites that are part of the JPSS Program are: Suomi NPP, JPSS-1, JPSS-2, JPSS-3, and JPSS-4. The JPSS program will now provide polar coverage through the 2030s to ensure the continuity and robustness of critical polar weather satellite observations.

JPSS provides data and information to NOAA's NWS, national defense, emergency managers and other users in the U.S. and around the globe with improved accuracy of public warnings and forecasts of weather and climate events, thus reducing the potential loss of human life and property.

Polar-orbiting satellites provide the most important type of observations for accurately predicting weather three days and beyond. This advanced notice greatly aids our Nation's leaders, decision makers, emergency managers, and media to provide better warnings and advisories to responders and to the public-at-large. The global environmental data from satellites in the JPSS constellation are fed into numerical weather prediction models to provide these warnings, forecasts, and environmental and climate monitoring.

CONTRACTS AWARDED FOR VIIRS, CrIS AND ATMS INSTRUMENTS FOR NOAA'S JOINT POLAR SATELLITE SYSTEM POLAR FOLLOW-ON / JPSS-3 AND JPSS-4 MISSIONS

On behalf of NOAA, NASA awarded contracts for the Polar Follow-On / JPSS-3 and JPSS-4 Missions. The sole source contract modification to Exelis Space Systems, Inc, a wholly owned subsidiary of the Harris Corporation of Ft. Wayne, Indiana, is for two CrIS instruments. The sole source contract modification to Raytheon Space & Airborne Systems is for two VIIRS instruments and the sole source contract modification to Northrop Grumman, of Azusa, California, is for two ATMS instruments. In each case, the Contractor will manufacture, test and deliver the instruments, support instrument integration on the JPSS-3 and 4 spacecrafts and provide launch and post-launch support. The contract modification is in process for the Polar Follow-On / JPSS-3 and JPSS-4 OMPS instruments.

EVENTS AND CONFERENCES

2016 AMERICAN METEOROLOGICAL SOCIETY 96TH ANNUAL MEETING

JPSS participated in the 2016 American Meteorological Society (AMS) 96th Annual Meeting in New Orleans, Louisiana in January. The Annual Meeting is the largest gathering for the weather, water, and climate community, bringing together great minds from a diverse set of scientific disciplines such as the physical, chemical, and biological study of the Earth, allowing important decisions to be made by policy makers and the public. This year's theme was "Earth System Science in Service to Society." NOAA Satellites was able to participate at AMS in a number of exciting ways; **click here to read more**.

ANNUAL INCIDENT METEOROLOGIST (IMET) VIRTUAL WORKSHOP

Several members of the JPSS PGRR Fire and Smoke Initiative Team participated in the IMET Workshop in Boise, Idaho during the 2nd week of March. They demonstrated a beta-version of a proposed Blended Fire and Smoke web-based product. This product uses the 'enhanced Infusing satellite Data into Environmental Applications (eIDEA) webpage as its host. The blended product features numerous VIIRS fire, smoke, and aerosol capabilities in an easy-to-use, zoomable, Google-maps interface. The positive responses from the IMETs following this demonstration showed that the initiative team was on the right track. The IMETs' feedback will be used to further develop the product in time to support of the 2016 Fire Season in Alaska and the US Western Region.

2016 OCEAN SCIENCES MEETING

The JPSS science team also participated in the 2016 Ocean Sciences Meeting cosponsored by American Geophysical Union, Association for the Sciences of Limnology and Oceanography, and The Oceanography Society on February 21-26th in New Orleans, Louisiana. The meeting consisted of a diverse program covering topics in all areas of the ocean sciences discipline and was attended by more than 6,000 scientists, managers, and other professionals from various ocean disciplines in the U.S. and participating international countries. The team lead led a session entitled "Advancing Water Quality Monitoring, Desalination, and Forecasting in Urban Coastal and Inland waters," which advanced the goals and objectives of the international Water Quality Summit held in 2015, particularly development of urban water quality monitoring and forecasting in developed and developing nations.

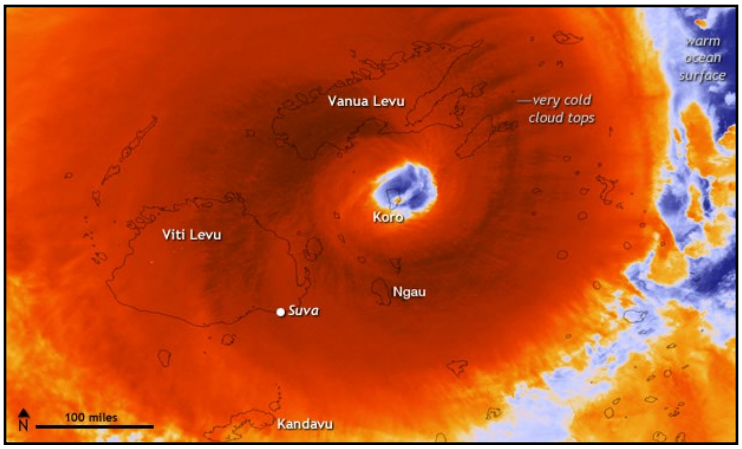
INTERESTING IMAGES

TROPICAL CYCLONE WINSTON SPRAWLED ACROSS THE FIJI ISLANDS ON FEBRUARY 20, 2016

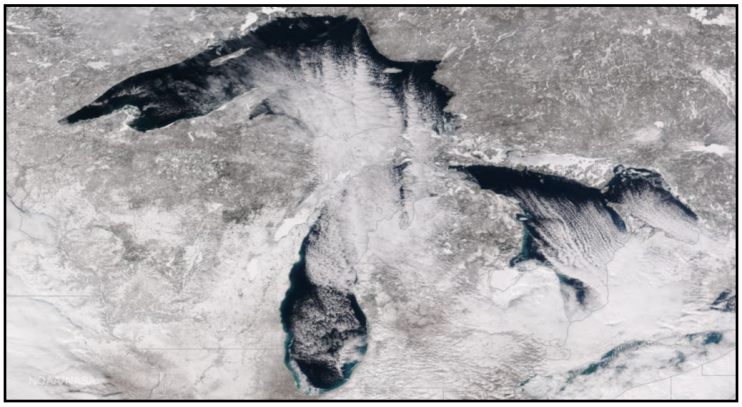
As one of the strongest storms ever recorded in the Southern Hemisphere, tropical cyclone Winston and its 185-mph winds caused widespread devastation across the island nation of Fiji when it made landfall February 19-20. The storm was one of the strongest tropical cyclones to make landfall anywhere on earth since the modern era of global records began in 1970.

This infrared view of the storm from the Suomi NPP satellite shows warm surfaces (such as the open ocean at image upper right) in shades of blue with progressively colder temperatures (such as the tops of Winston's towering thunderstorm clouds) in darkest red.

Credit: NOAA Environmental Visualization Lab



GREAT LAKES TOTAL ICE COVER AT 23.7%

The February 2016 total ice cover on the Great Lakes was much less than the previous two years, with ice concentrated along the shorelines. Understanding the major effect of ice on the Great Lakes is crucial because it impacts a range of societal benefits provided by the lakes, from hydropower generation to commercial shipping to the fishing industry. The amount of ice cover varies from year to year, as well as how long it remains on the lakes. This image was taken by Suomi NPP's VIIRS instrument on February 17, 2016.

Credit: NOAA Environmental Visualization Lab