



Joint Polar Satellite System (JPSS)

PRODUCTS AND PLANS

Mitch Goldberg

Program Scientist

Joint Polar Satellite System
National Environmental Satellite, Data, and Information Service
U.S. National Oceanic and Atmospheric Administration
U.S. Department of Commerce



JPSS Overview

JPSS is NOAA's next generation operational polar orbiting satellites in the early afternoon orbit with an ECT of 1:30 pm

JPSS consists of five satellites (Suomi NPP, JPSS-1 through JPSS-4), ground system and operations through 2038

SNPP is NOAA's primary weather satellite, NOAA-19 secondary

JPSS-1 immediately becomes NOAA-20 once safely in orbit

JPSS is a partnership between NOAA and NASA

NASA is the acquisition agent for the flight system (satellite, instruments and launch vehicle), mission unique ground system, leads program systems engineering, and program safety and mission assurance

NOAA is responsible for operations, enterprise ground, operational science algorithms, data exploitation and archiving, infrastructure

Includes Joint Polar System agreement with EUMETSAT and DoD, and agreements with JAXA



JPSS Overview Video



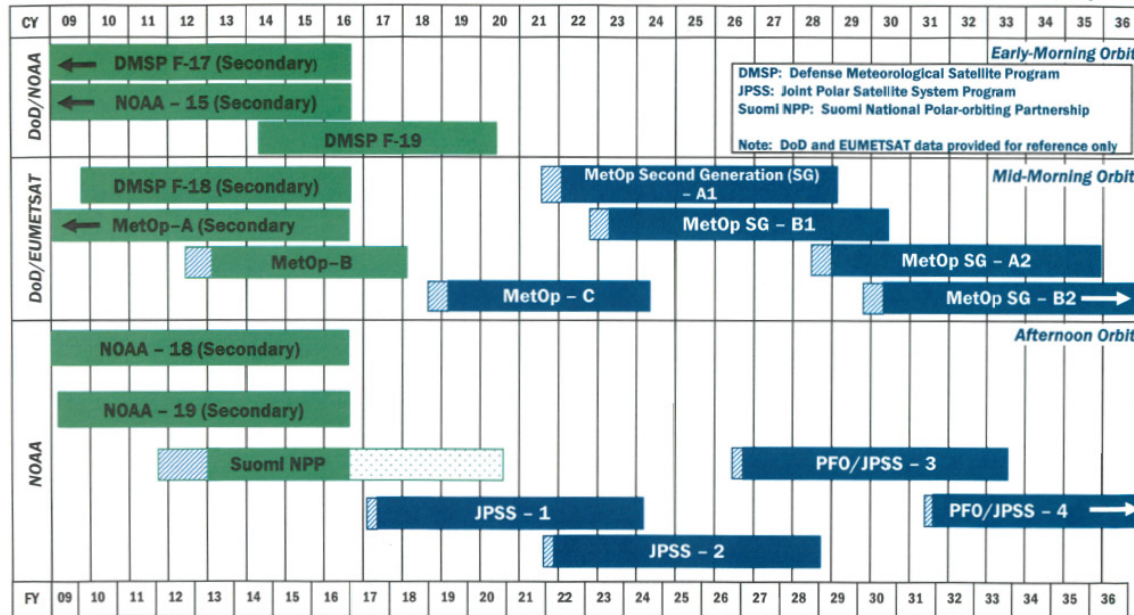
Polar Satellite Launch Schedule



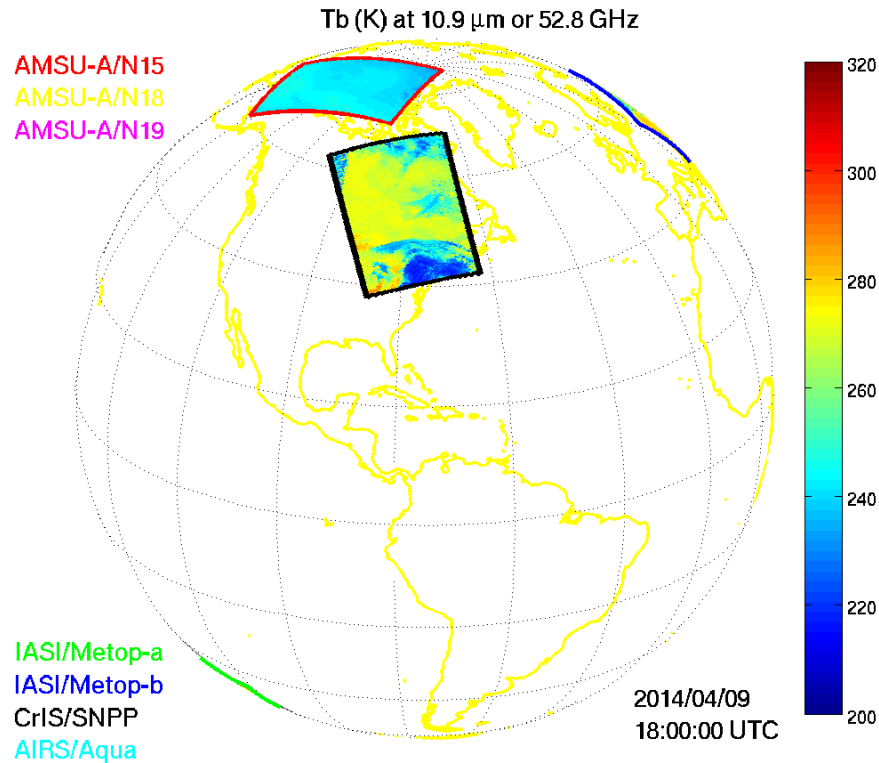
NOAA & Partner Polar Satellite Programs Continuity of Weather Observations



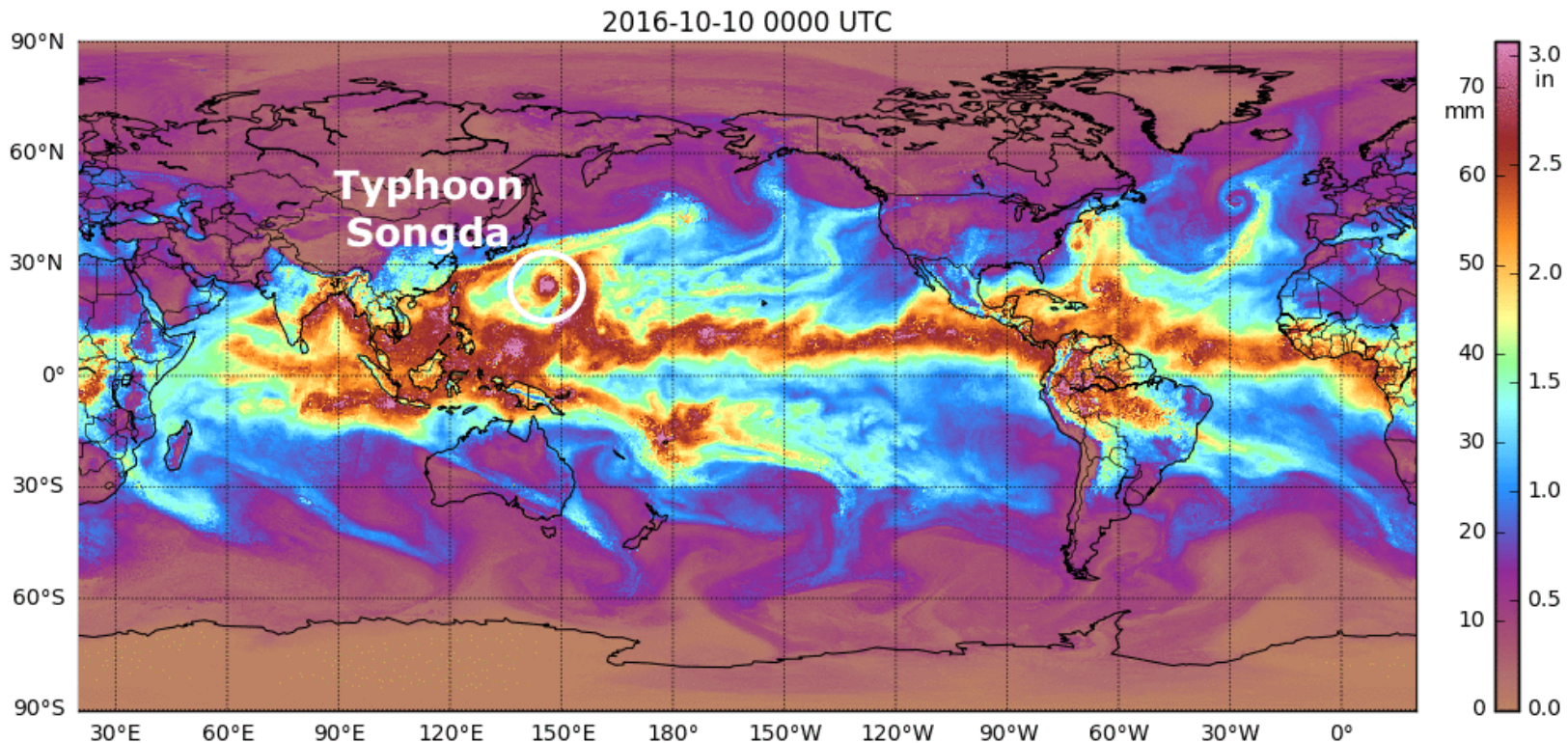
As of January 2016




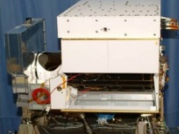
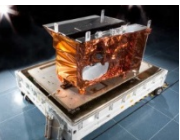

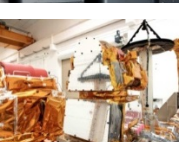
Multiple Orbits Create Better Coverage



Data Fusion of 5 microwave sounders to produce hourly total precipitable water

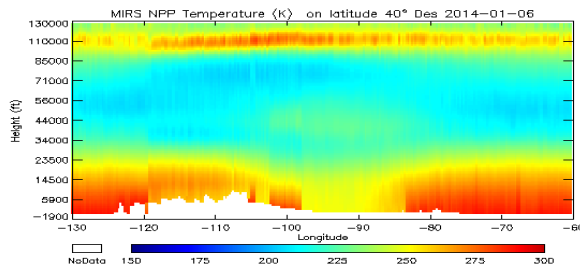


From Tony Wimmers - MIMIC TPW2

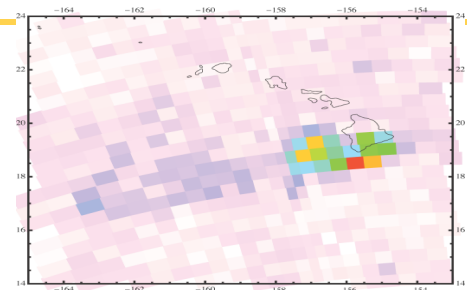
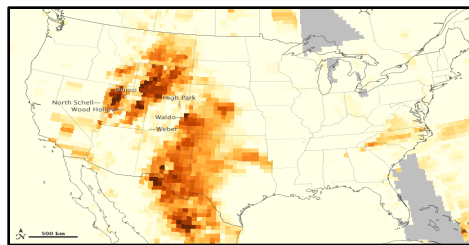
JPSS Instruments		Measurements
	ATMS—Advanced Technology Microwave Sounder	ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 3 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks
	CrIS—Cross-track Infrared Sounder	
	VIIRS—Visible Infrared Imaging Radiometer Suite	VIIRS provides many critical imagery products including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, and phytoplankton/chlorophyll abundance
	OMPS—Ozone Mapping and Profiler Suite	Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts
	CERES—Clouds and the Earth's Radiant Energy System	Scanning radiometer which supports studies of the Earth Radiation Budget

JPSS provides a wide range of capabilities

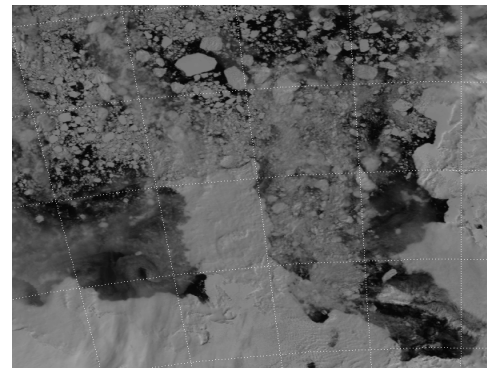
- Microwave – provides temperature and moisture soundings in cloudy conditions and rainfall rates, sea ice, snow, surface temperature - ATMS
- Infrared – provides high vertical resolution temperature and moisture soundings in clear and cloud corrected regions; atmospheric chemistry - CO, CH₄, SO₂, ... and cloud products - CrIS
- Visible (day & night) and Infrared Imagery (including deep blue channels) – chlorophyll, cloud imagery, cloud products, SST, Active Fires, Smoke, Aerosols, land products, Snow, Ice, oil spills... at exceptional resolution/global coverage - VIIRS
- UV - ozone - Aerosols over bright surfaces, SO₂ plumes, NO_x (air quality)... - OMPS



Algae in Lake Erie

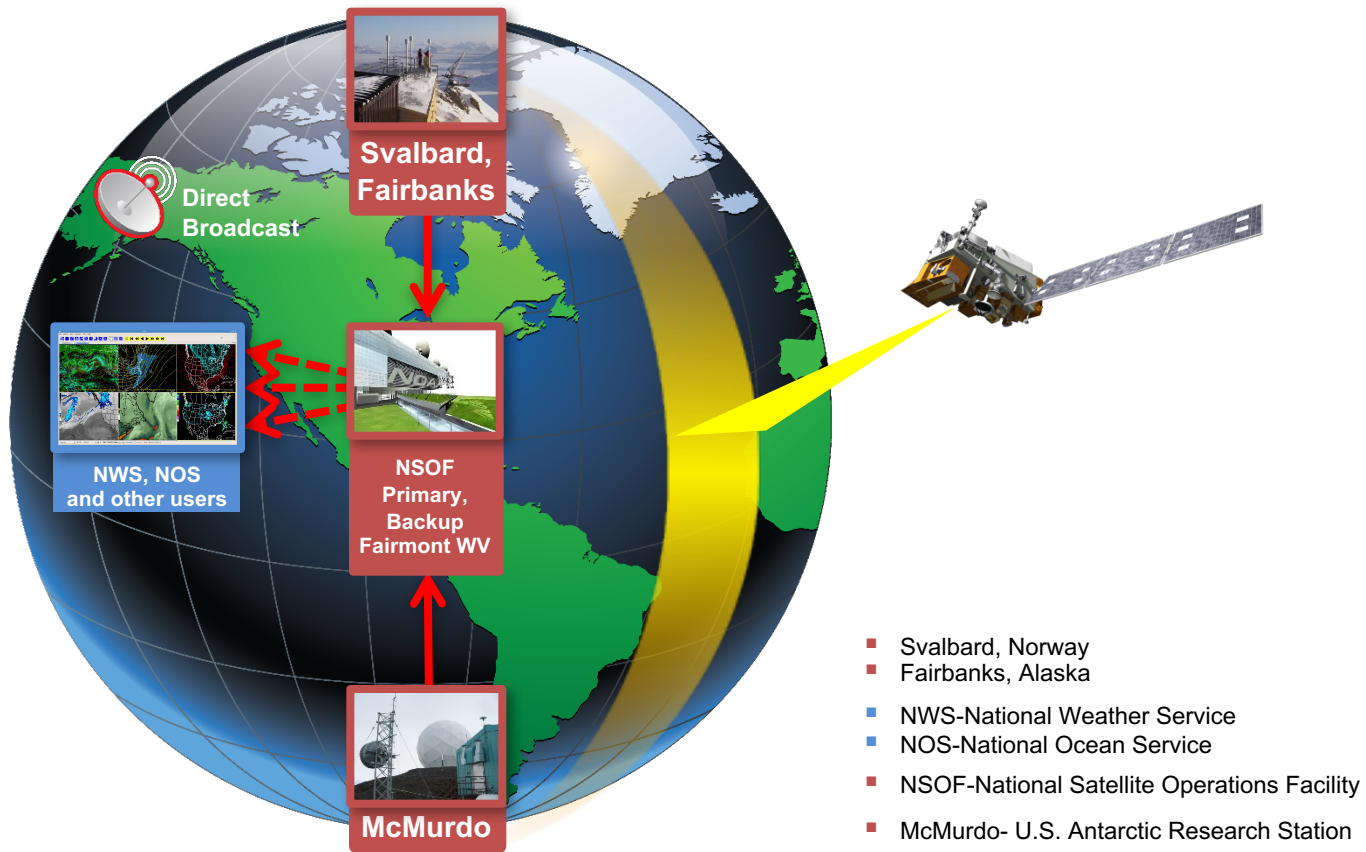


OMPS- Volcano SO₂ degassing



DNB Ice detection

JPSS System Architecture



Operational Use of JPSS Data

NOAA real-time users of JPSS data include:

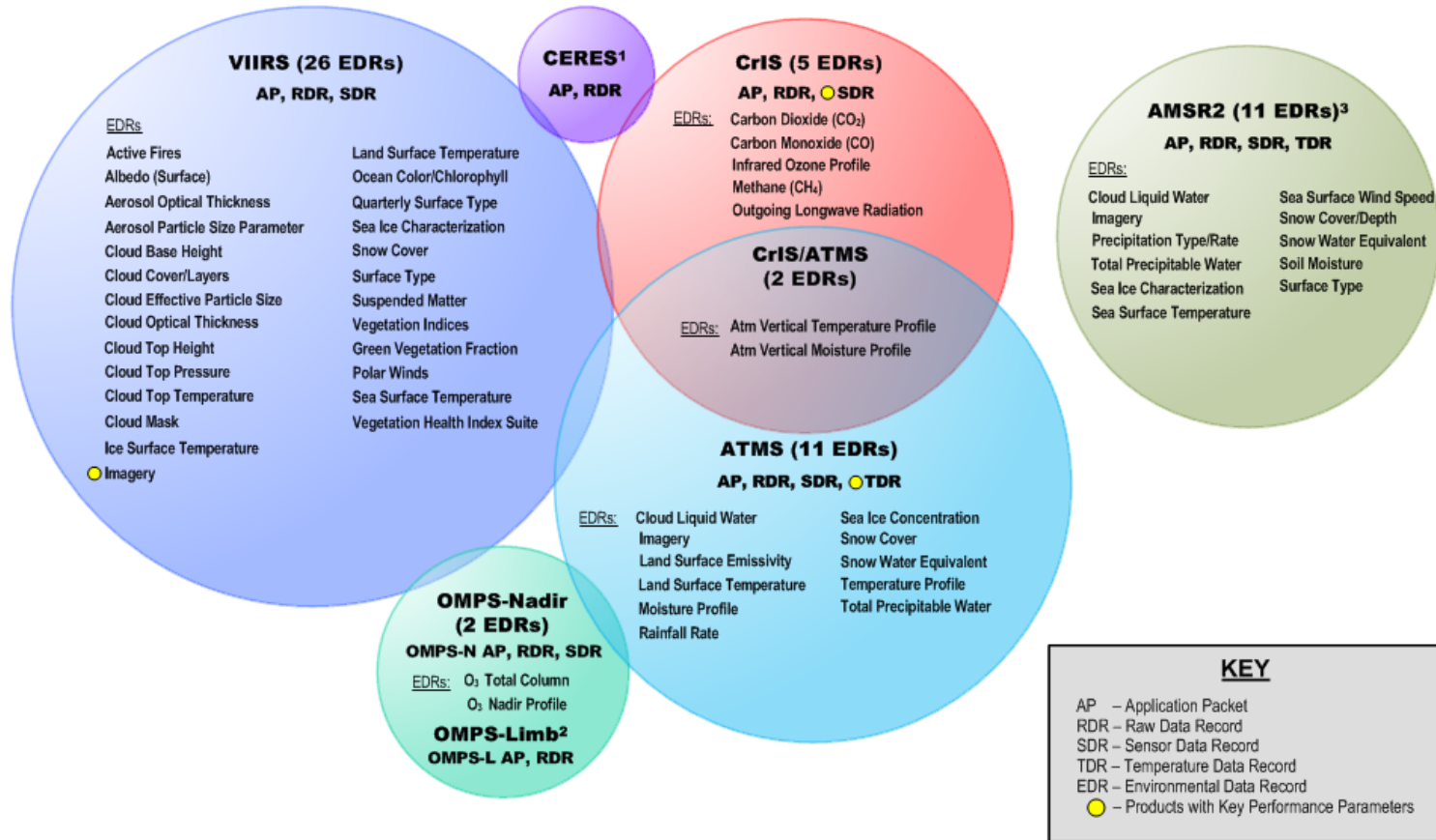
- National Weather Service
 - ATMS and CrIS for weather forecasts
 - VIIRS nowcasting imagery and products
 - VIIRS environmental products for modeling and assessments
 - OMPS ozone for ozone monitoring and UV forecasts
- National Ocean Service
 - Coastal water quality alerts
 - Harmful algal bloom alerts
- National Marine Fisheries Service
 - Marine resources/ecosystems
- NOAA Satellite and Information Service
 - Hazard mapping system
 - COASTWATCH



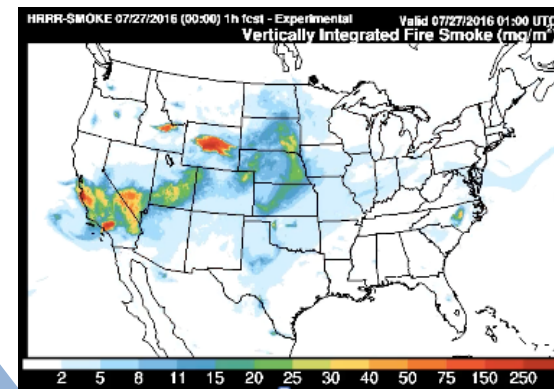
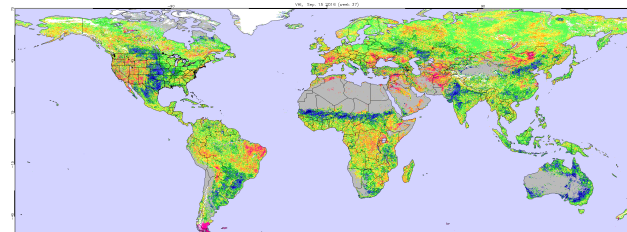
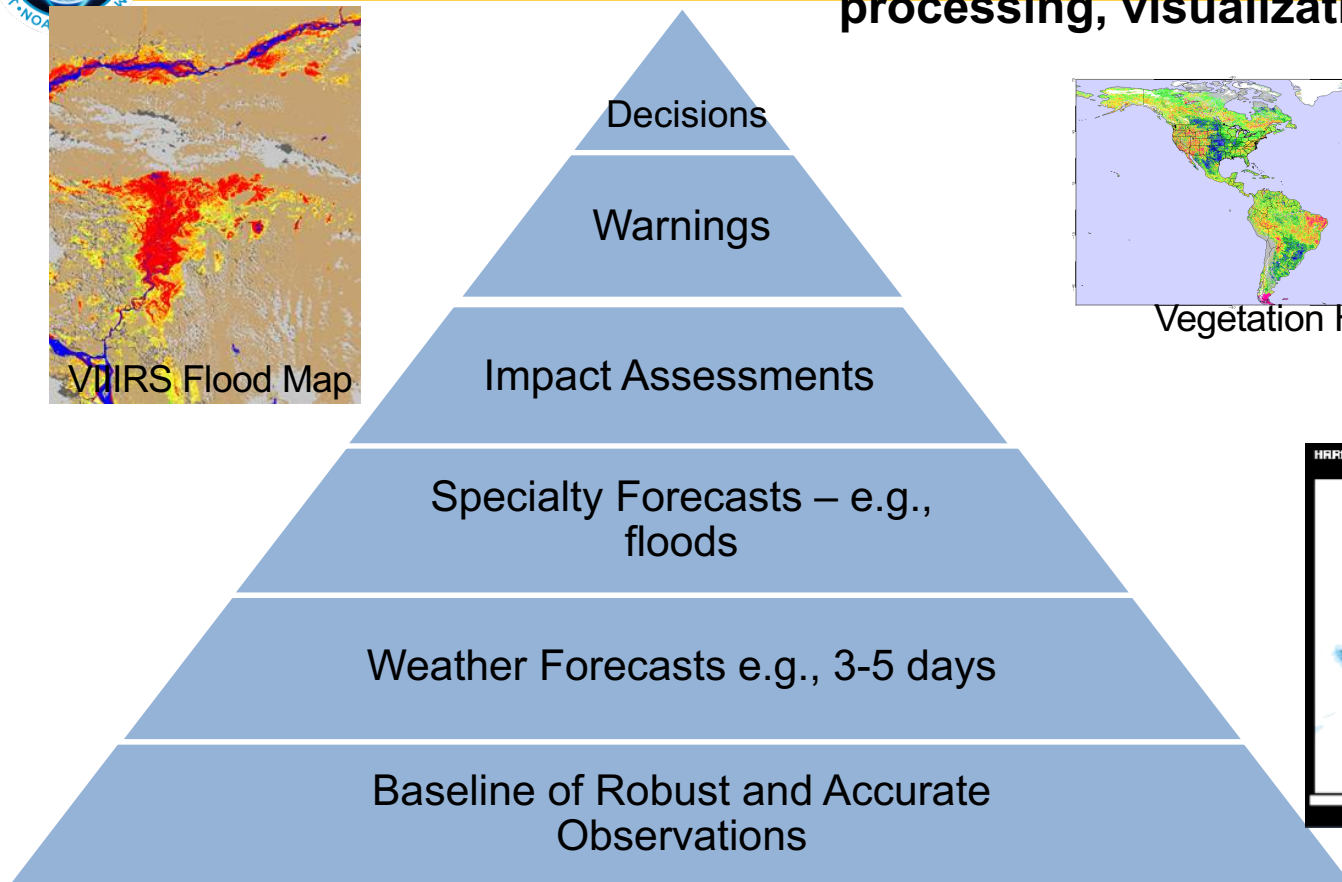
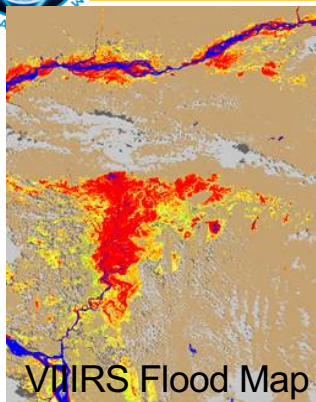
Partner real-time users of JPSS data:

- DoD forecast agencies
- EUMETSAT member meteorology services
- Other Met agencies around the world

JPSS Program Data Products



Societal Benefits – Accurate decisions are driven by observations, science, applications, data processing, visualization, and access





User Engagement: PGRR

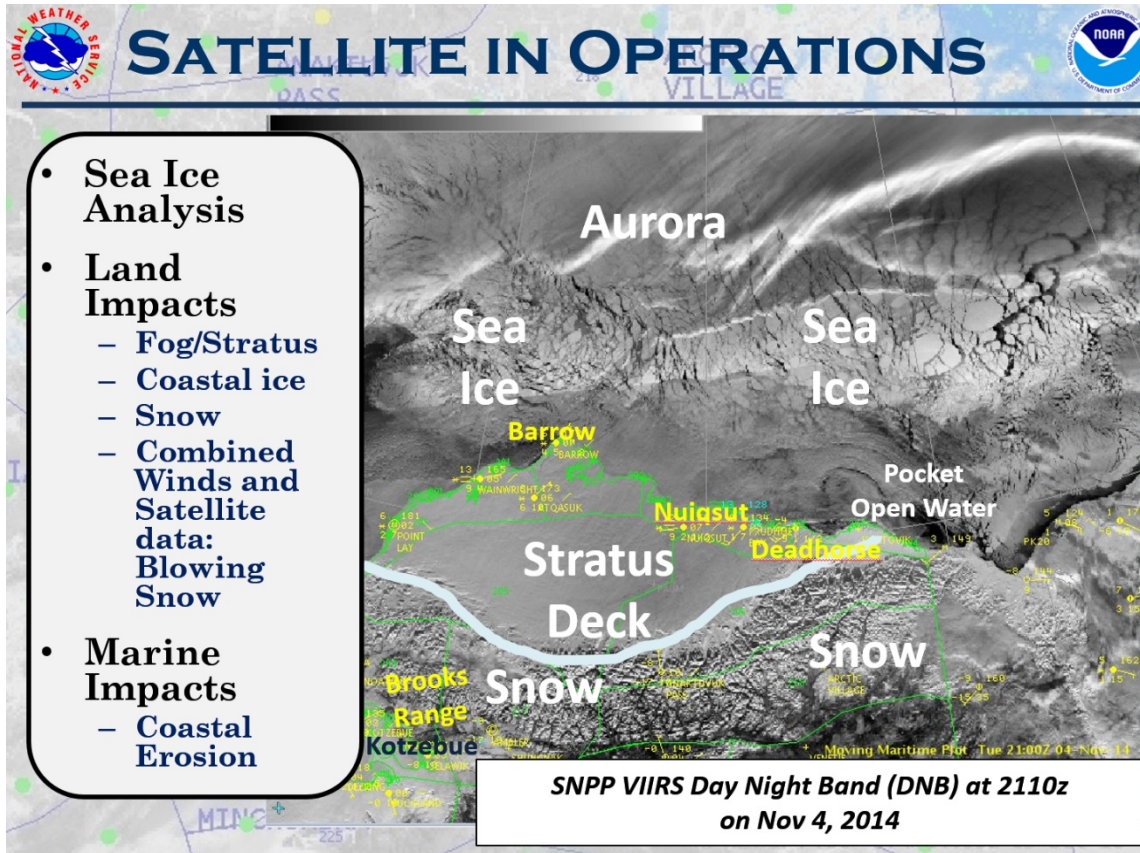
The Proving Ground and Risk Reduction program enhances user applications of JPSS data, algorithms and products by stimulating interactions between technical experts and key user stakeholders.

Initiatives include:

- River Ice and Flooding
- Fire and Smoke
- Sounding Applications NOAA Unique CrIS/ATMS Processing System (NUCAPS)
- OCONUS and NCEP Service Centers—AWIPS
- Hydrology
- Atmospheric Chemistry
- Ocean and Coastal
- Severe Weather/NWP/Data Assimilation
- Arctic
- Innovation and Training



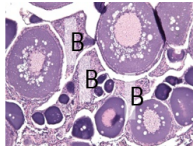
NWS Alaska utilizing JPSS Data



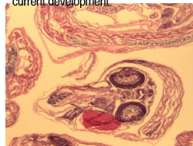
NOAA Fisheries utilizing JPSS Data



NOAA
FISHERIES
AFSC
Kodiak Laboratory
Christina Conrath



A histological section of a non-spawning adult shortraker rockfish. There is evidence of a prior spawning (B) but no current development.



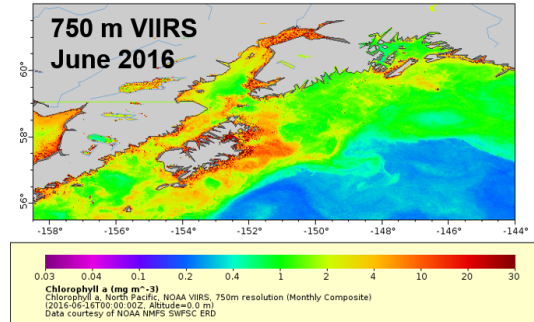
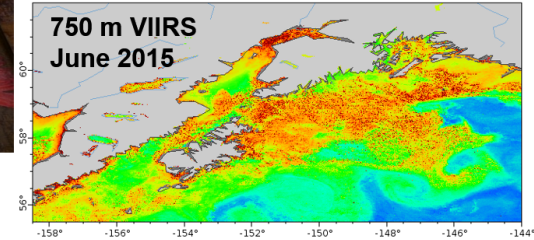
A histological section of a spawning adult shortraker rockfish. The embryos within this section were at the eyed stage of development.

Temporal variability in rockfish reproductive parameters in the Gulf of Alaska



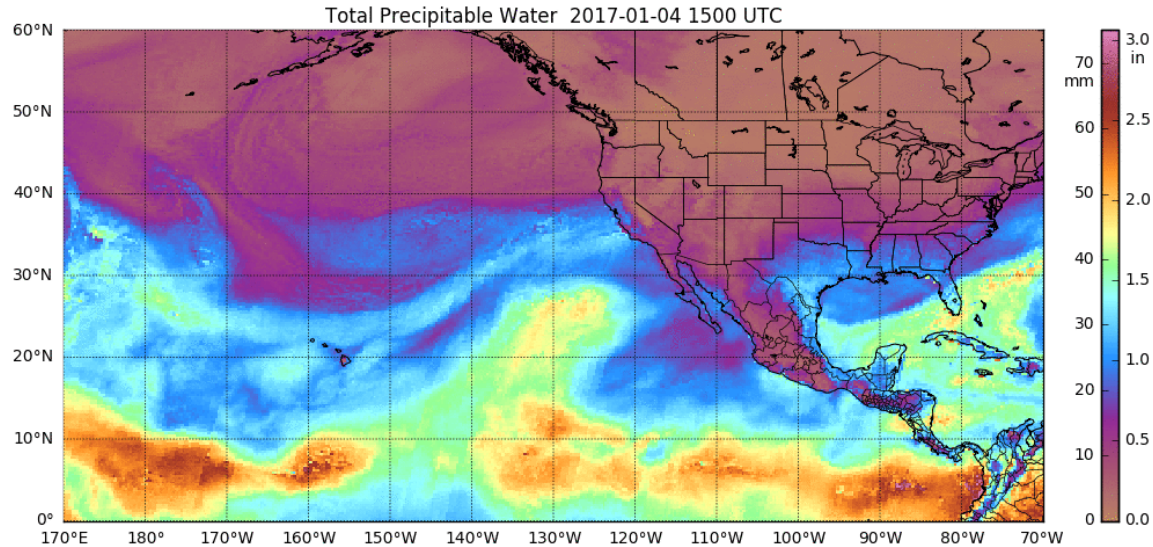
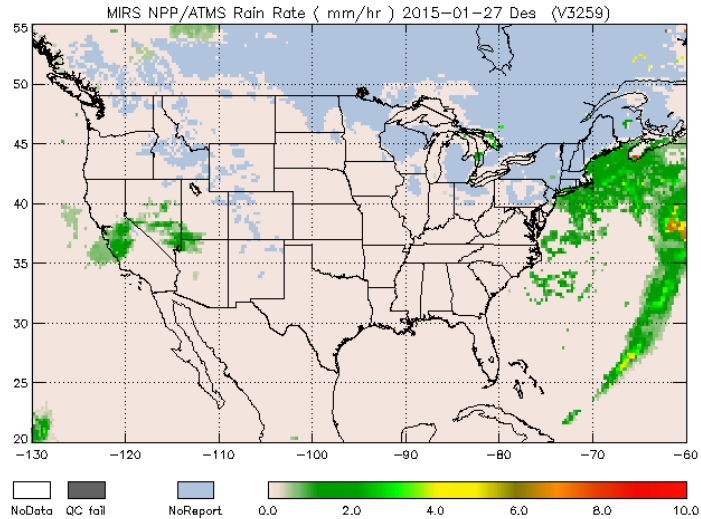
Objective

Examine temporal variability in reproductive parameters (maturity, fecundity, reproductive success, and the strength of maternal effects) to see how these changes may be related to environmental variability including sea surface temperature and primary productivity.

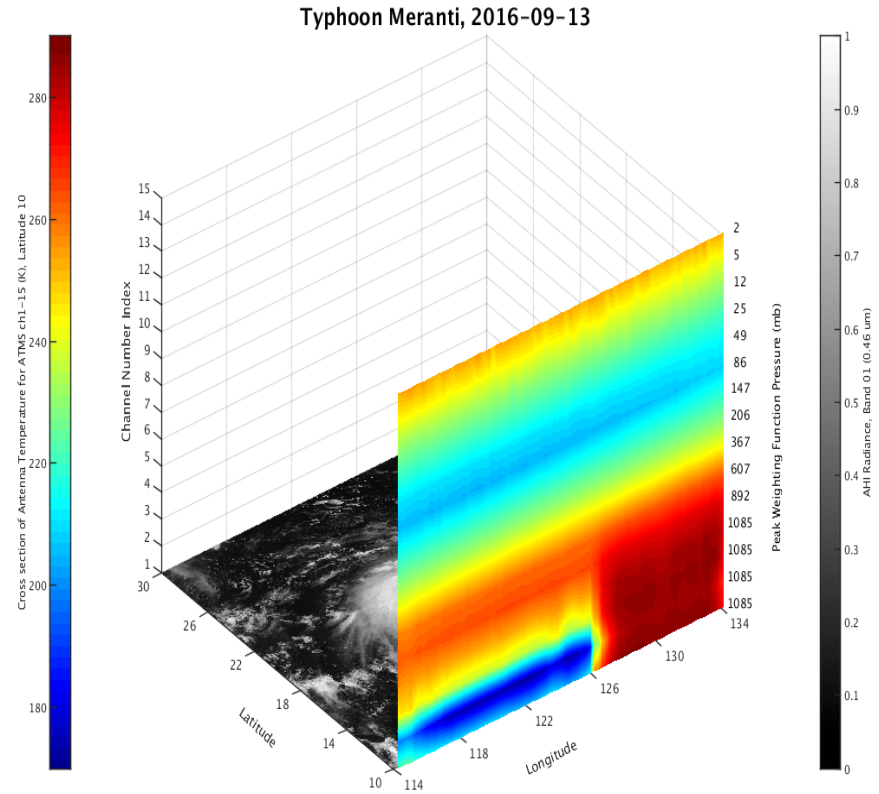
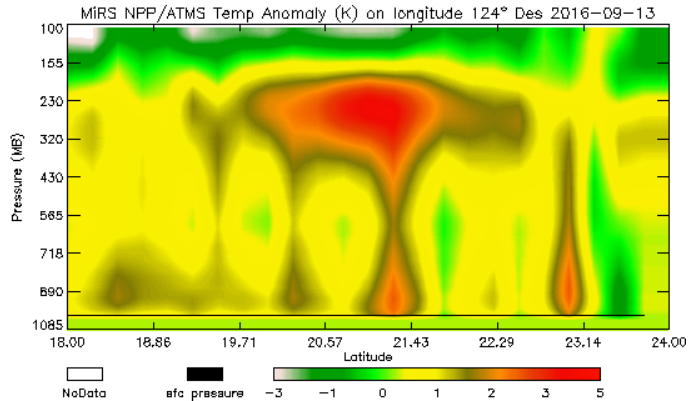


These charts show the variability in chlorophyll a concentrations on the same day during two different years (2015 and 2016).

ATMS Monitors Rain and Precipitation

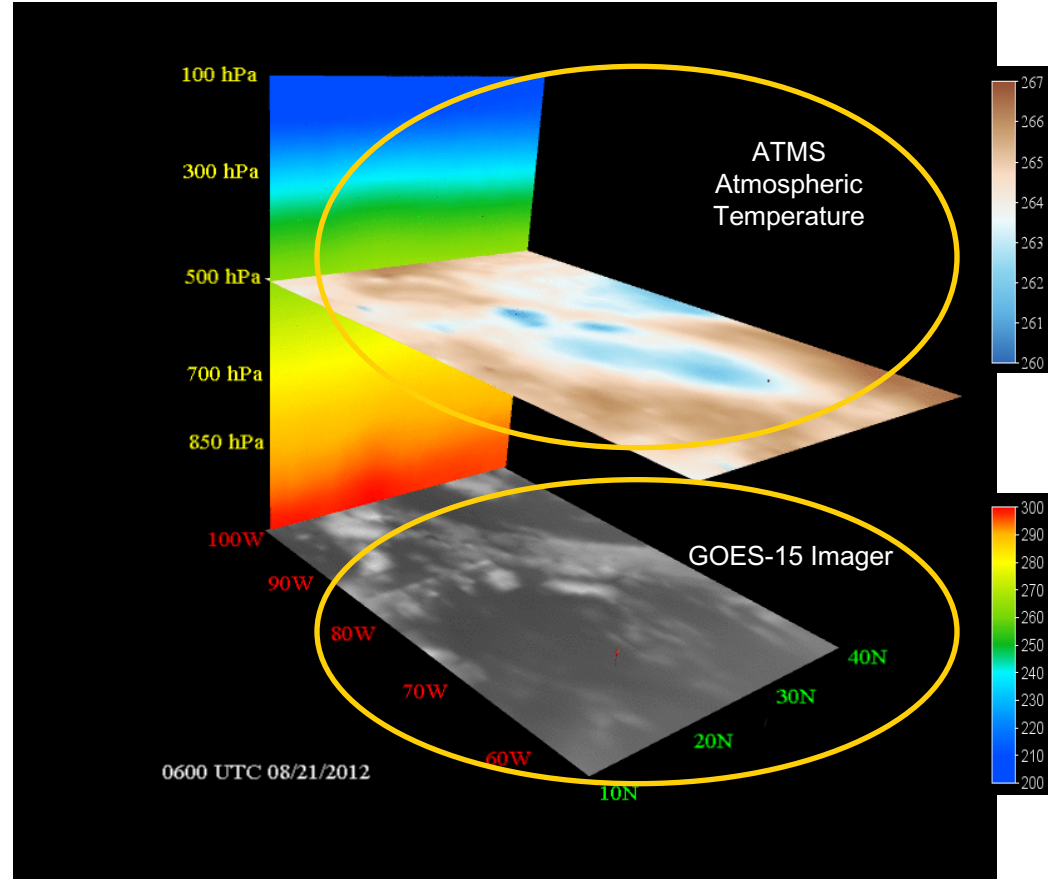


ATMS Measures Vertical Profiles



ATMS Measures Vertical Profiles

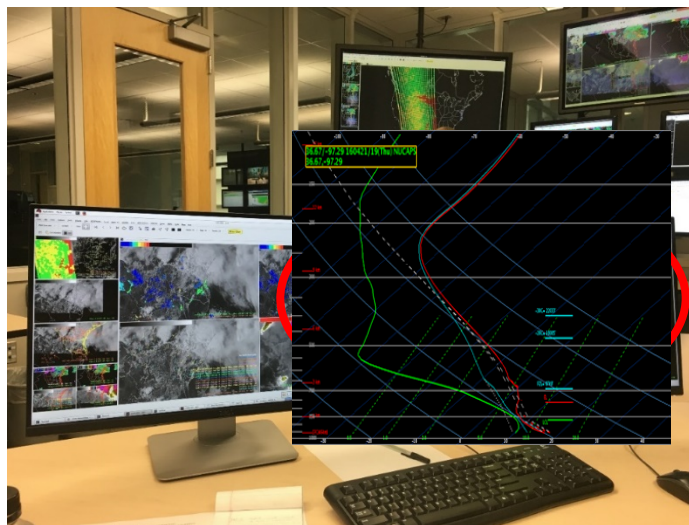
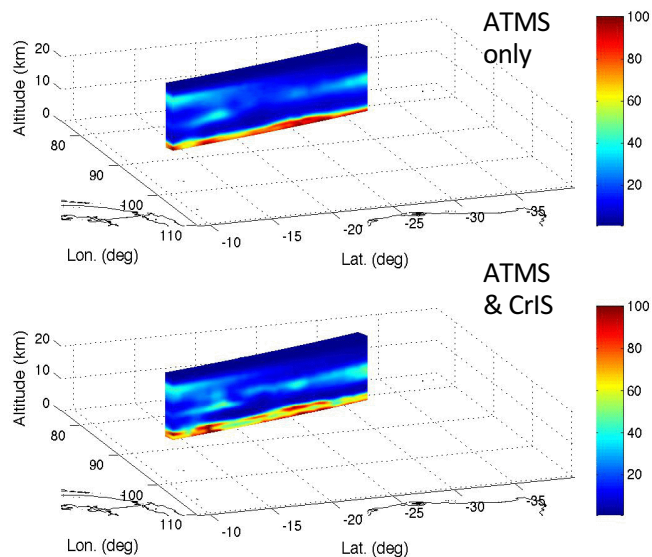
Hurricane Isaac's warm core characterized by a 2K anomalous temperature.



Credit: Fuzhong Weng

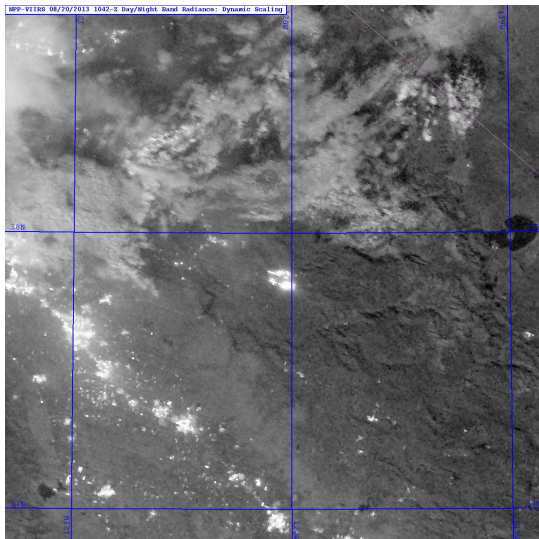
Combine CrIS and ATMS in AWIPS

Relative Humidity Vertical Slice



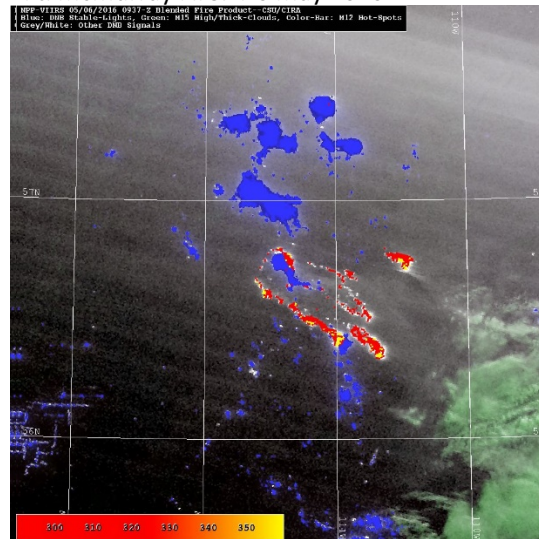
New capabilities for fire detection

Rim Fire: ~Aug 2013



Help firefighters monitor the status of nocturnal fire lines,

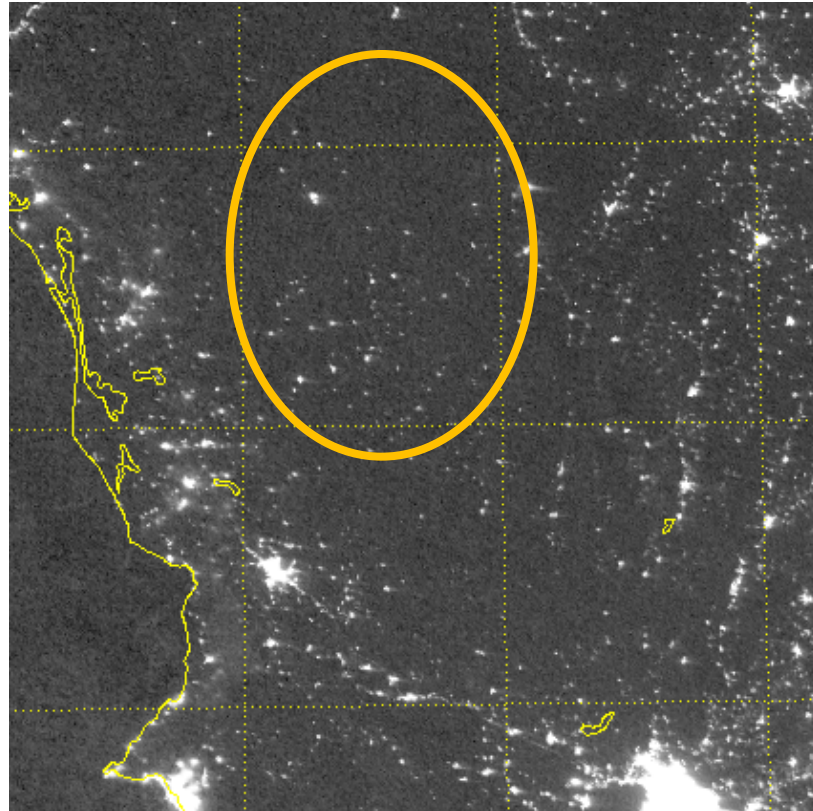
Ft. McMurray Fire: 4-6 May 2016



Detection of lights from small/nascent fires (e.g., lightning triggered) initially undetected by thermal infrared bands.

08:43 UTC
23 May 2017

- VIIRS 4.0 μm fire detection band (M-13) shows small fires in the Sierra Madre Occidental (Durango, Mexico).
- The Day/Night Band better highlights these fires at night, improving fire detection.
- VIIRS Day/Night Band image from 08:10 UTC 28 April 2017



Suomi NPP VIIRS I-band

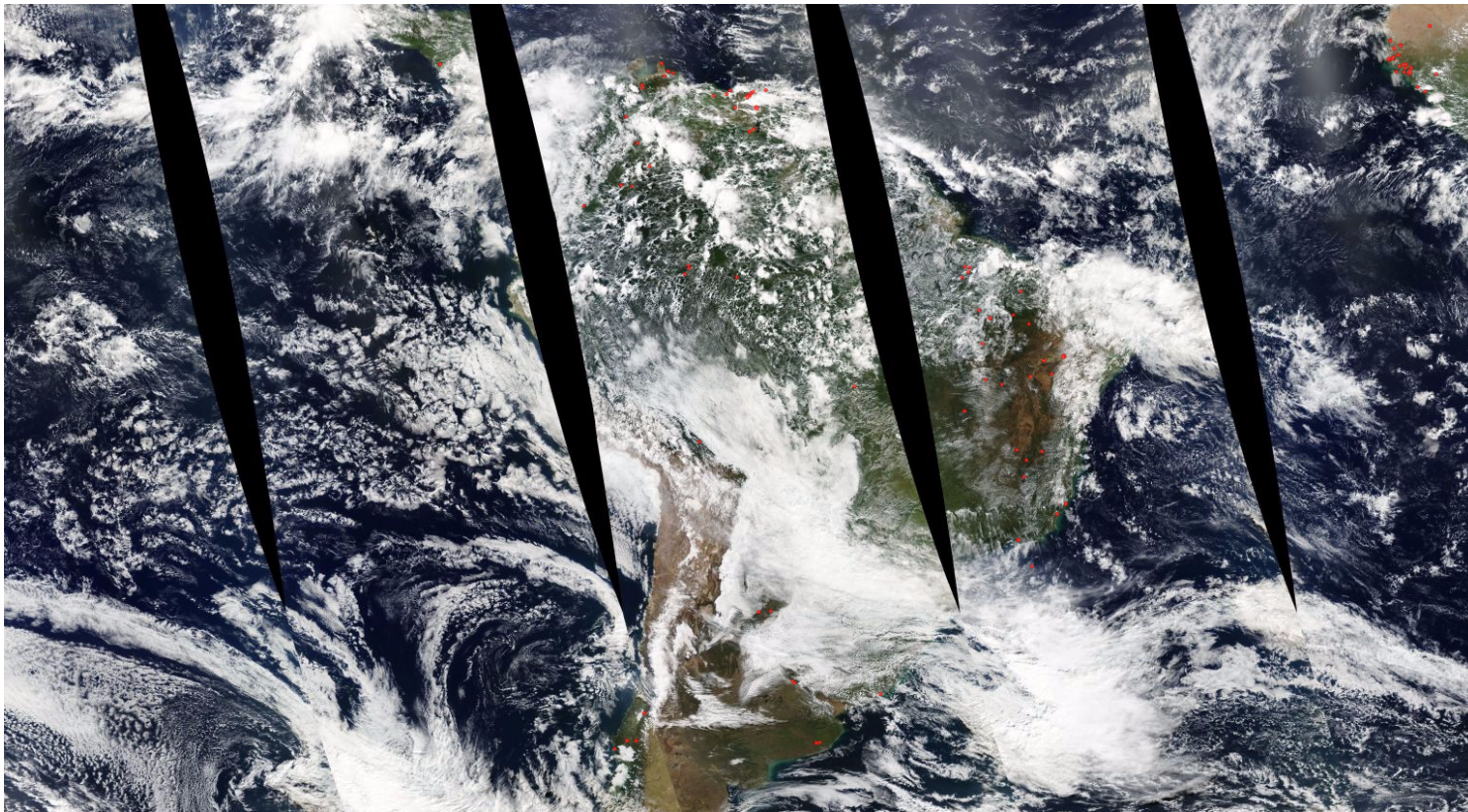


May 29, 2017

<https://worldview.earthdata.nasa.gov>

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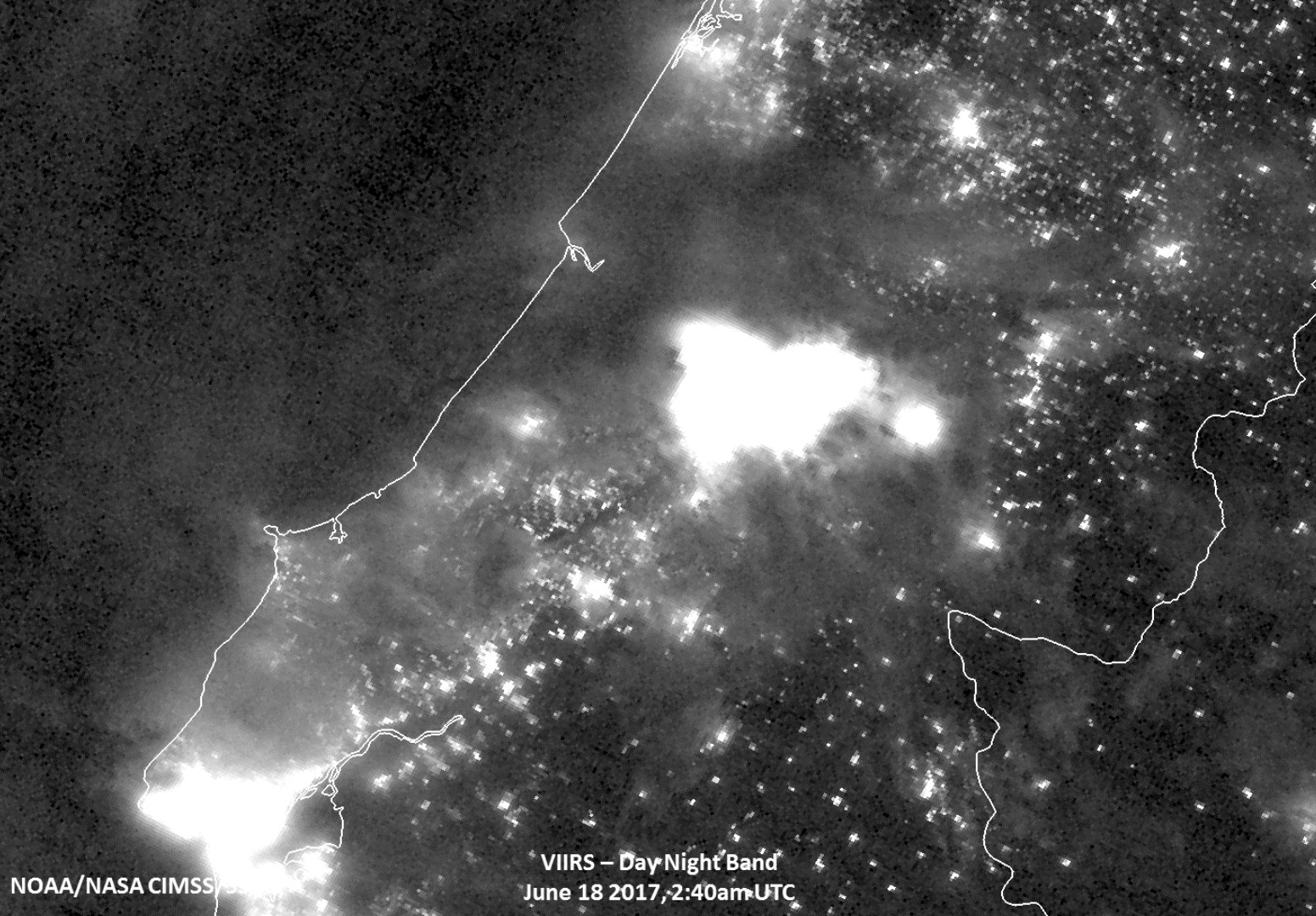
Aqua MODIS



May 29, 2017

<https://worldview.earthdata.nasa.gov>

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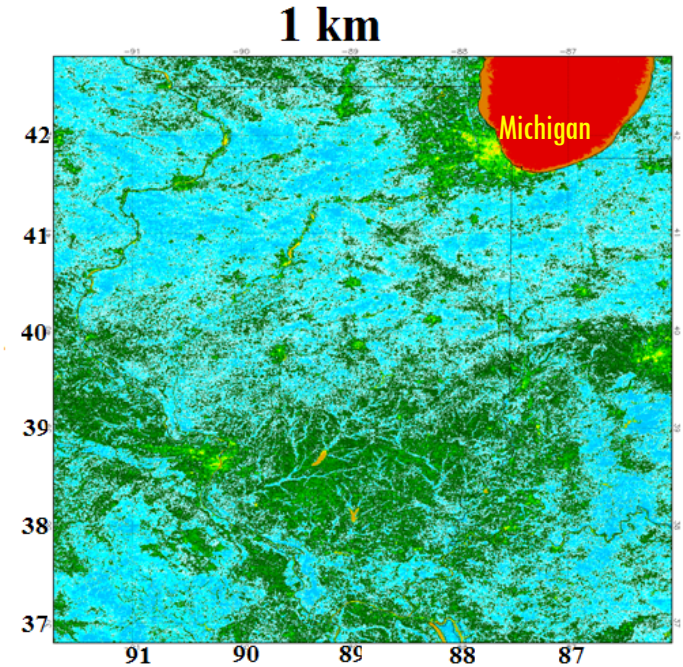
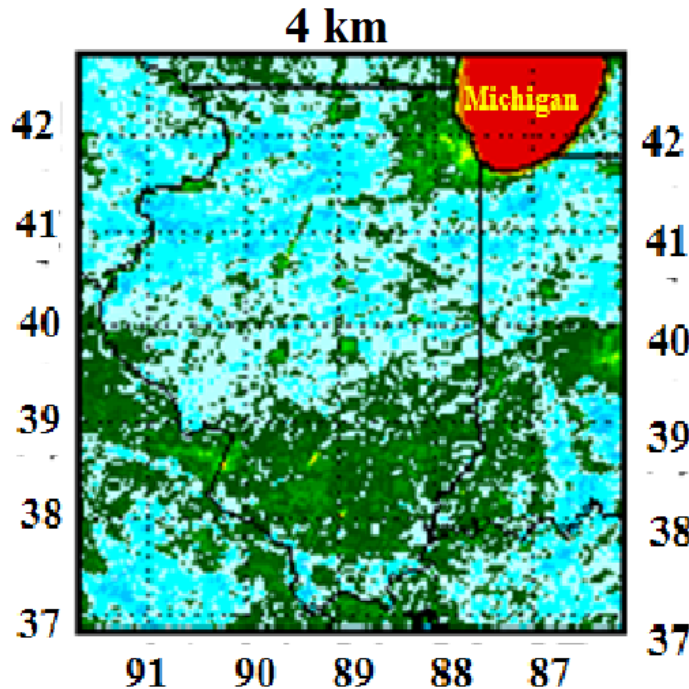
NOAA/NASA CIMSS

VIIRS – Day-Night Band
June 18 2017, 2:40am UTC

Credit:
Straka

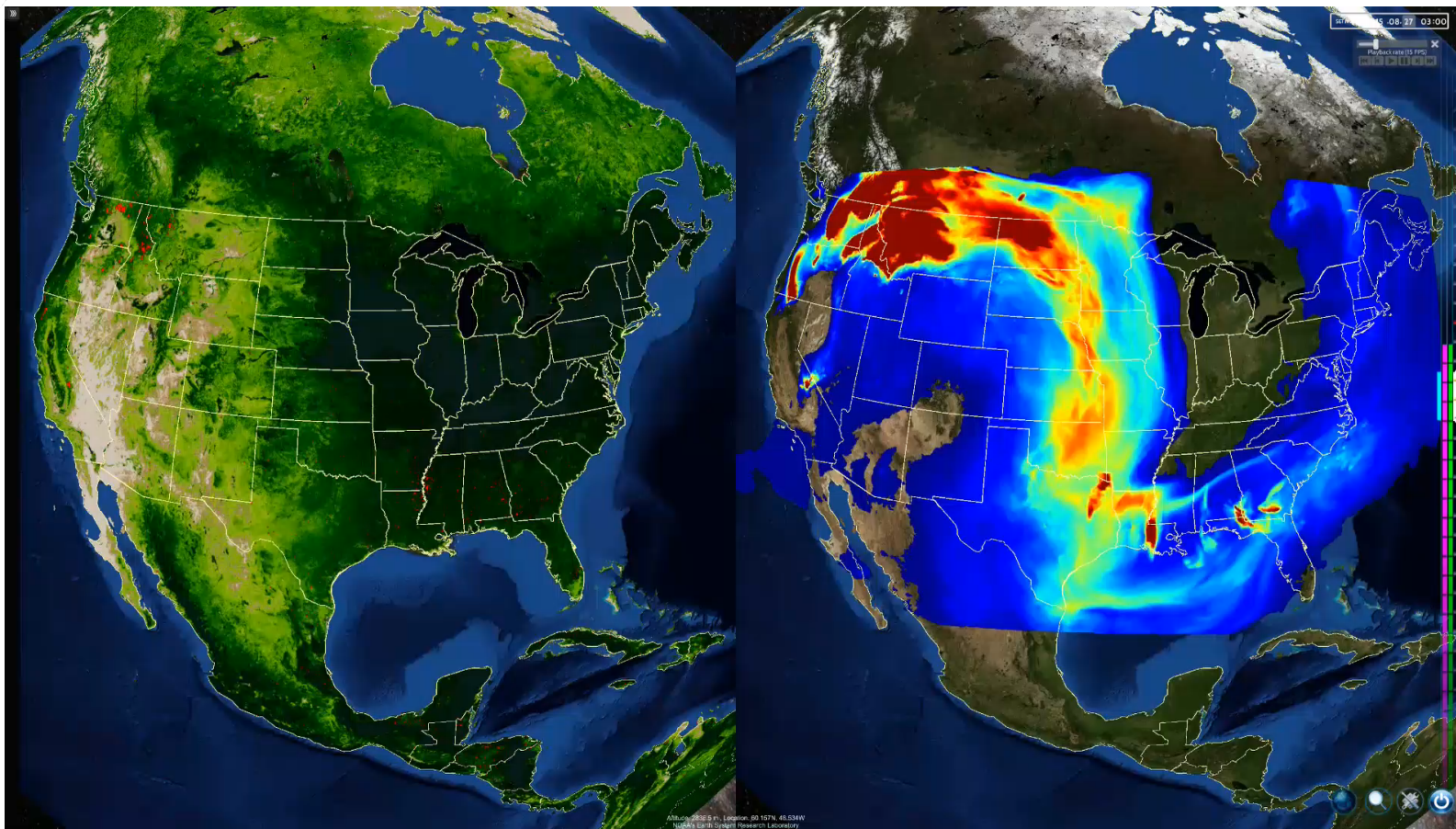
VIIRS NDVI, Jul 28, 2012

NDVI is used as a base for Vegetation fraction and Ecosystem classes used in NWS modeling



resolution NDVI shows many features which is hard to see with 4 km data:
 small lakes & reservoirs
 river valleys

VIIRS fire location/FRP to smoke forecasts



NWS River Forecast Centers utilizing JPSS Data



A Case Study of the 2015-2016 Mississippi River Basin Flood Using Suomi-NPP VIIRS Flood Products

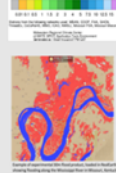
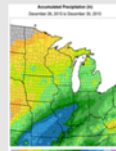
Mike DeWeese
NWS North Central River Forecast Center
Chanhassen, MN 55317



Background

Historic flooding from an unusual winter rainfall event impacted Missouri in December 2015. Rain amounts of 8-10 inches fell along a 60-mile-wide band across the Meramec and lower Missouri Rivers, and into the Illinois River basin. The heavy rain event fell on saturated ground due to rainfall over the previous week, causing widespread major to record flooding. Rivers spilled into the flood plain as numerous levees were breached and water backed up into tributaries. River forecast models were adjusted in real time, based on observed information, to account for these dynamic conditions as they occurred during this event.

One new source of observed data utilized was the Flooded Area Imagery from the Suomi-NPP VIIRS satellite, developed by George Mason University. This experimental product has been under development since 2014 and proved valuable in determining the flood inundated areas, providing forecasters and decision makers with detailed inundation imagery over extensive areas.



US Army Corps of Engineers made a map book using VIIRS 30-m flood maps along the Illinois River during the Midwest flood event in January 2016.



VIIRS Processing and Dissemination

The VIIRS floodwater fraction product has been available routinely at five River Forecast Centers in the USA since 2014, under the support of the Joint-Polar Satellite System Proving Ground and Risk Reduction Program (JPSS/PGRR). The 375 meter resolution VIIRS images are processed initially at GMU, then sent to the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin. From there the images are repackaged for dissemination in AWIPS. The images are also downsampled from the native 375 M resolution to 30 M high resolution images available in the web based Real Earth viewer at CIMSS.



The downsampled 30-m flood maps present a lot more inundation details than the original VIIRS 375-m flood maps.

VIIRS near-real-time flood maps:

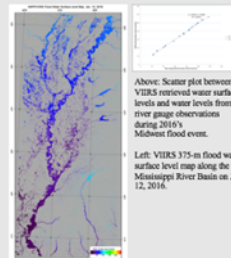
- ✓ Coverage: any regions between 80° S and 80° N.
- ✓ Spatial resolution: 375-m
- ✓ Flood types: supra-vapour flood and supra-snow/ice flood.
- ✓ Classification types: Cloud, Snow, River/Lake Ice, Shadow (cloud shadow and terrain shadow), supra-snow/ice, Normal Open Water, and Flooding Water fractions of supra-vapour flood.
- ✓ Near-real-time 375-m resolution JPSS VIIRS Flood Products are distributed to forecasters in AWIPS, and to the general public via RealEarth's web-based mapping service.
- ✓ RealEarth is available online or via mobile app.

<http://realearth.soc.wisc.edu>



Downscaling and Operational Applications

River forecasters used the imagery to adjust models for extensive flood plain storage effects, thereby improving model simulations of river levels at downstream points. The images were also provided to the FEMA Region VII Regional Response Coordination Center (RRCC) for daily briefings and high level response planning. The USACE Rock Island District used the images to develop a flood playbook for Emergency Managers to monitor levee conditions on the Illinois River. Finally, the images were provided to the Ohio and Lower Mississippi River Forecast Centers (OHRFC and LMRFC) for their use as the flooding progressed to other regions.



Above: Scatter plot between VIIRS retrieved water surface levels and water levels from river gauge observations during 2016's Midwest flood event.

Left: VIIRS 375-m flood water surface level map along the Mississippi River Basin on Jan. 12, 2016.


Future Development

Developers are working with the NCRFC to create water level images in addition to flood areas. Results have been validated within one meter accuracy for several events based on the 30 M STRM DEM dataset. The potential for improved vertical accuracy within one foot or less is high using the 10 M NED dataset, which will be completed in the next phase of the project. This will provide forecasters with quantitative gridded forcings that can be used to directly calculate storage volumes in river models, which have never been available before.

JPSS PGRR responds to International Disaster Charter

Example of NOAA responding to International Disaster Charter Activation June 6, 2017

for floods in Uruguay. - VIIRS found more flooding In Argentina than Uruguay



**International Charter
SPACE & MAJOR DISASTERS**

[About the Charter](#)
[Activations](#)
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[News](#)

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[- Latest Activation](#)

Flood in Uruguay
 Tuesday, 06 June 2017



Location of Event: Uruguay

Date of Charter Activation: 6 June 2017

Time of Charter Activation: 15:17:00

Time zone of Charter Activation: UTC+03:00

Charter Requestor: Sistema Nacional de Emergencias - Presidencia de la República

Activation ID: 535

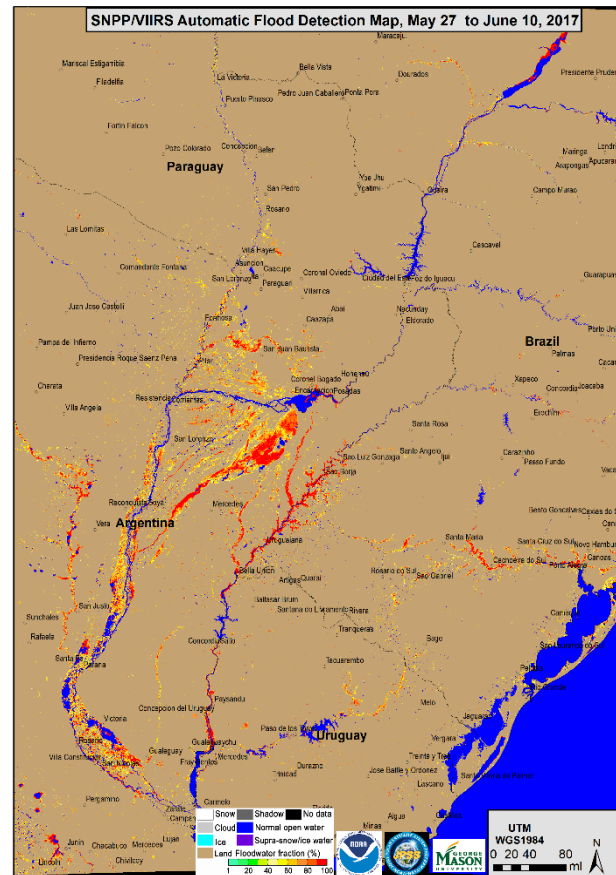
Project Management: CONAE

Description of the event

Heavy rains caused severe flooding in Uruguay's Salto Department, Paysandú Department and Bella Unión city of the Artigas department displacing 3500 people.

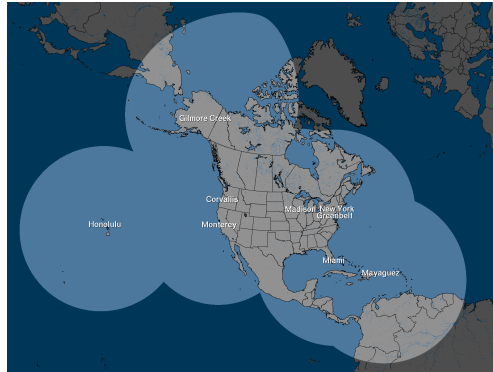
Uruguay's National Emergency System (SINAE) are visiting affected areas to assess the damage and prepare relief efforts. Many of the displaced people are already receiving food, shelter and medical care.

Northern parts of Uruguay have been under a heavy rain warning since 24 May, and authorities expect further rain with flood waters set to continue rising.



Foundation to Proving Ground

- Enterprise algorithms and Cal/Val Program
- Direct Readout Capabilities – CSPP
- STAR R&D Services
- User workshops and Training
- Management commitment
- Innovation



STAR JPSS

STAR Joint Polar Satellite System Website

Maintaining the continuity of climate observations and critical environmental data from the polar orbit — Increasing the timeliness and accuracy of severe weather event forecasts

JPSS Home

- STAR Home
- STAR JPSS Program
- Product Teams
- JPSS Publications
- 2015 News Gallery

JPSS Instruments/SDRs

- ATMS
- CrIS
- VIIRS
- OMPS

Environmental Data Records

- Ocean Products
 - [Sea Surface Temperature >>](#)
 - Ocean Color
- Land Products
 - Active Fires
 - Land Surface Temperature
 - Surface Albedo
 - Surface Type
 - Surface Reflectance
 - Vegetation Index
 - Green Vegetation Fraction
 - Vegetation Health
- Cryosphere Products
 - Snow Cover
- Atmosphere
 - Imagery
 - Clouds
 - Aerosols
- NUCAPS IR+MW Products
- MIRS MW Products

Algorithm Cal/Val Maturity Product Operational Matrix

Product Monitoring

- ICVS

Product Applications

- Fort McMurray Fire
- Blizzard 2016
- Hurricane Iselle 2014
- Paraguay Flooding 2014

JPSS Home > Product teams > Sea Surface Temperature

Sea Surface Temperature (SST)

Team Lead: [Sasha Ignatov](#)

Background

SST is a priority JPSS product. It is used in many applications including monitoring of climate variability, operational weather and seasonal forecasting, military and defense operations, validation and/or forcing of the ocean and atmospheric models, ecosystem assessment, tourism, and fisheries. Satellite SST retrievals are assimilated into climate, mesoscale atmospheric, and sea surface numerical models, which form the cornerstone of the operational ocean forecasting systems.

Product History

Since launch of S-NPP in October 2011, and opening VIIRS cryoradiator doors in January 2012, the official JPSS SST Interface Data Product System (IDPS) SST EDR has been produced and archived at CLASS (www.class.noaa.gov). Simultaneously, the JPSS SST Team at STAR started producing an experimental SST product from VIIRS, using the NOAA heritage Advanced Clear Sky Processor for Ocean (ACSPO) system. In January 2014, based on two years of side-by-side comparisons in the NOAA online SST Quality Monitor (SQUM; Dash et al, 2010), and users' feedback, the JPSS Program recommended to re-allocate the JPSS SST requirements from IDPS to ACSPO. In March 2014, ACSPO product became operational in the NOAA NPP Data Exploitation (NDE) system. It has been archived at the PO DAAC and NODC since May 2014.

ACSPO Product and Data Access

ACSPO system produces SST in each cloud-free pixel over water. ACSPO Clear-Sky Mask (Petrenko et al, 2010) is used. The JPSS SST algorithm is regression, stratified by day and night (Petrenko et al, 2014). Skin temperature of the ocean (at depths on the order of 10 microns) is retrieved. Level 2 product (in swath projection) has daily data volume of ~27 GB/day. Its gridded (0.02°; approximately 2km at equator, 0.85GB/Day) Level 3U (uncollated) counterpart was introduced in ACSPO v2.40 in May 2015. Both L2 and L3U products are organized in 10min granules and reported in the Group for High-Resolution SST (GHRSSST) Data Specifications version 2 (GDS2) NetCDF4 format. In addition to SST, estimates of its systematic and random errors (bias and standard deviation) are also reported.

Users

ACSPO VIIRS L2P SST is currently used in the NOAA Geo-Polar Blended L4 analysis, and in the Canadian Meteorological Centre (CMC) L4 analysis. Based on consideration of data volume, several L4 producers (including Australian Bureau of Meteorology, to support GAMSSA L4 analysis; Met Office, to support OSTIA L4 analysis; and Japanese Met

ACSPO Regional SST Monitor, Baja, California, 11/1/2015 - click to enlarge

ACSPO L2P products and data:

- [NCEI](#)

L3U products and data:

- [NCEI](#)

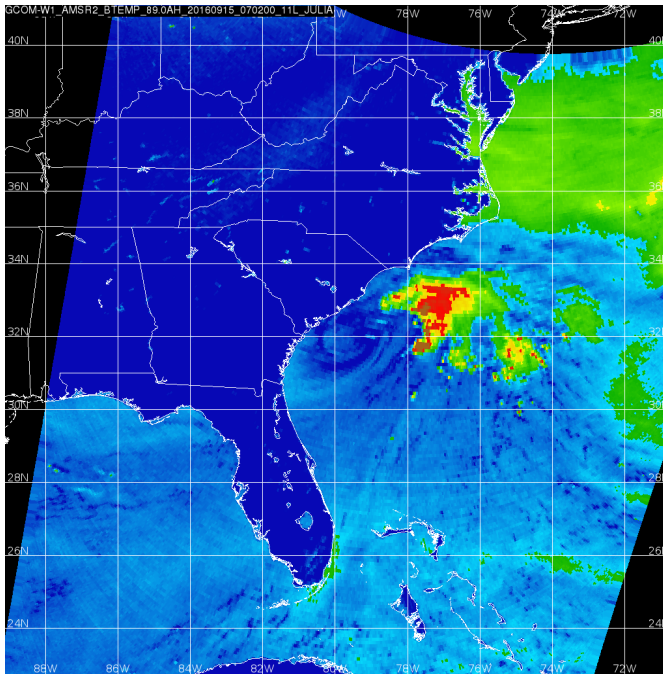
EDR Long Term-Monitoring

- [SST](#)
- [SST Quality Monitor](#)
- [SST Regional Monitor](#)

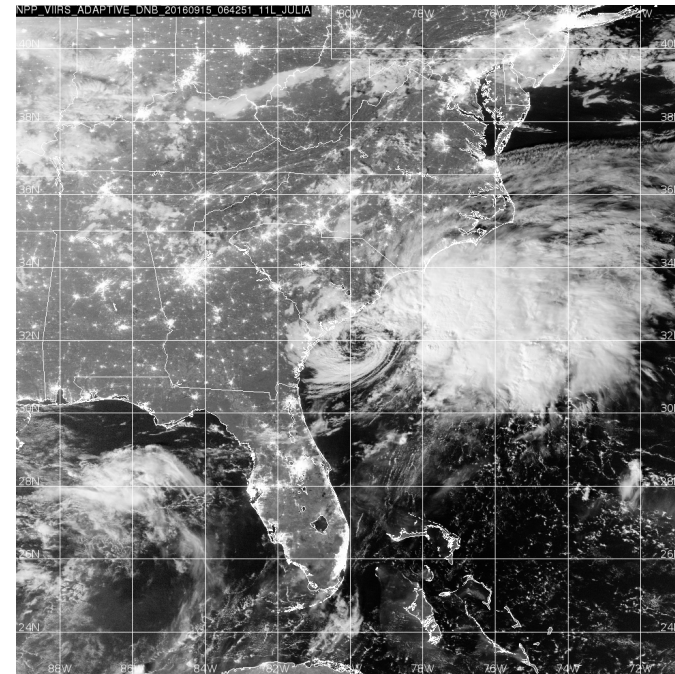
Documentation

- [ACSPO SST ATBD](#), (PDF, 2.7 MB)

Storm Centered Images for NHC using AOML Miami DB Station

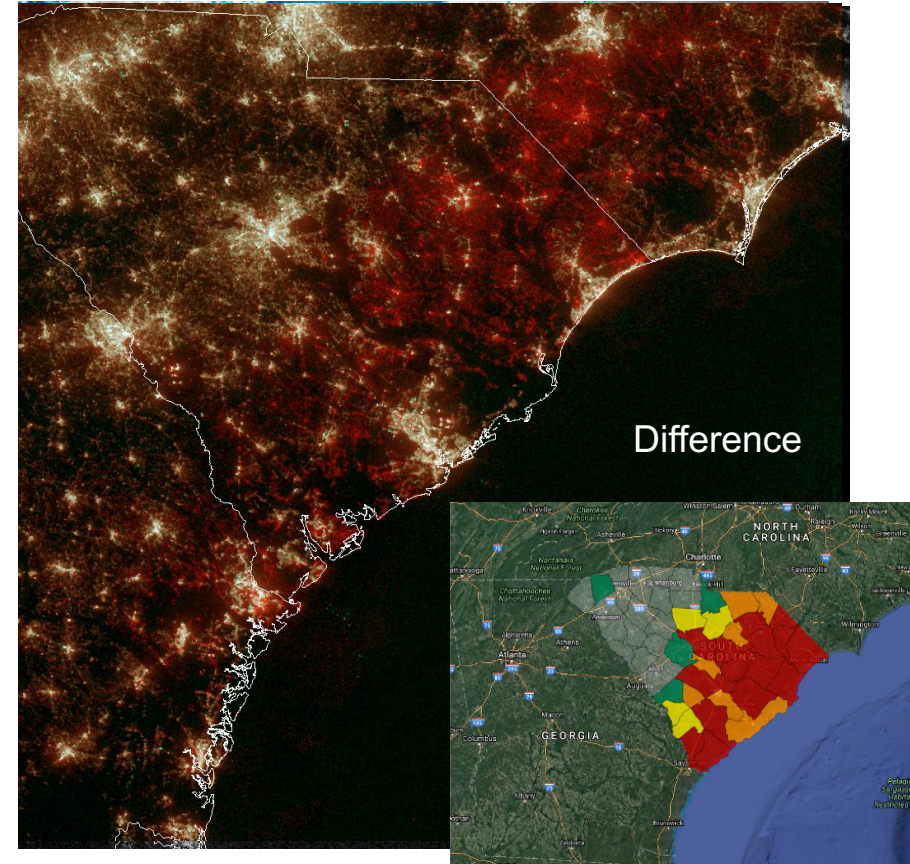
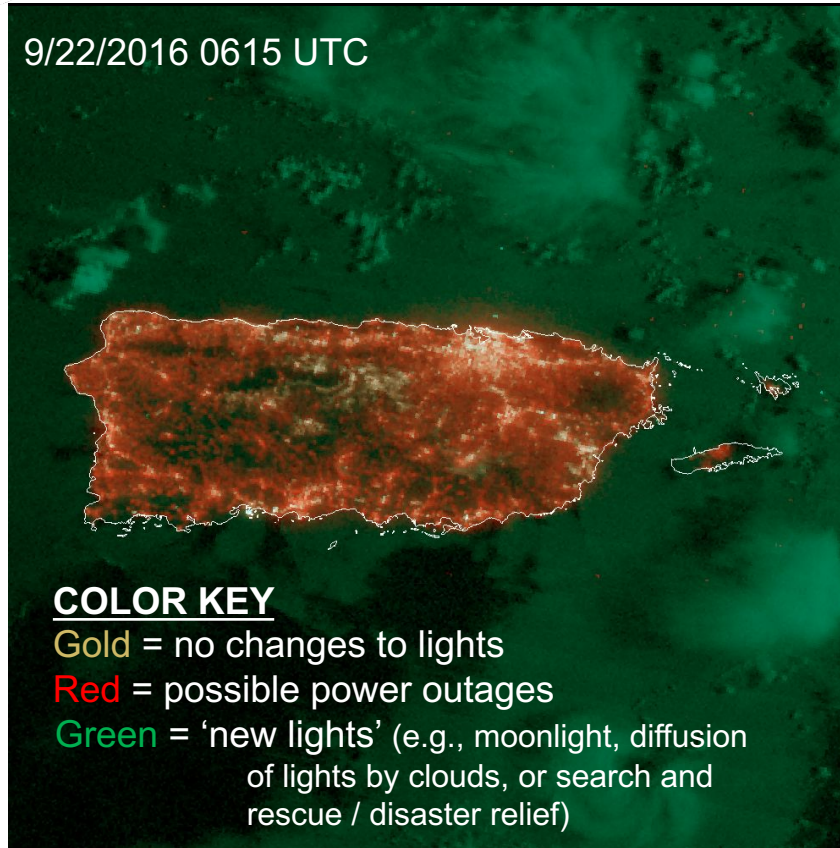


GCOM-W1 AMSR2 89GHz



SNPP VIIRS DAY/NIGHT

Innovation - Power Utilities



Training available for public and forecasters

JPSS Satellites: Capabilities and Applications Course



Languages: English
Completion Time: 3-4 hrs
Topics:
Satellite Meteorology

Enrollment Information:

Enroll

Description

Objectives

Overview

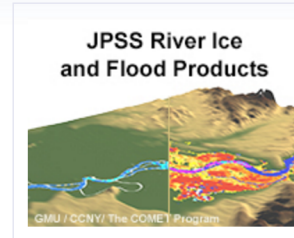
Overview

This self-paced distance learning course provides access to a suite of learning resources focused on the Joint Polar Satellite System (JPSS) and the capabilities offered by the next generation of U.S. polar-orbiting satellites.

The course includes four core lessons as well as optional lessons covering the benefits and applications of JPSS observations and products for monitoring of river ice and flooding, wildland fires, climate, and land and ocean surfaces, and for atmospheric profiling and numerical weather prediction.

To receive a course completion certificate, you must successfully complete a minimum of the four core lessons which collectively may take about 3 to 4 hours to complete.

JPSS River Ice and Flood Products



Languages: English
Publish Date: 2016-03-16
Skill Level: 2
Completion Time: .75 - 1.00 h
Includes Audio: no
Required Plugins: none
Topics:
Hydrology/Flooding, Satellite Meteorology
Included in Courses:
JPSS Satellites: Capabilities and Applications Course

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JPSS has a level 1 requirement to provide software to the direct readout community

CSPP will be populated by JPSS operational software. Software from NESDIS STAR will be provided to both Global Operations (OSPO) and Direct Broadcast.

Testing of new science and user feedback will be done through CSPP before operational consideration.

The CSPP - LEO is funded by JPSS out to 2038.

JPSS Proving Ground – includes data fusion with other observations - so we plan to bring in MeTOP and GOES-R series when it makes sense.



SCIENCE PUBLICATIONS

On behalf of the Joint Polar Satellite System (JPSS) Program Science, it is my pleasure to share with you our science digests, which are a collection of technical articles generated from a series of monthly science seminars. The digests capture the importance of the close collaborative efforts between product developers and key users to conceptualize and develop new products that help improve the use of JPSS data to enhance key services, such as forecasting of severe weather events and environmental monitoring of land, ocean and the cryosphere. I would like to thank our federal staff, private sector support staff, and university partners whose contributions and dedicated efforts have made JPSS a big success.



The JPSS program is committed to ensuring that its user community is prepared to utilize the satellite imagery and data available from JPSS – the United States' next generation polar-orbiting operational environmental satellite system. JPSS provides environmental observations which are used in a wide range of application areas that include severe weather, hazards, aviation, ocean, coastal, land, imagery and data assimilation.

2013 SCIENCE DIGEST

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Thank You!



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