Suomi-NPP/JPSS Overview

Supporting the NOAA, USA and International Missions through Applications and Research

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National Oceanic & Atmospheric Administration | NOAA

JPSS Program Scientist

JPSS Overview

JPSS consists of three satellites (Suomi NPP, JPSS-1, JPSS-2), ground system and operations through 2025

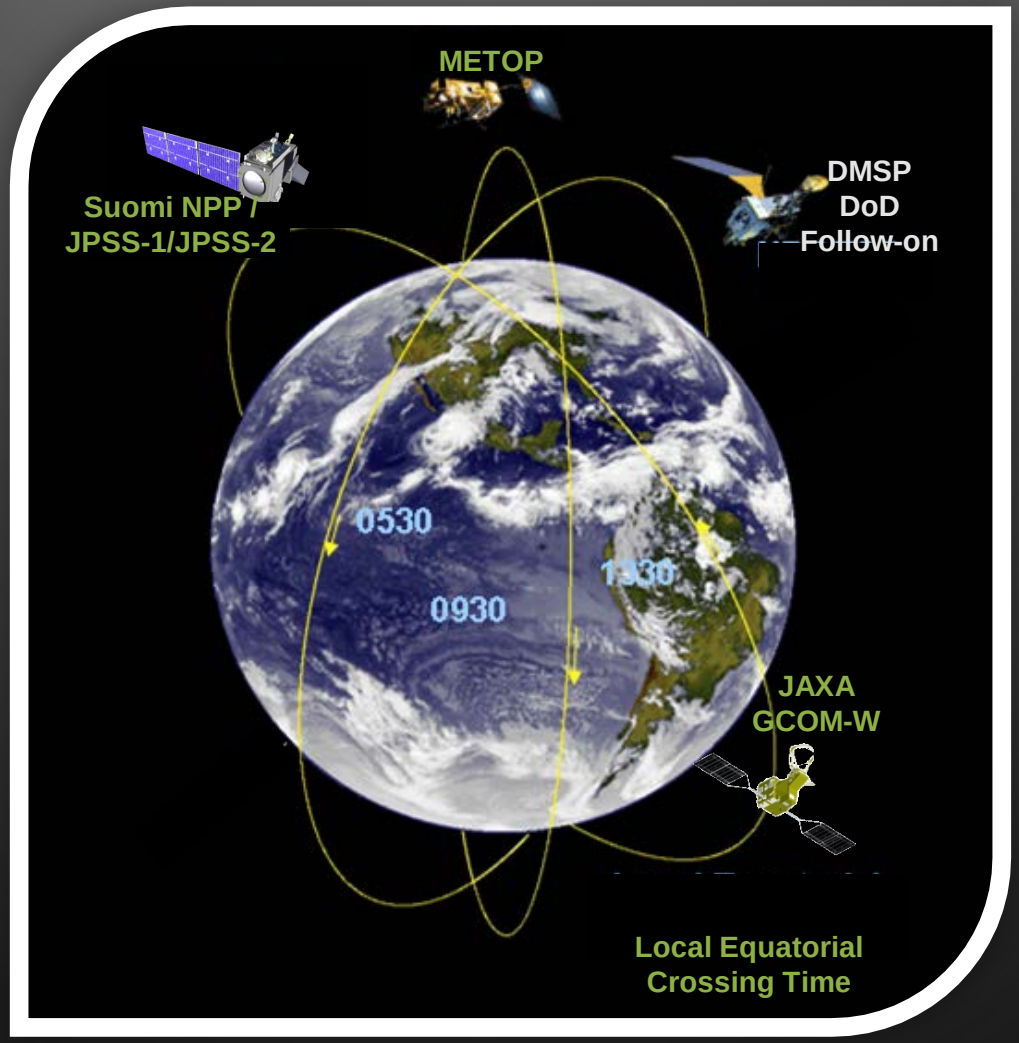
- JPSS mission is to provide global imagery and atmospheric measurements using polar-orbiting satellites

JPSS is a partnership between NOAA and NASA

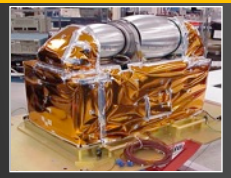
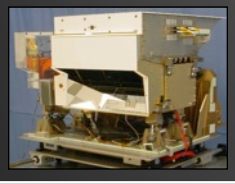
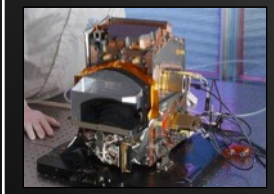
- NOAA has final decision authority and is responsible for overall program commitment
- NASA is the acquisition agent for the flight system (satellite, instruments and launch vehicle), ground system, leads program systems engineering, and program safety and mission assurance
- NOAA is responsible for operations, science, data exploitation and archiving, infrastructure

JPSS Integral to 3-Orbit Global Polar Coverage

JPSS implements US civil commitment, interagency and international agreements to afford 3-orbit global coverage.



JPSS-1 Instruments (same as S-NPP)

JPSS Instrument		Measurement
	**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 5 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, phytoplankton abundance/chlorophyll
	**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 Earth Radiation Budget

JPSS provides continuity and improved observations to meet critical operational applications

JPSS

CrIS provides significantly improved temperature and water vapor information than POES HIRS

ATMS provides improved global coverage and spatial resolution than AMSU

VIIRS provides superior imagery and more spectral bands than AVHRR

OMPS provides improved spatial resolution, coverage and vertical profiling than SBUV

CERES and TSIS for fundamental energy budget climate measurements

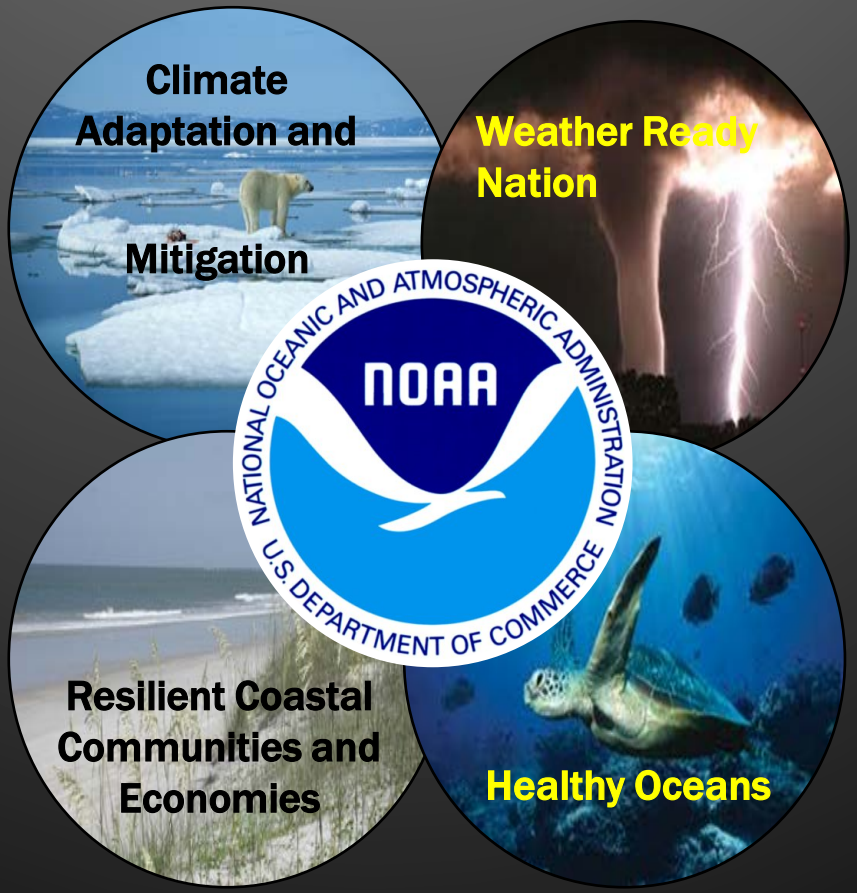
Advancements are driven by the value of information

Supporting the NOAA Mission

JPSS data supports all four NOAA mission areas

- Assessments of **current and future states of the climate** system that identify potential impacts and inform science, service and stewardship decisions.
- **Mitigation and adaptation efforts** supported by sustainable, reliable and timely climate services.
- Improved scientific **understanding of the changing climate system.**

- Improved **coastal water quality** supporting human health and coastal ecosystem services.
- Safe, environmentally sound **Arctic access** and resource management.
- **Coastal communities that can adapt** to the impacts of hazards and climate change



- **Reduced loss of life, property and disruption** from high-impact events.
- More productive and efficient economy through relevant **environmental information.**
- Healthy people and communities due to improved **air and water quality services.**
- Improved **transportation** efficiency and safety.

- Improved **understanding of ecosystems** to inform resource management decisions.

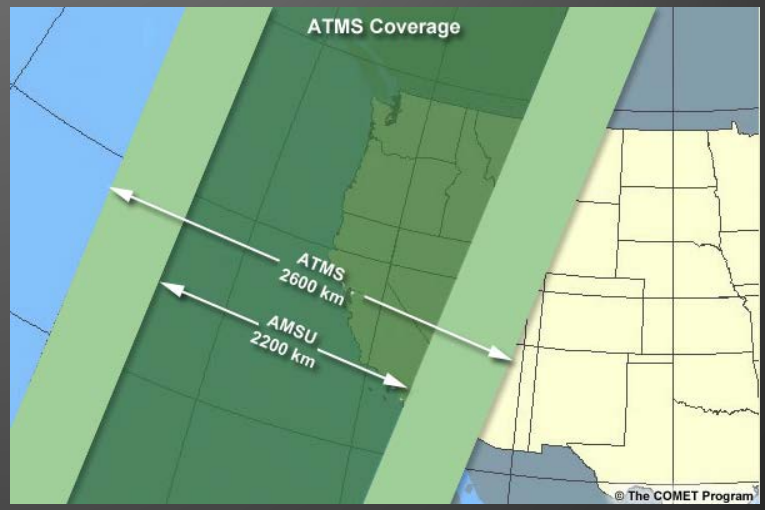
ATMS - Advanced Technology Microwave Sounder

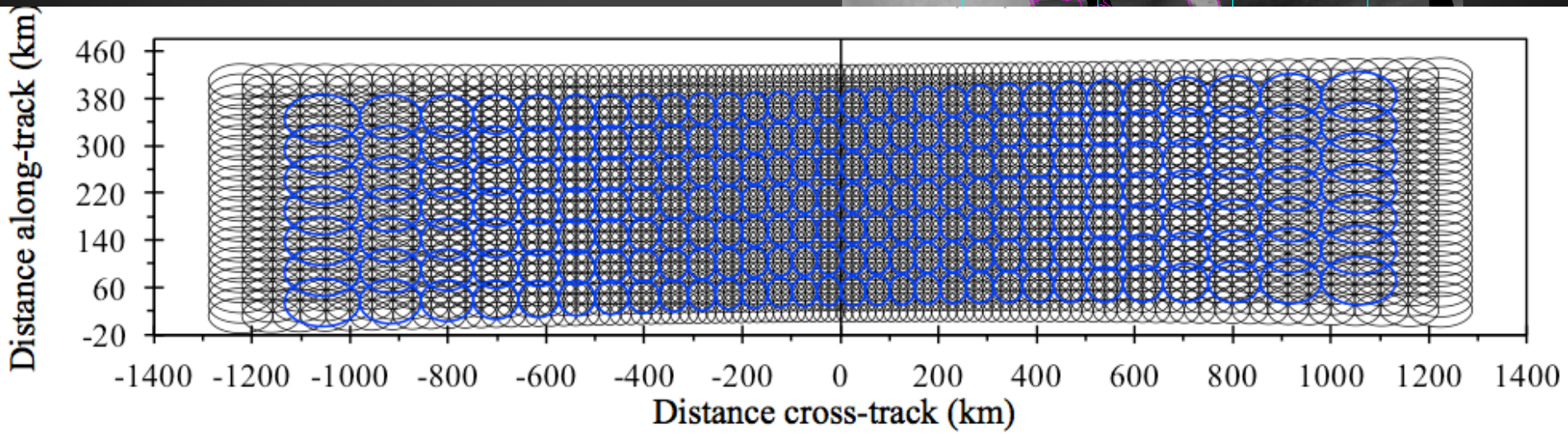
Advanced Features

Three instruments (AMSU-A1, AMSU-A2 and MHS) in one instrument – less power and weight

Better spatial resolution (~48 to 32 km) for key temperature sounding channels

Oversampled footprints for improved warm core



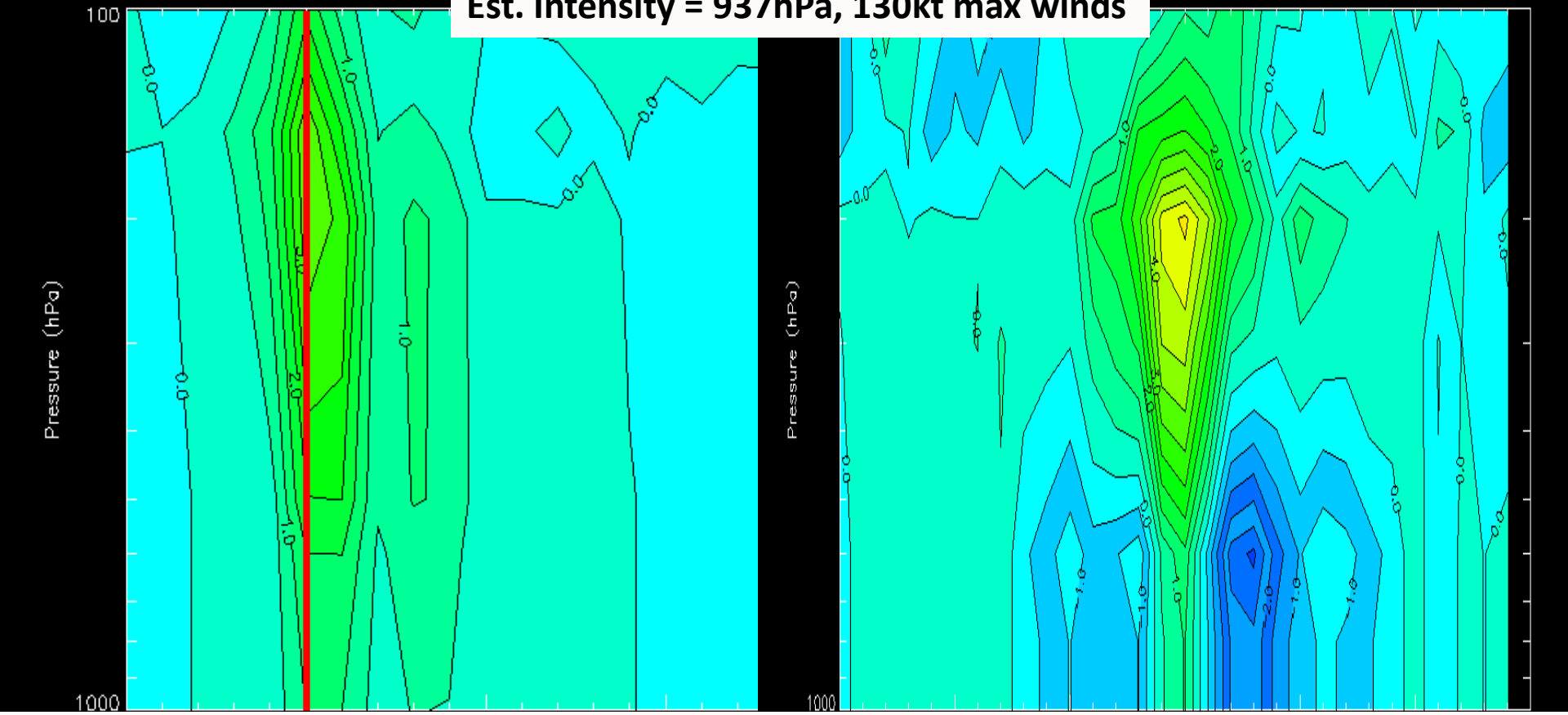


JPSS ATMS-Based TC Intensity Estimates

Calculate TC Warm Core Anomalies from ATMS Microwave Radiances and Relate to Storm Intensity using Method Developed at UW-CIMSS Based on AMSU and SSMIS

AMSU 06UTC Typhoon Bopha, Dec 3 2012 ATMS 04UTC

Est. Intensity = 937hPa, 130kt max winds

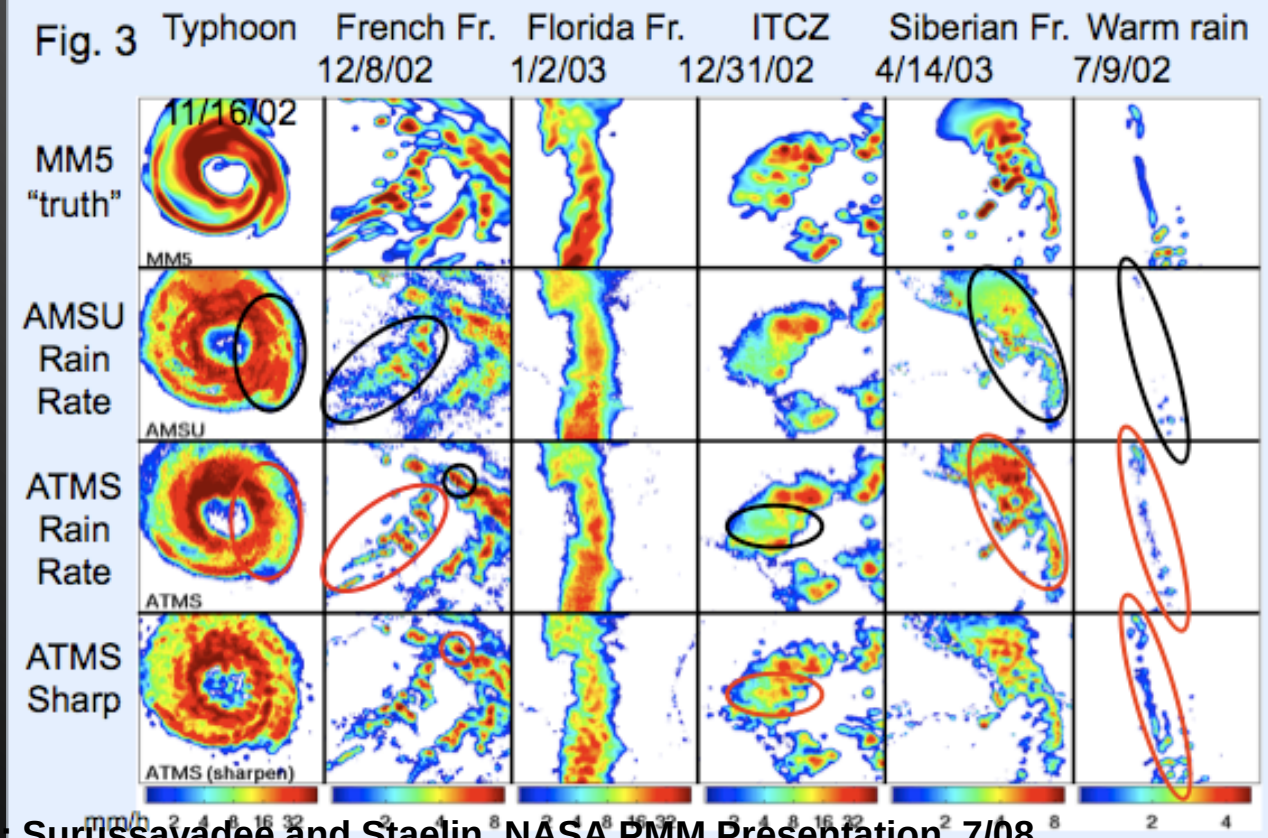


Vertical cross-sections through TC Bopha center (red line on left panel indicates storm center).

- **Warm anomalies in green/yellows (contour interval=0.5C), with max around 200 hPa.**
- **Correction for rain scattering in ATMS not yet applied (cool/blue signal in lower levels (eyewall).**
- **NPP ATMS FOV resolution is 32km at nadir versus AMSU 48km >> Better depiction of warm core.**

ATMS Storm Mapping: Improvements Relative to AMSU

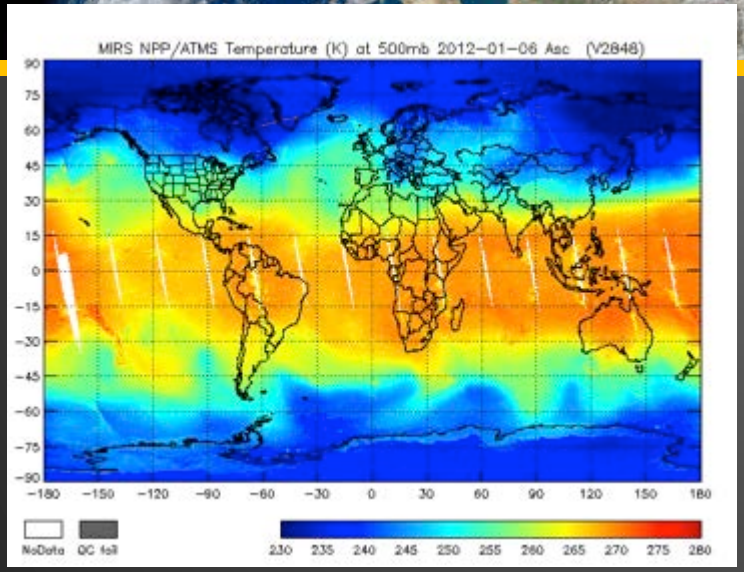
Black and red circles highlight "before" and "after" differences between AMSU and ATMS, and between ATMS and ATMS-sharpened, for six simulated storms validated with AMSU. Note the better definition of strong convective cells with ATMS due to its 33-km resolution and Nyquist sampling, and the better recovery of the warm rain with sharpening



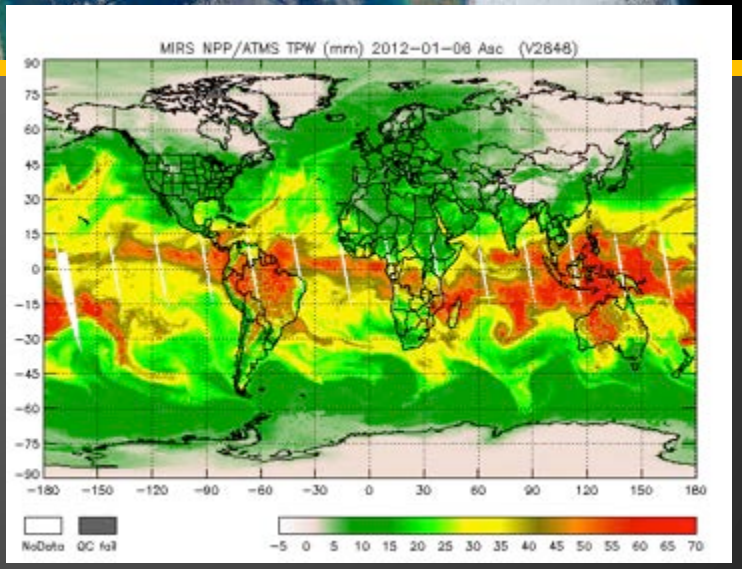
Source: Surussavadee and Staelin, NASA PMM Presentation, 7/08

NOAA ATMS MIRS Products

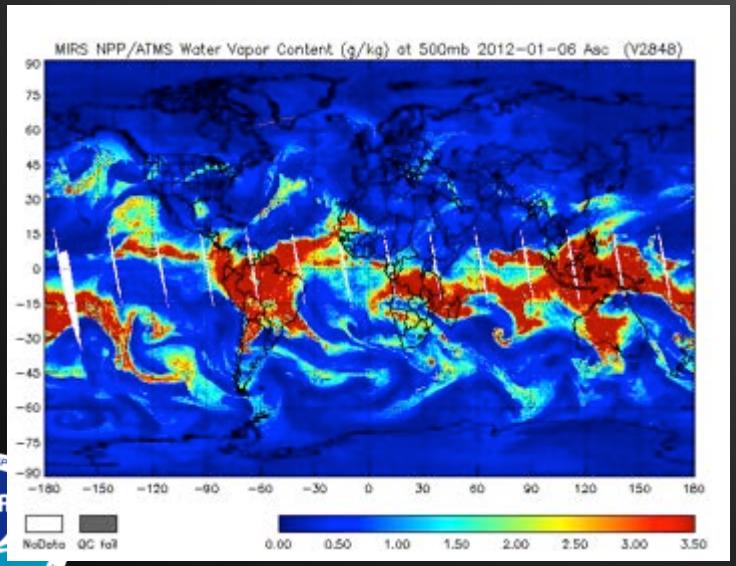
T



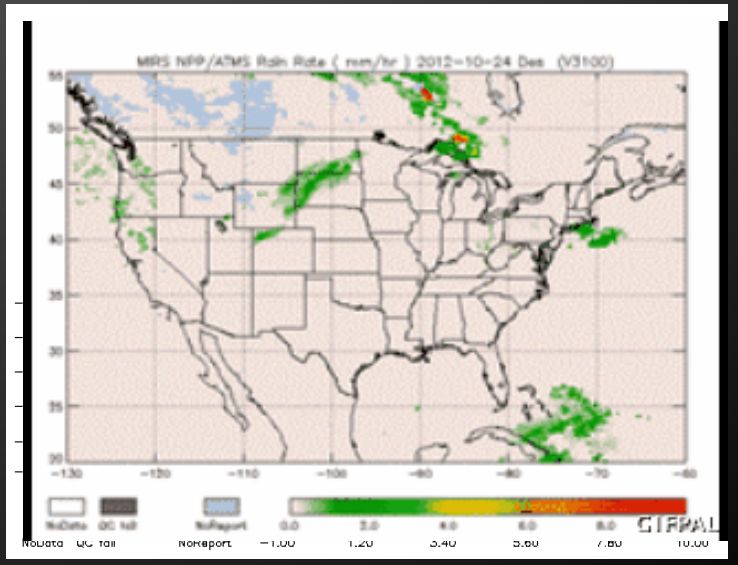
TPW



WV



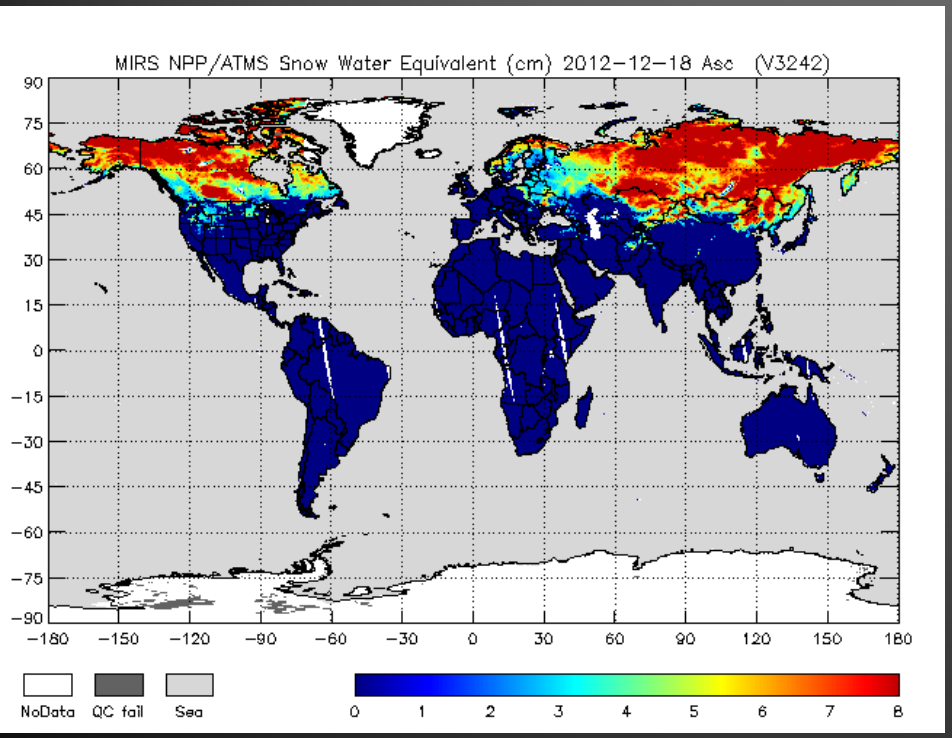
RR



Courtesy of Sid Boukabara (STAR)

MiRS SNPP/ATMS-based Snow Water Equivalent

Global perspective



ATMS Data Products

ATMS TDRs, SDRs (radiances)
CLOUD LIQUID WATER
PRECIPITATION RATE
PRECIPITABLE WATER
LAND SURFACE EMISSIVITY
ICE WATER PATH
LAND SURFACE TEMPERATURE
SEA ICE CONCENTRATION
SNOW COVER
SNOW WATER EQUIVALENT
ATM VERT TEMPERATURE PROFILE
ATM VERT MOISTURE PROFILE

CrIS – Cross-track InfraRed Sounder

Advanced Features

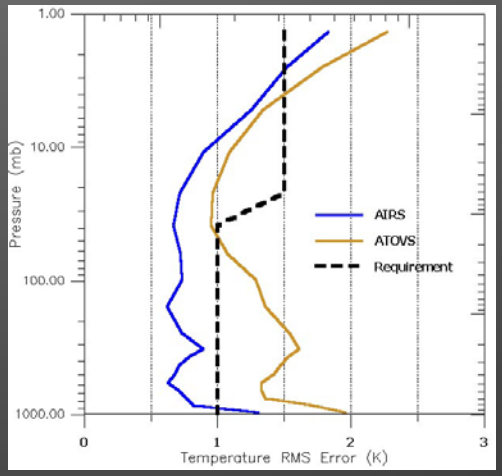
Lower power, volume and mass when compared to AIRS and IASI, and excellent signal to noise

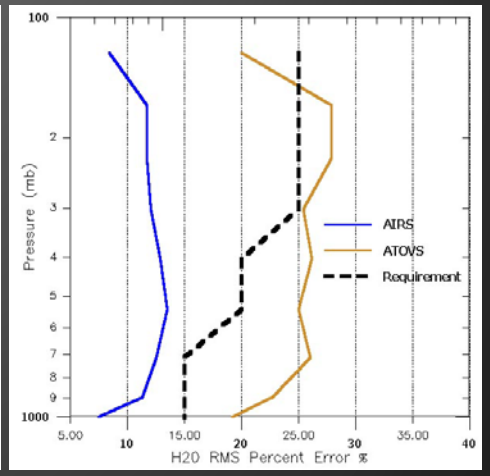
Significantly improved vertical resolution of temperature and water vapor when compared to POES HIRS and AMSU (1 – 2 km instead of - 6 km)

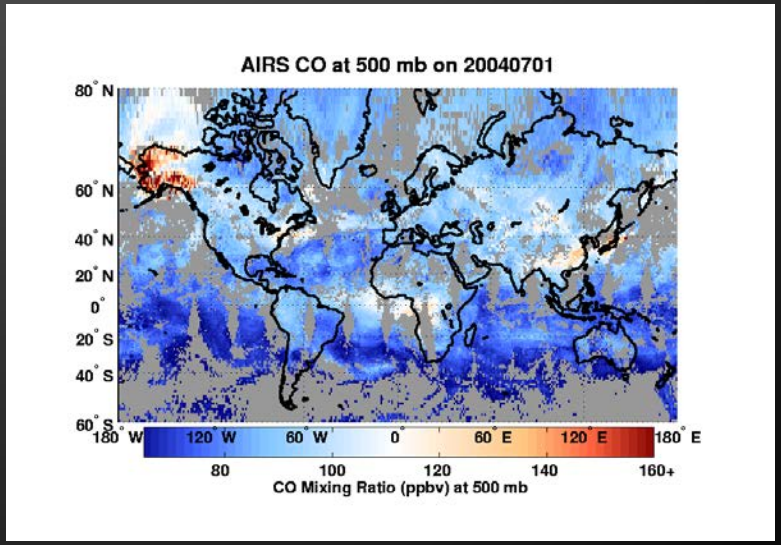
Combined with ATMS for cloud clearing – provides precision of about 1 Celsius for temperature and 15% for water vapor at vertical resolutions of 1-2 km

Also provides information on trace gases – O3, CO2, CO, CH4 - monitor continental transport of greenhouse gases

Provides accurate cloud properties (at 14 km resolution near nadir)



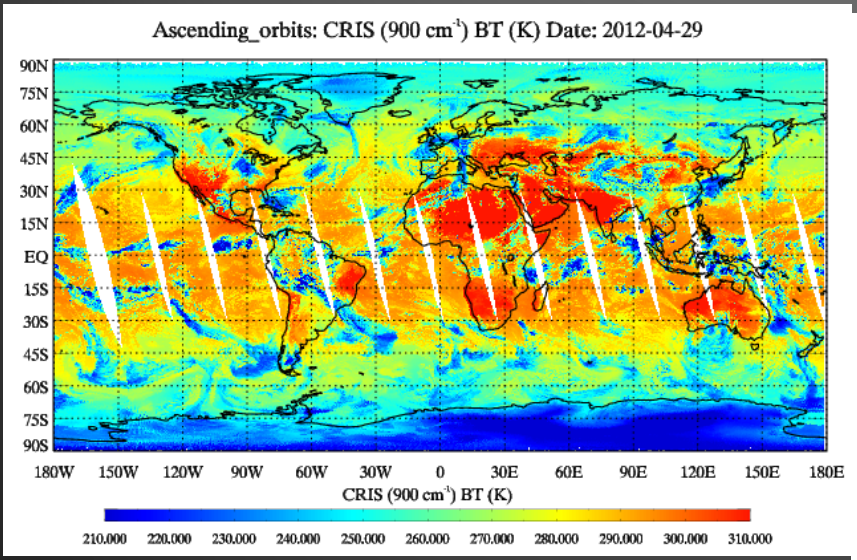


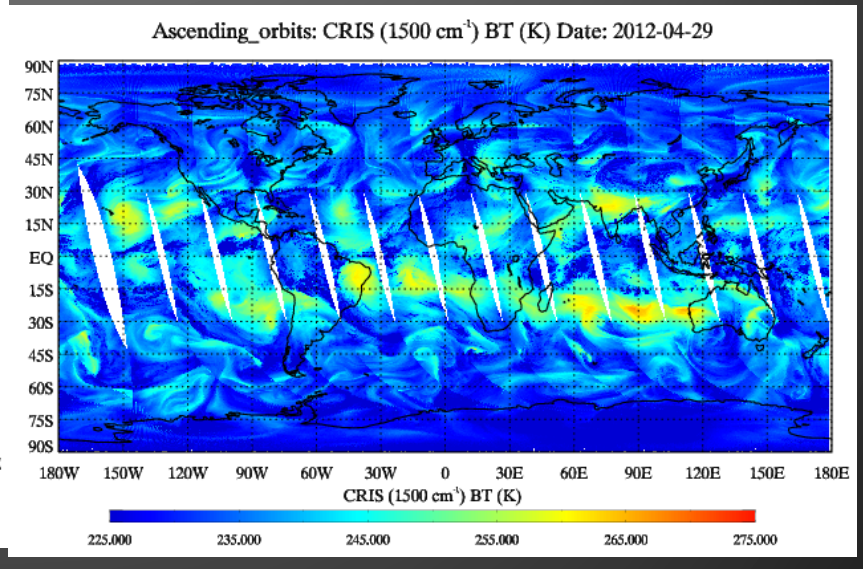


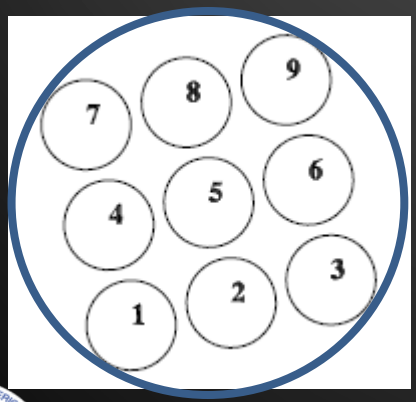
CrIS SDR Spectra and Global Coverage

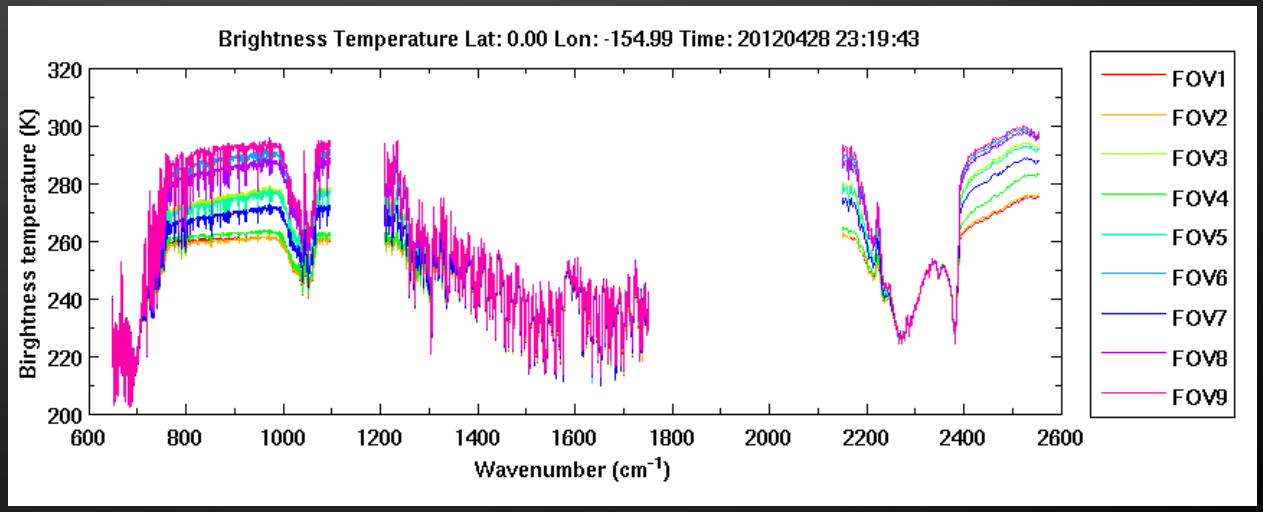
Window Channel

Water vapor Channel





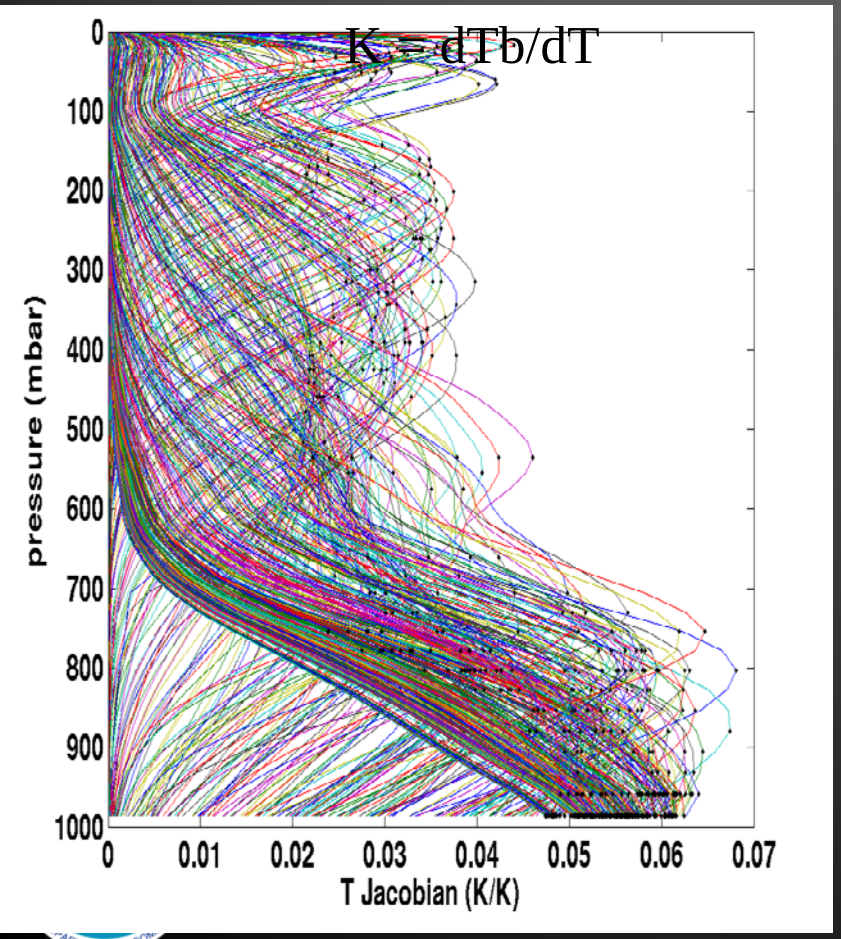




Example of T(p) & q(p) Channel Kernel Functions

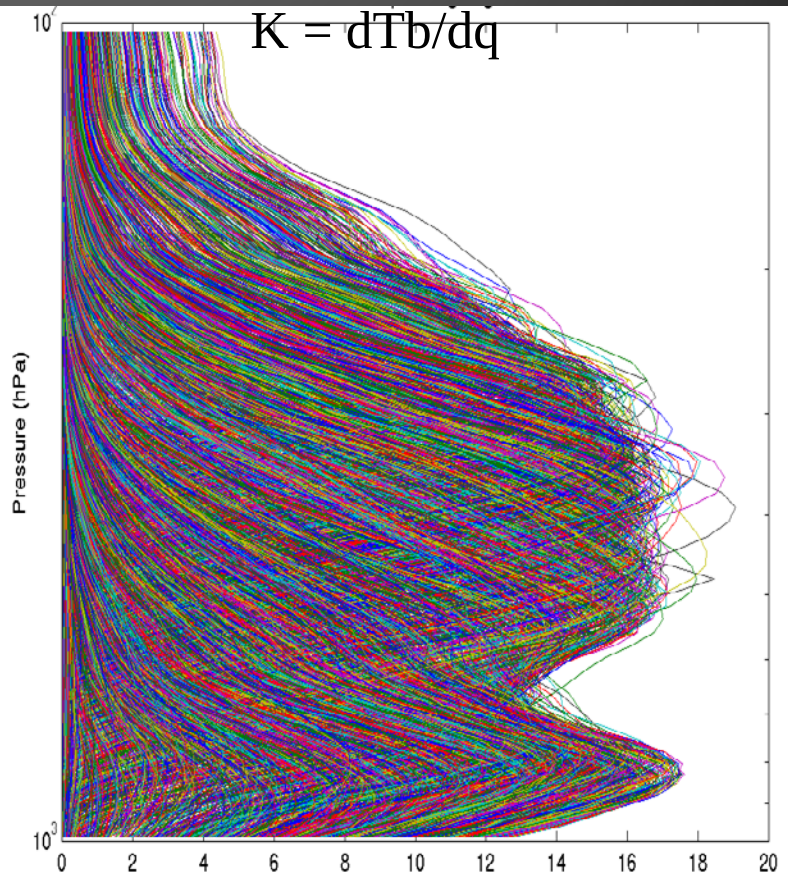
Temperature 15 µm (650-800 cm-1) band

K = dTb/dT

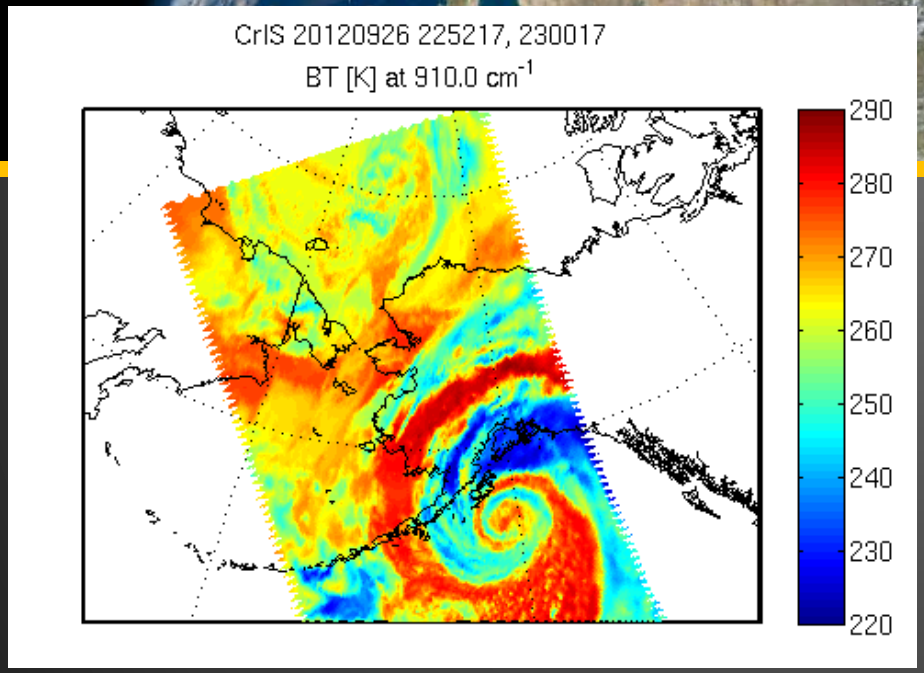


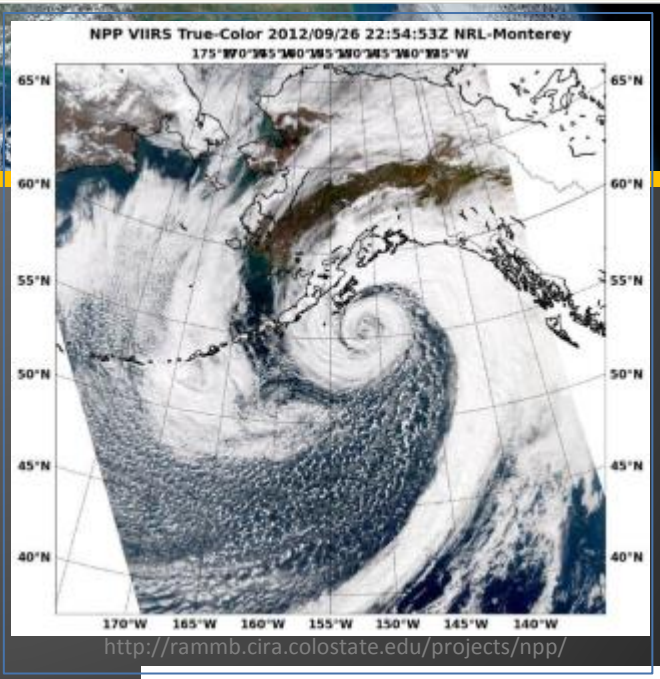
Water Vapor 6.7 µm (1200-1600 cm-1) band

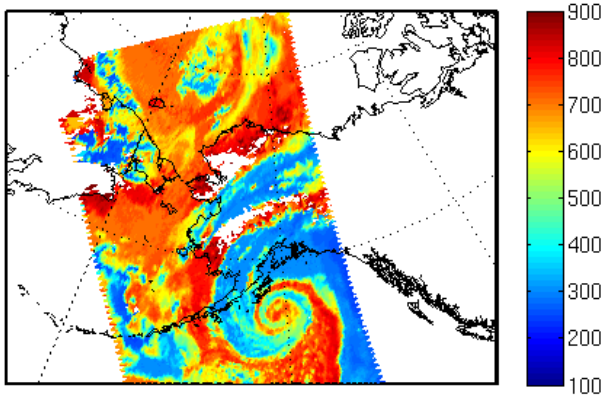
K = dTb/dq

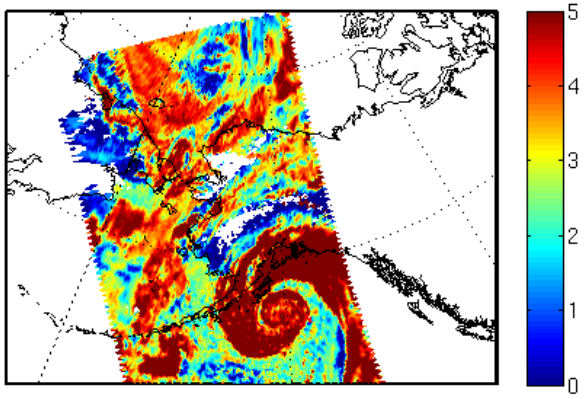


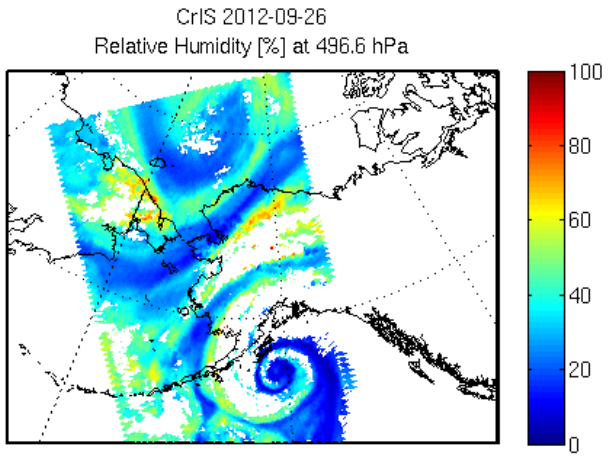
Gulf of Alaska Low Pressure System (26 Sept 2012)





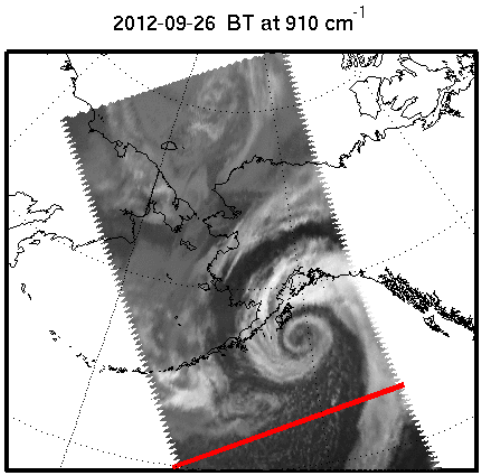


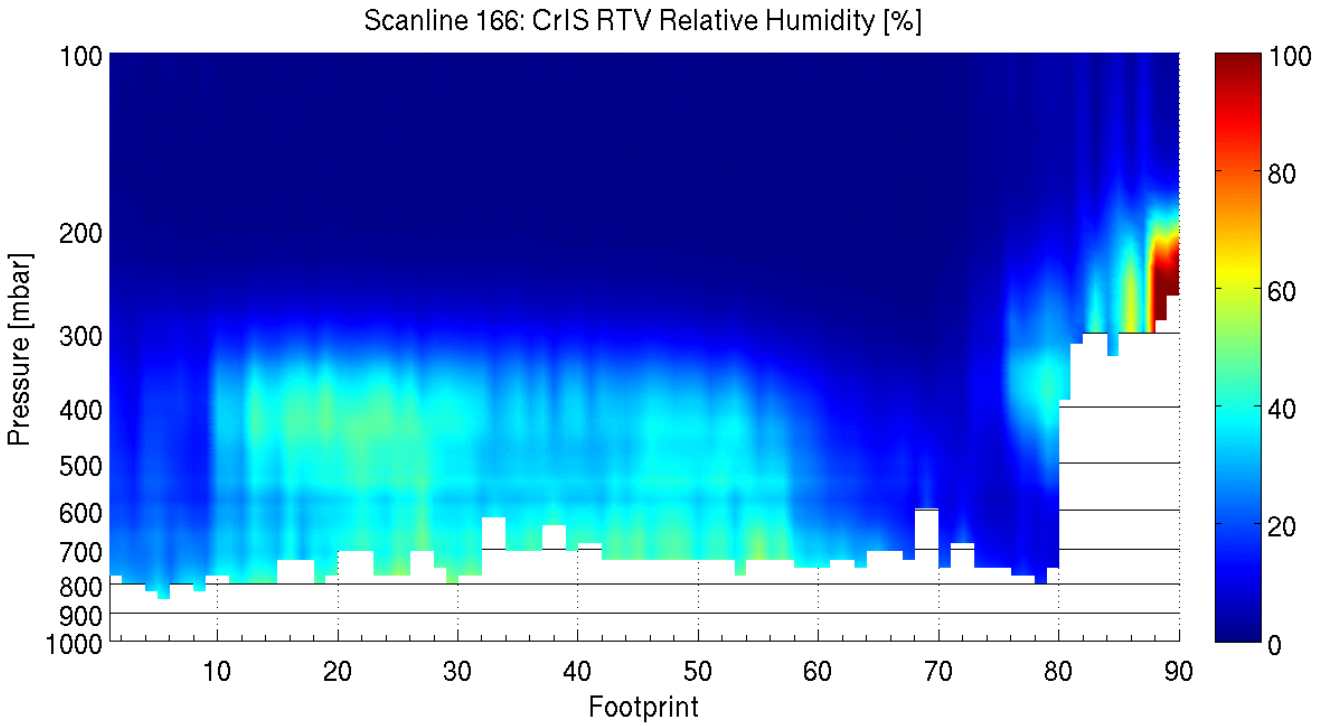




Sounding retrievals provide quantitative interpretation of satellite imagery

RH south-north cross-section Movie (26 Sept 2012)

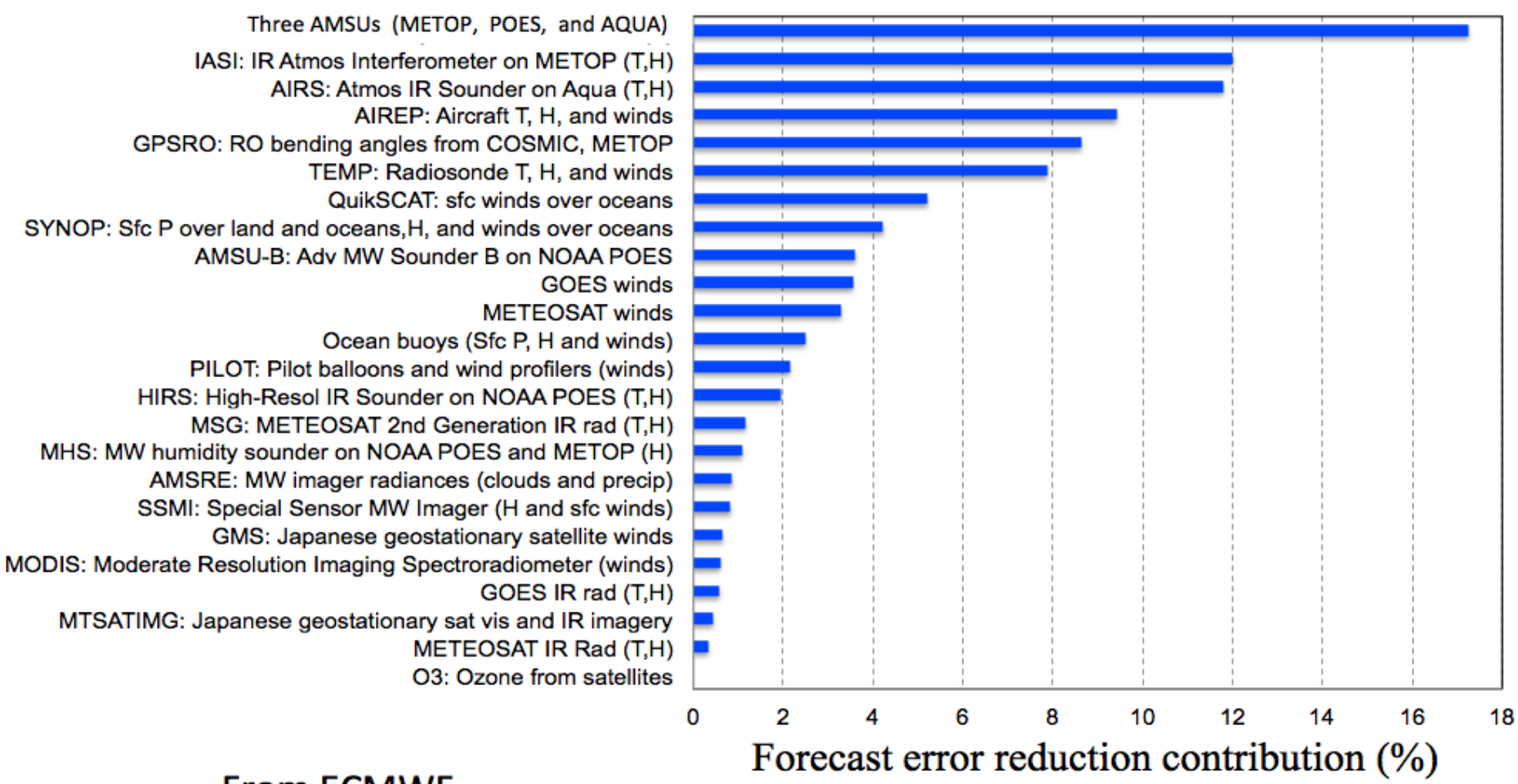




Sounding retrievals provide 3-d structure of storm systems

CrIS and ATMS provides continuity of essential atmospheric soundinginformation for weather forecasting

Hyperspectral Infrared Sounders and Advanced Microwave Sounders are the top two contributors for reducing forecast errors

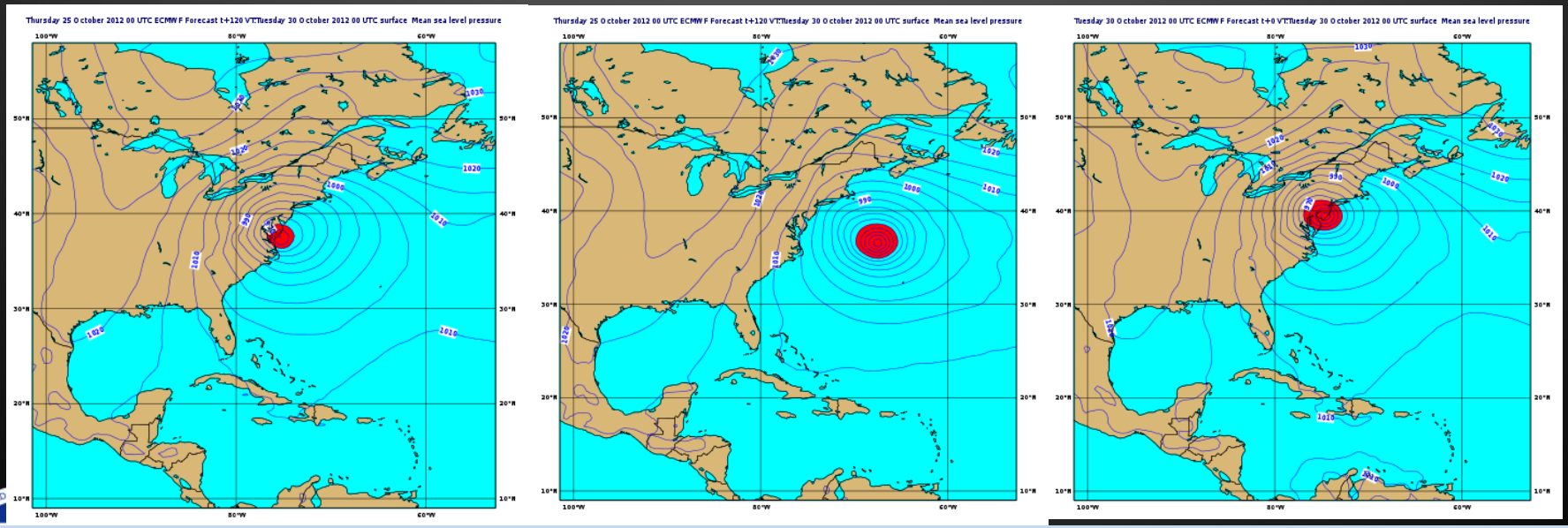


From ECMWF

Forecasts of Hurricane Sandy without polar satellites

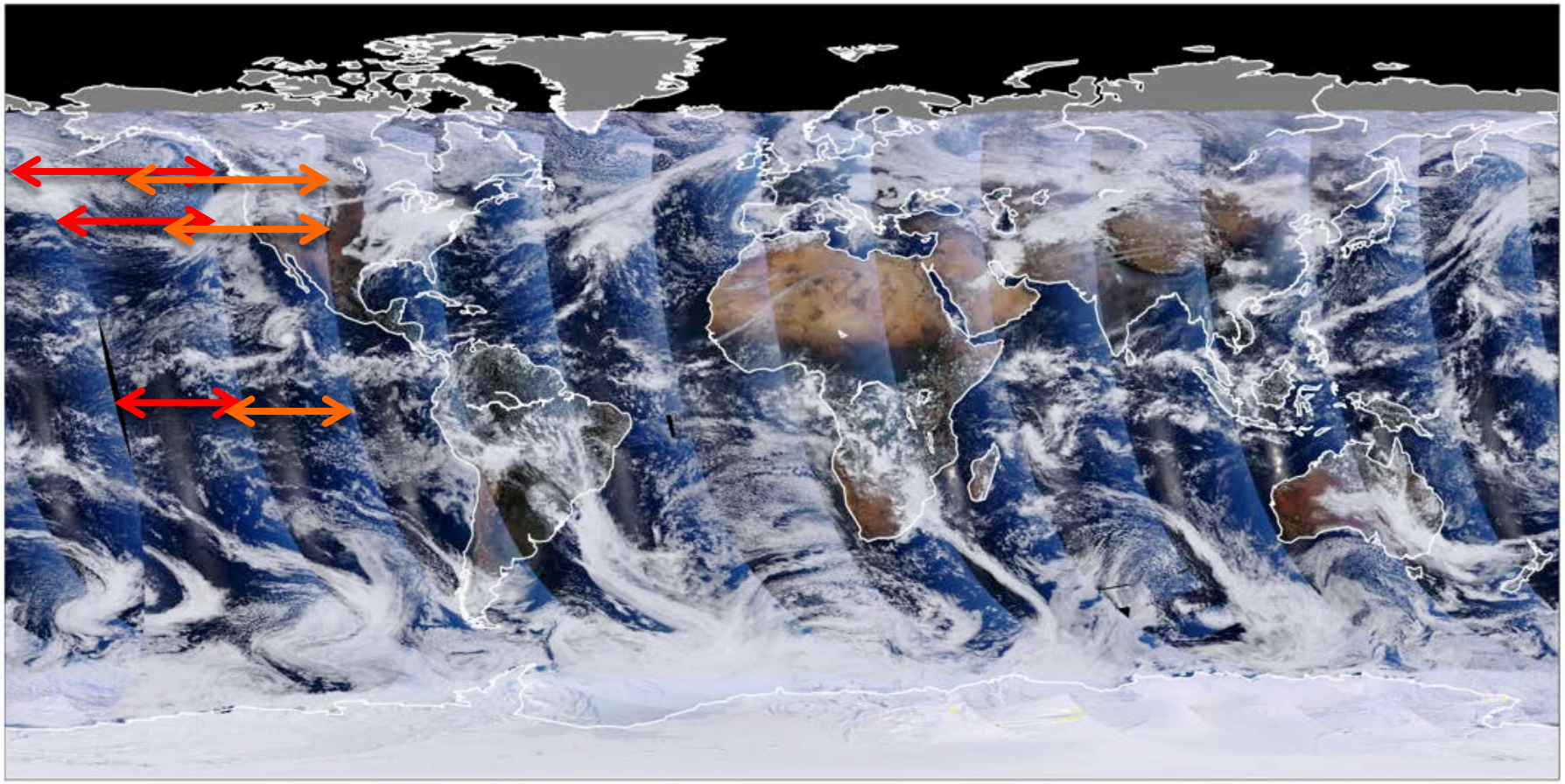
ECMWF forecasts of Mean Sea Level Pressure, **5 days in advance** of the 30th October 2012 for the landfall of Hurricane Sandy. Forecasts from an assimilation system **with no polar satellites** fail to predict the landfall of the storm on the US east coast.

ECMWF OPS	NO POLAR SAT	VERIFICATION



5 day forecast: Base time 2012-10-25-00z **Valid Time: 2012-10-30-00z**

VIIRS – the work horse for environmental assessments



VIIRS RGB (True Color), 20111122

R : M05 (0.672 μm); G : M04 (0.555 μm); B : M02 (0.445 μm)

Creation date: 2011-11-26 07:19:26 Z

Imagery provides large number of environmental products

Land

- ✓Active Fire
- ✓Land Surface Albedo
- ✓Land Surface Temperature
- ✓Vegetation Index & Fraction
- ✓Surface Type
- ✓Ice Surface Temperature
- ✓Sea Ice Characterization
- ✓Snow Cover/Depth

Ocean

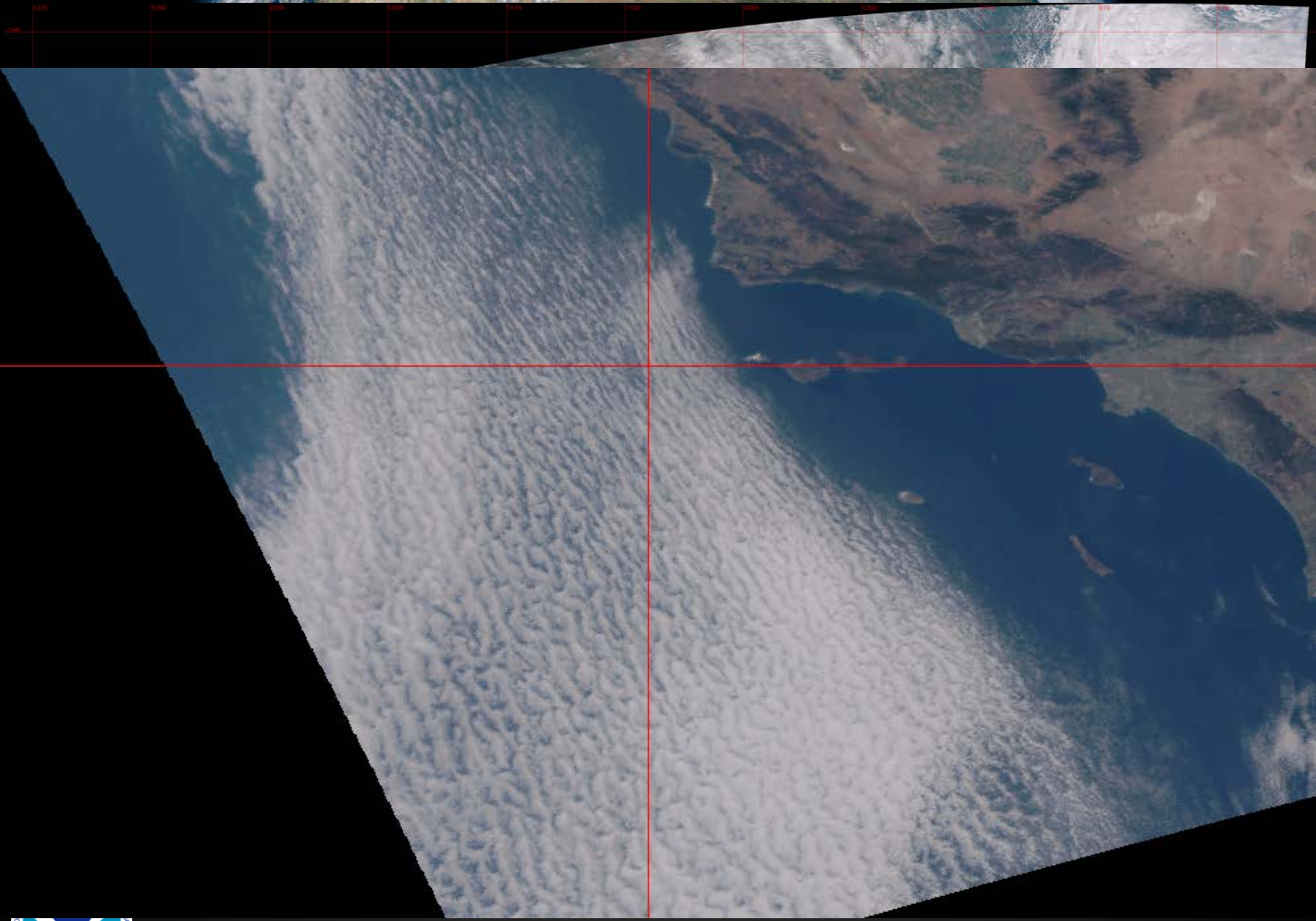
- ✓Sea Surface Temperature
- ✓Ocean Color/Chlorophyll

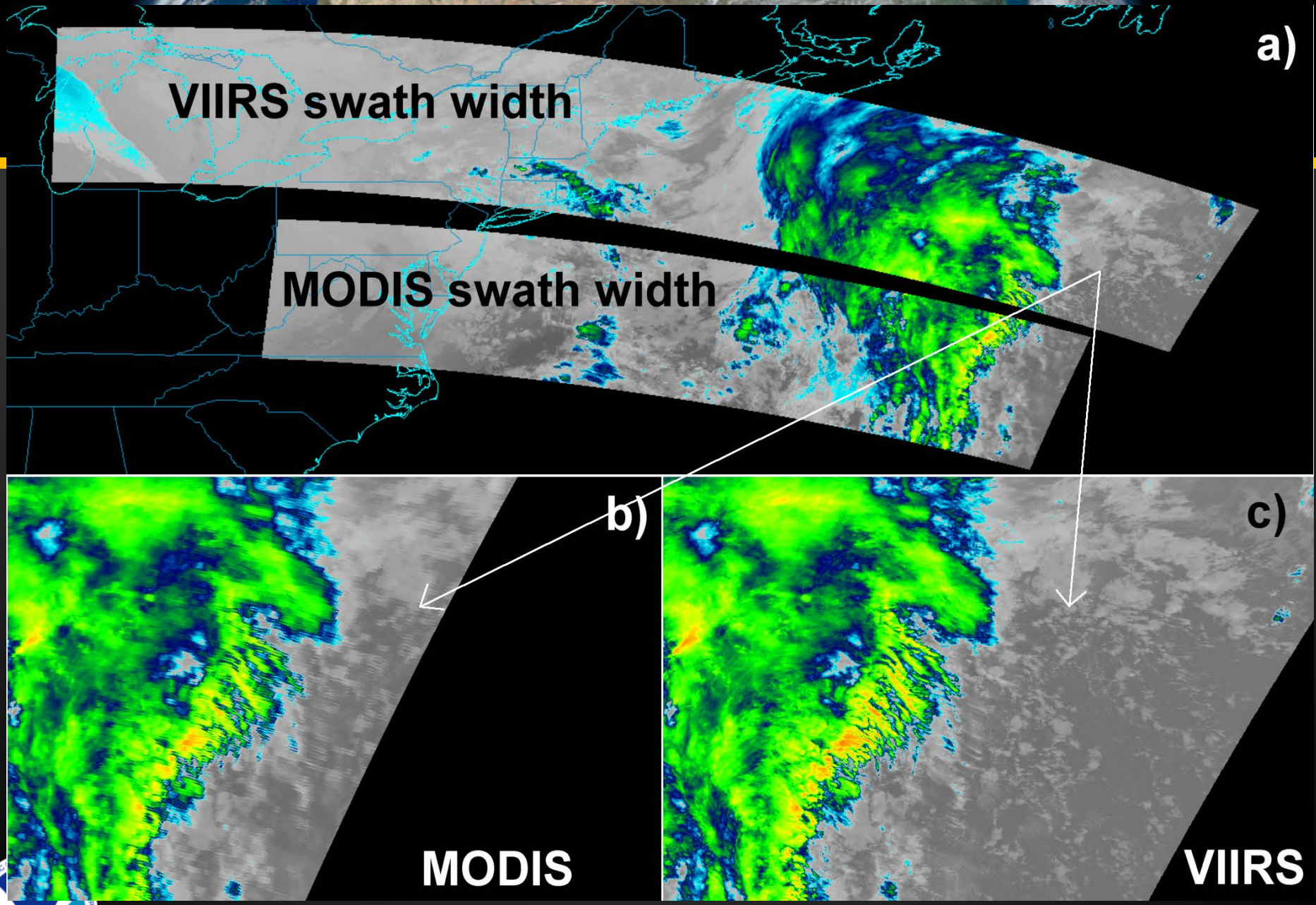
Clouds

- ✓ Cloud Mask
- ✓ Cloud Optical Thickness
- ✓ Cloud Effective Particle Size Parameter
- ✓ Cloud Top Height
- ✓ Cloud Fraction
- ✓ Polar winds

Aerosols

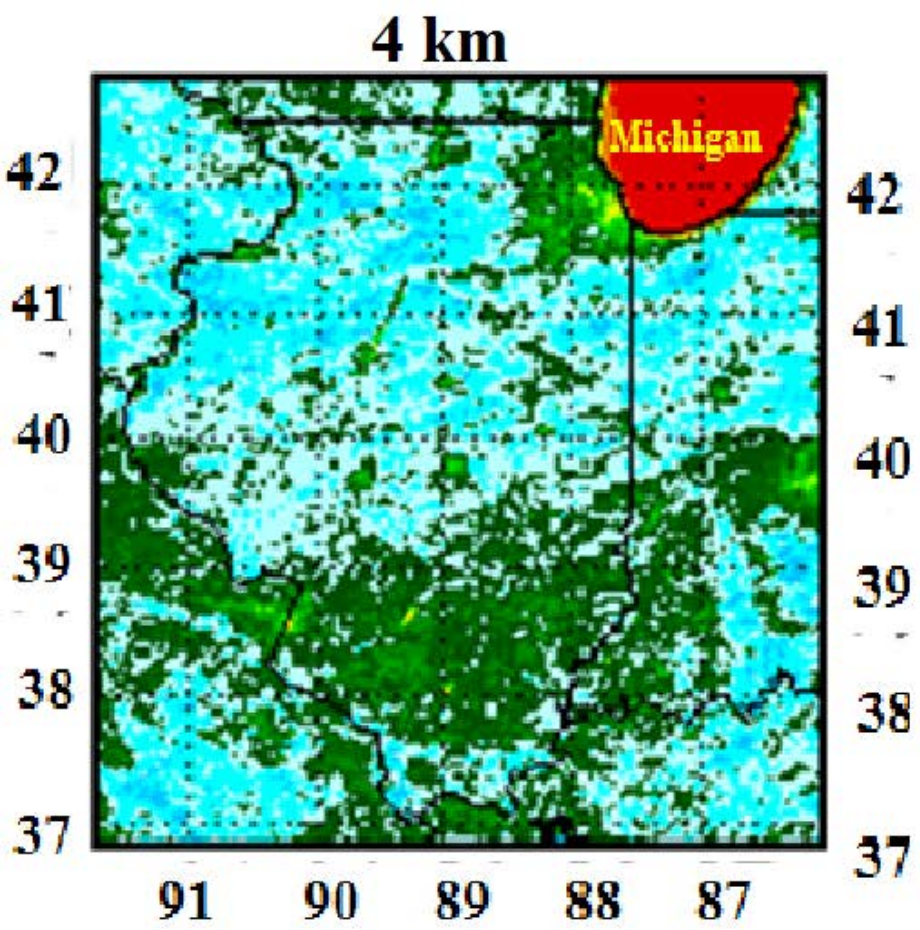
- ✓ Aerosol Optical Thickness
- ✓ Aerosol Particle Size Parameter
- ✓ Suspended Matter (Volcanic Ash)

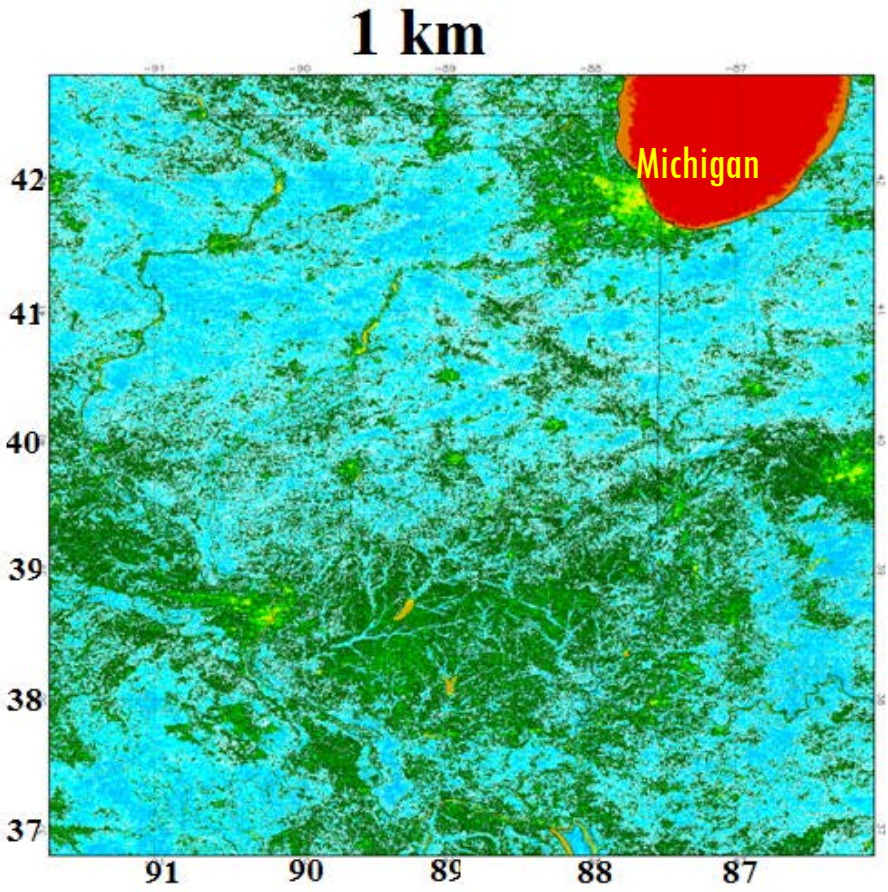



a)
VIIRS swath width
MODIS swath width
b)
c)
MODIS
VIIRS

VIIRS NDVI, Jul 28, 2012

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



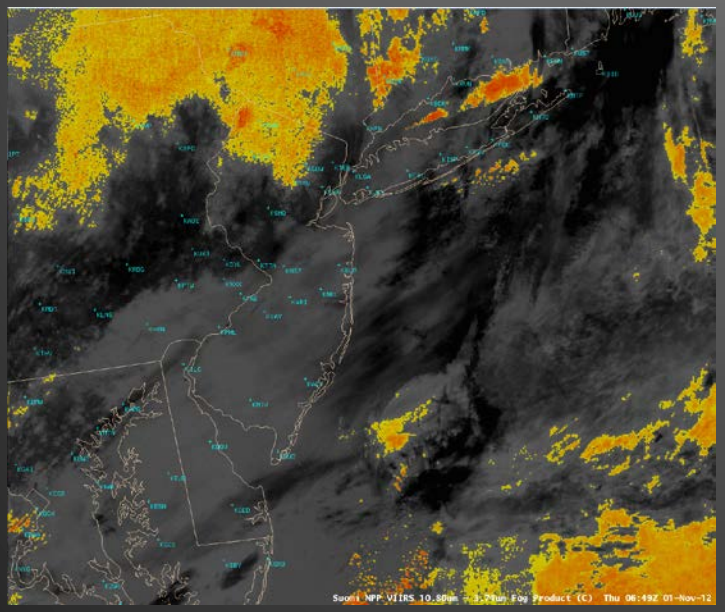


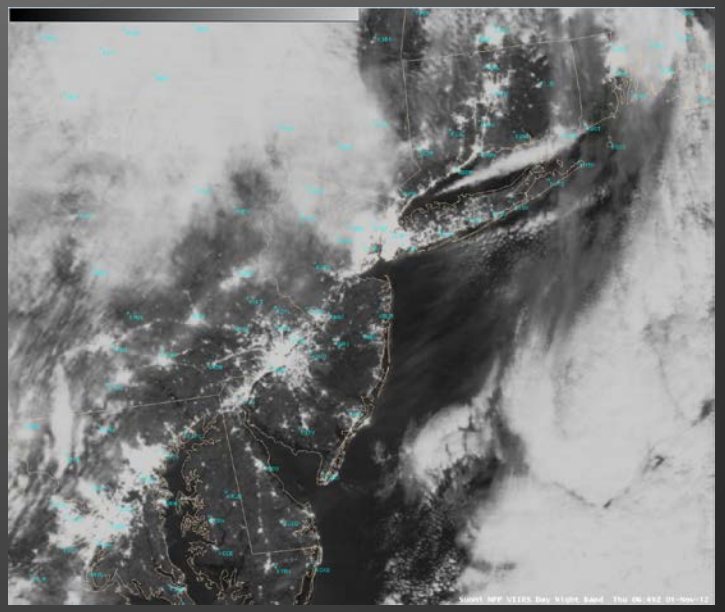
1 km resolution NDVI shows many features which is hard to see with 4 km data:

- small lakes & reservoirs
- river valleys;
- forest

VIIRS Day Night Band - Hurricane Sandy

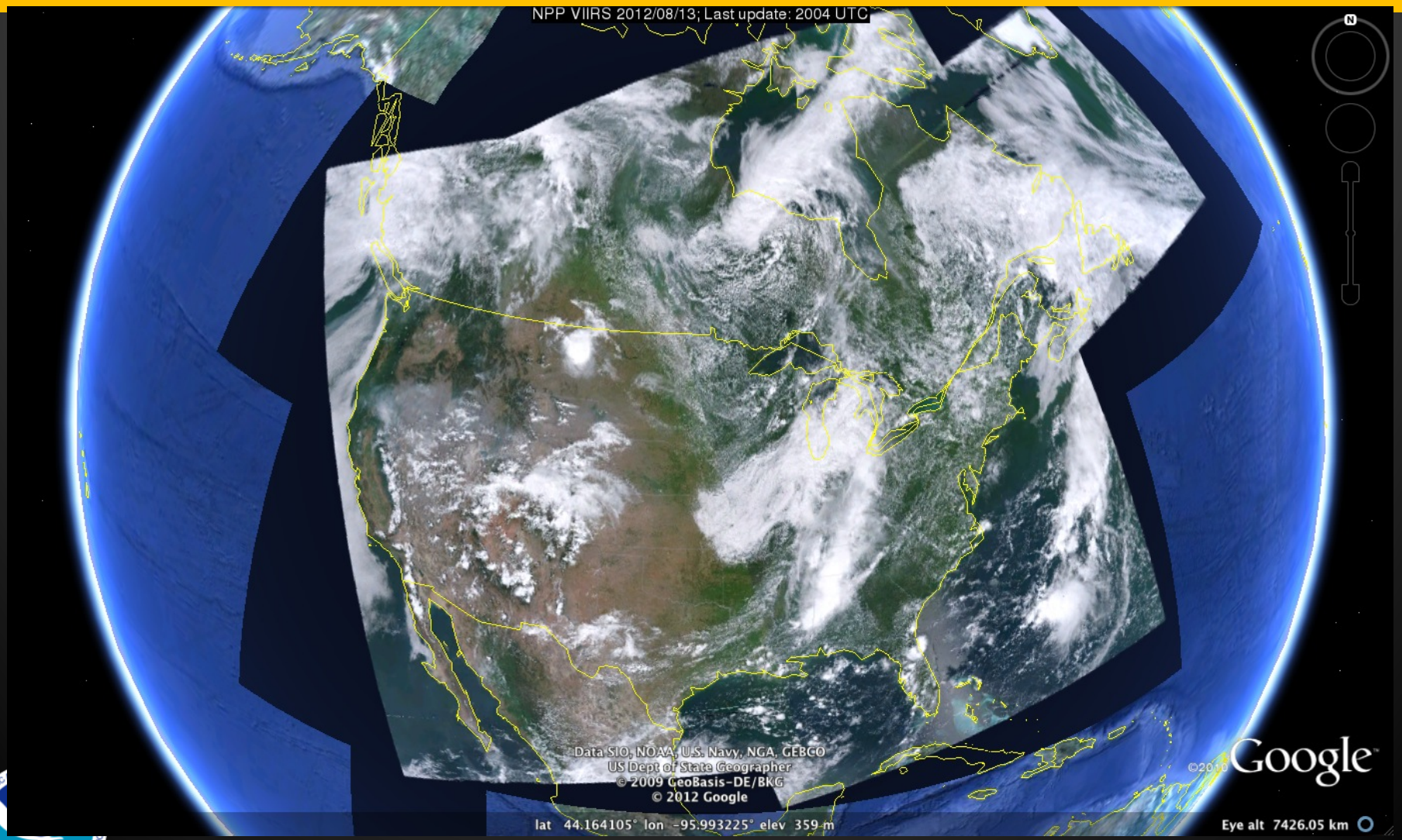
Improved Fog Products – using DNB





Cloud mask: Images show an example how DNB can improve cloud detection. Left image shows difference M12 (3.75um) – M15 (11um) brightness temperature, one cloud test in the current cloud mask. Water clouds appear yellow and red. Right image shows VIIRS DNB, where water clouds are very bright. It can be seen that DNB will detect low-level clouds those are missed in IR.

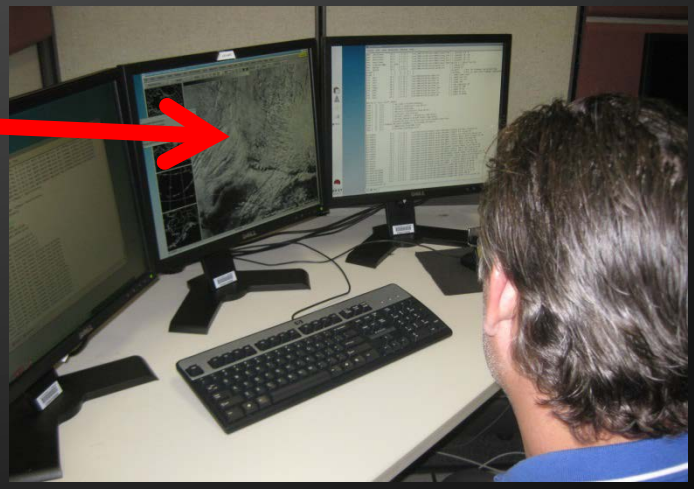
Direct Broadcast Through the CSPP *Data Faster - Greater Operational Impact*



University of Alaska Provides Real-Time VIIRS imagery to Alaska WFOs

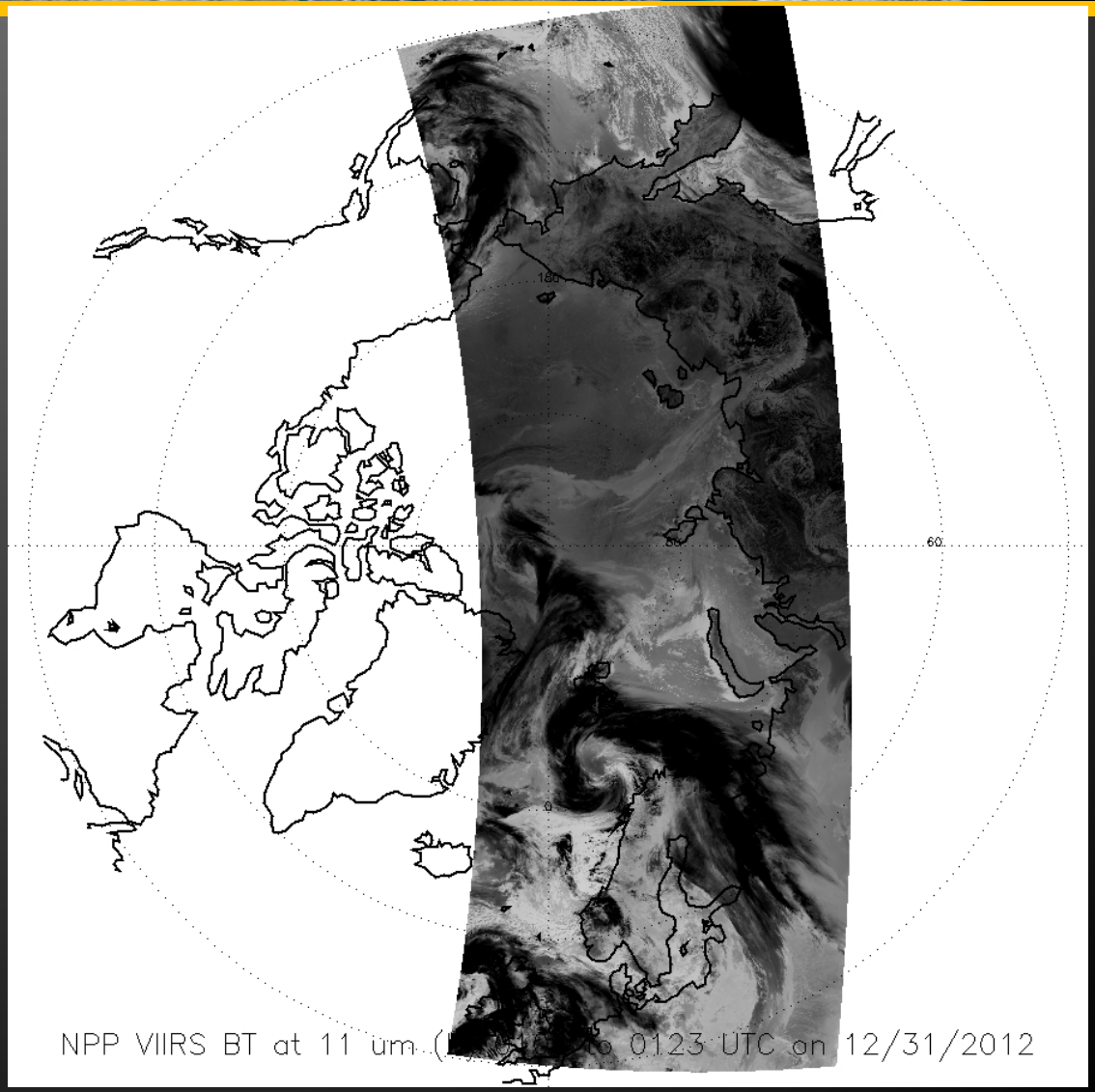
Big Dog Dish

The GINA X-Band receiving station antenna on top of the IARC building. The 3.6-meter dish inside the fiberglass radome captures dozens of passes per day from the SNPP-VIIRS, Terra-MODIS, and Aqua-MODIS satellites. (UAF photo by Todd Paris)



JPSS Supporting Weather Ready Nation through VIIRS

VIIRS provides critical visible and IR imagery which supports weather forecasting and navigation and hydrology at polar latitudes.



LocalForecast by City, St or Zip Code

City, St Go

Forecasts/Products
Public
Forecast Discussion
- With Glossary
Aviation
Marine
Hydrology(RFC)
Rivers & Lakes AHPS
Ice Desk
TV Weather
Fire Weather
Avalanche
Travel 511
Graphical
XML RSS Feeds
Marine FTPMail

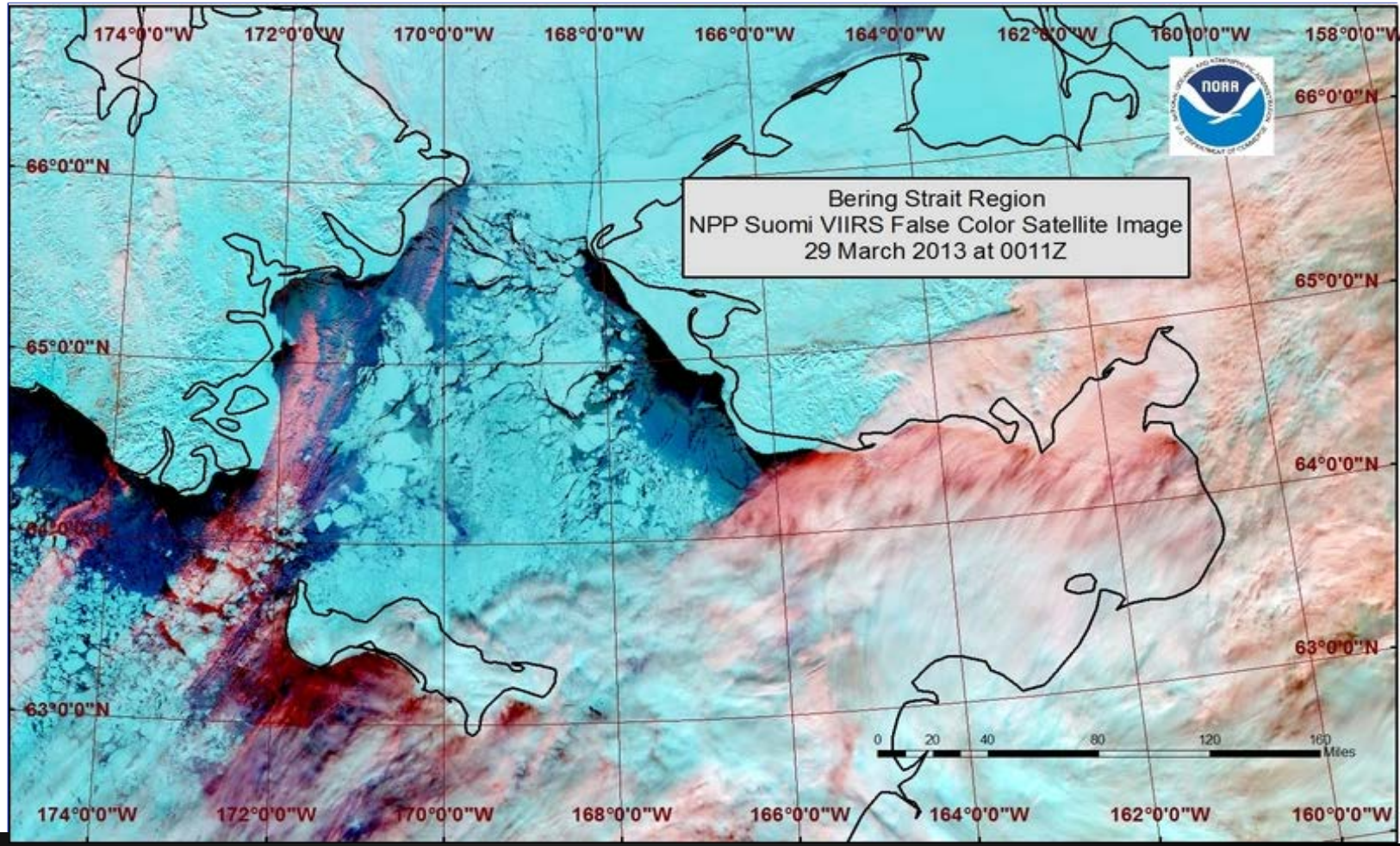
Data
Vent Factor
Mesonet
Model Graphics
Local Model
Observations
Marine Obs
Satellite/Radar
Soaring Index
Weather Links

Climate
PAFC Climate
Interactive Climate
PAFC Records

Satellite Ice Imagery

This page is used to post satellite images of sea ice. Resolution of the images ranges from 250 meters to 4 kilometers. Sources for the imager
POES AVHRR from NWS Alaska Region. Images are added to this page as cloud cover and time permit.

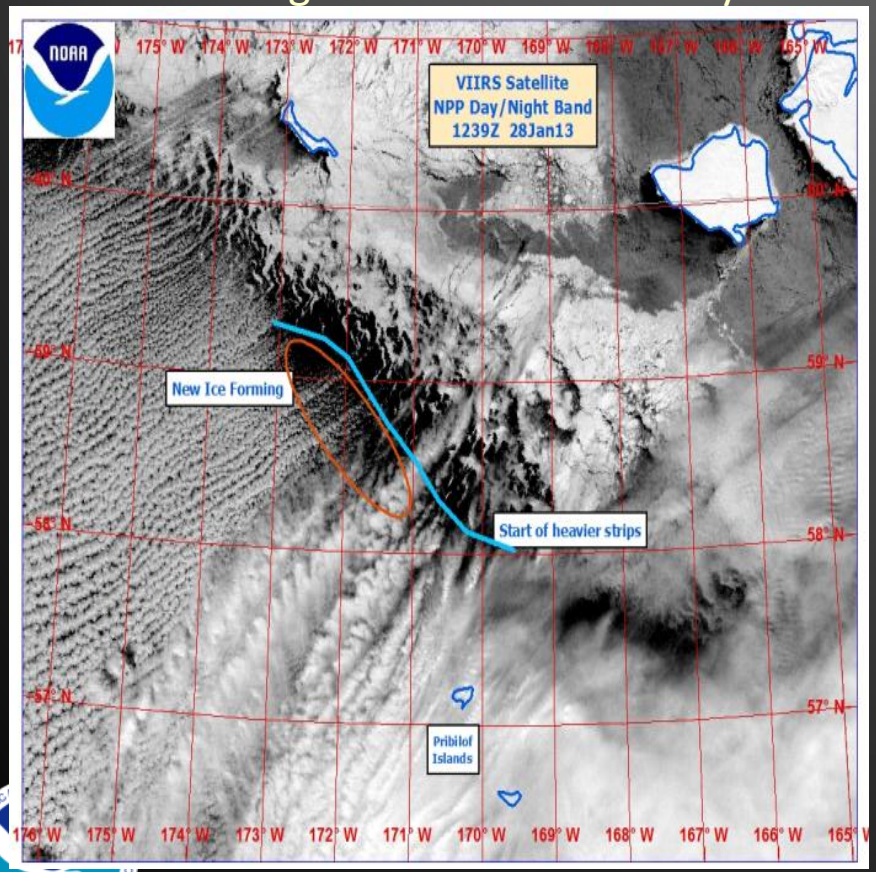
Click on each image for a larger view:



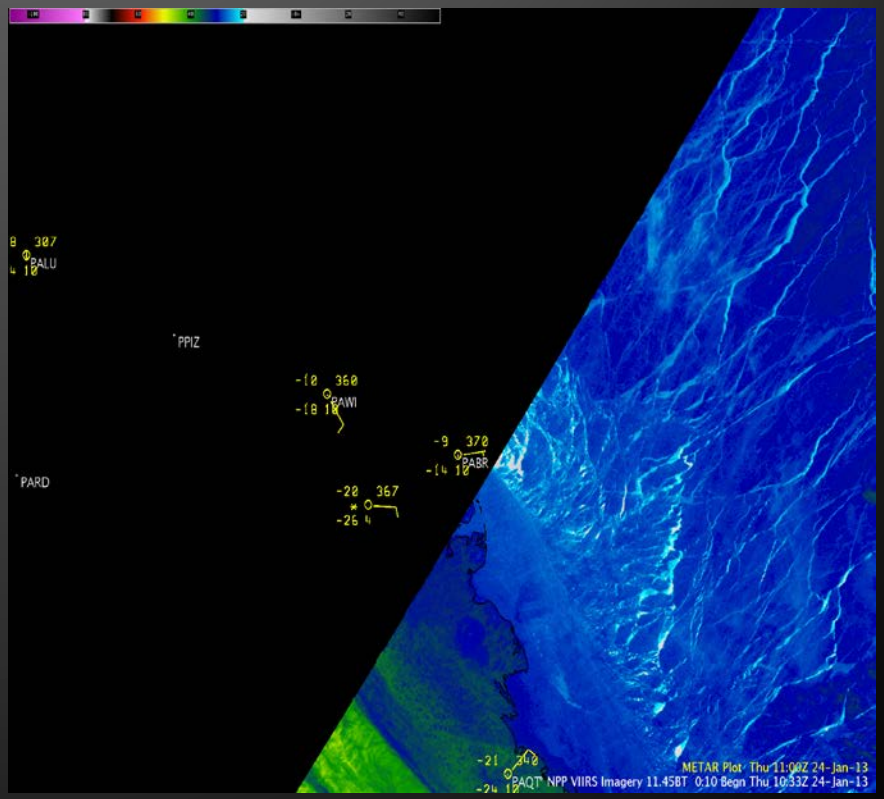
NWS in Alaska, through the JPSS Proving Ground, has become a primary and proactive user of VIIRS products and imagery.

The examples demonstrates exploitation of critical data for arctic access and navigation, and safe transportation.

VIIRS being used for sea ice analysis



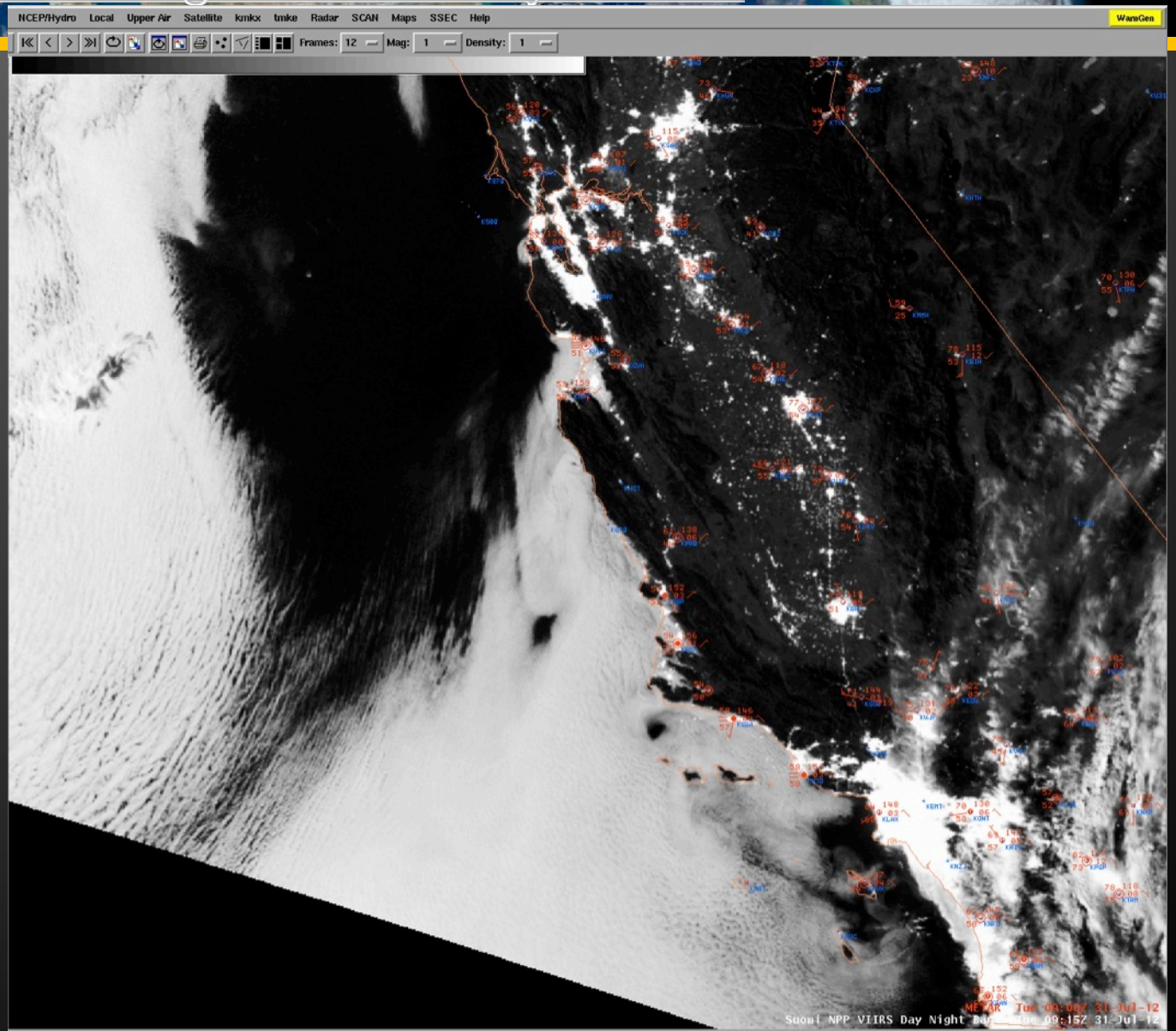
VIIRS animation showing strong Easterly Flow (Polynyas* and Leads) in Ice.



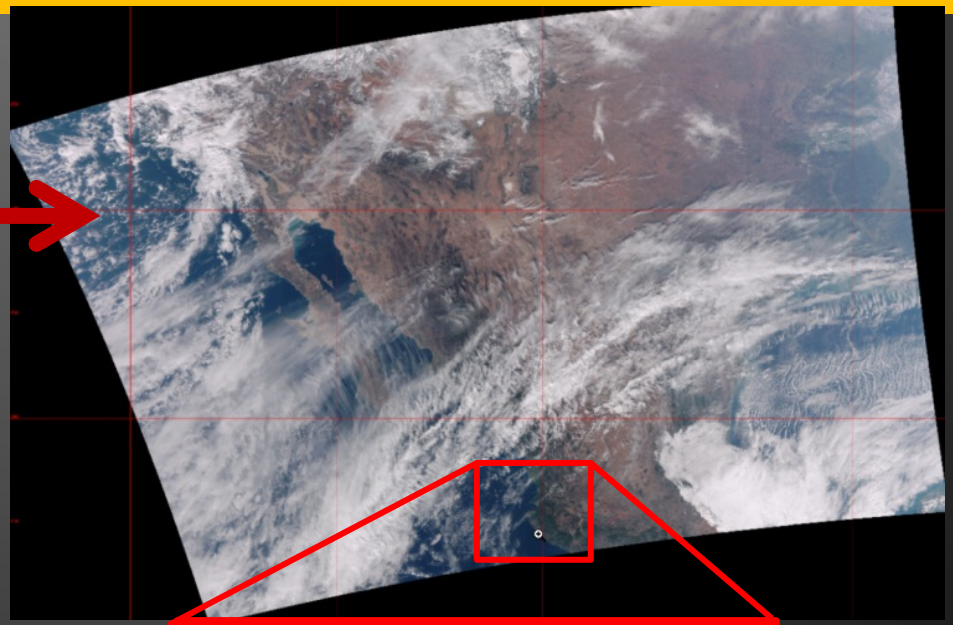
* An area of open water surrounded by sea ice. It is now used as a geographical term for an area of unfrozen sea within the ice pack.

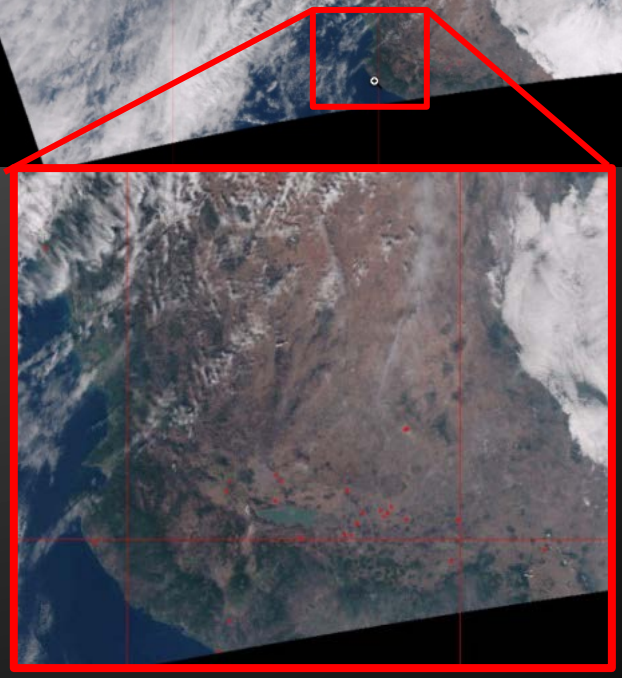
Identifying Maritime Stratus Intrusion at Night 31 July 2012

The National Weather Service Forecast Office in Monterey, California Currently employs the VIIRS DNB to provide higher confidence for issuing marine dense fog advisories



JPSS Supporting Wildfire Detection through VIIRS

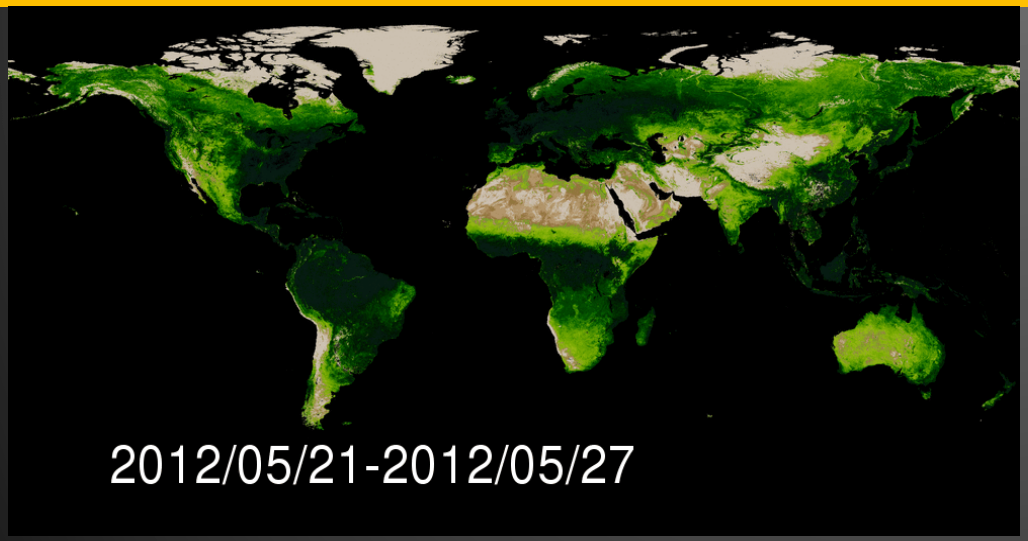


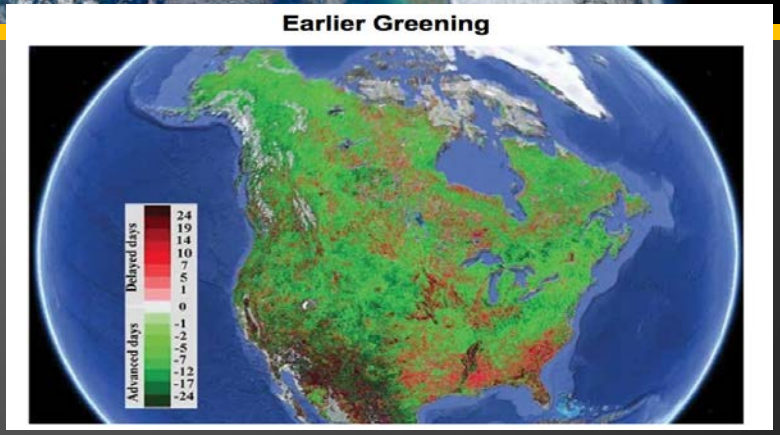


The National Weather Service and US Forest Service both depend on VIIRS data to predict, identify and monitor wildfires.

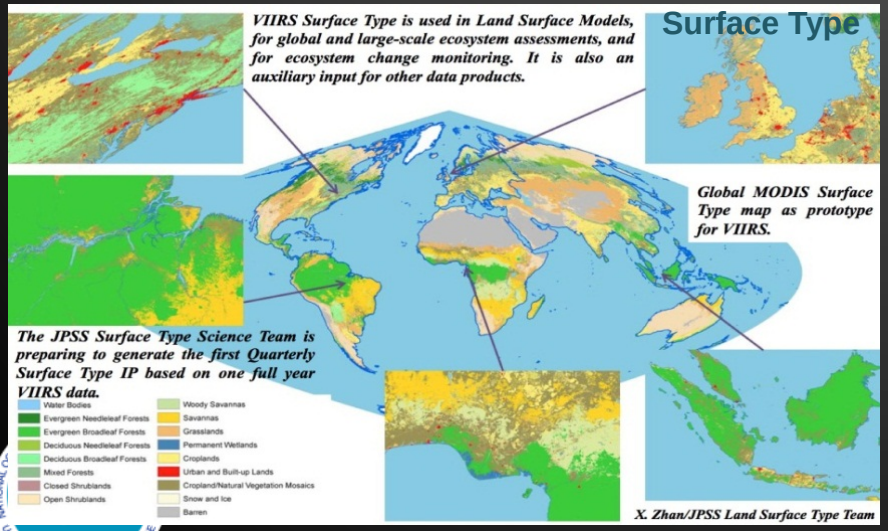
JPSS has funded development and implementation of the Active Fires program through its Proving Ground.

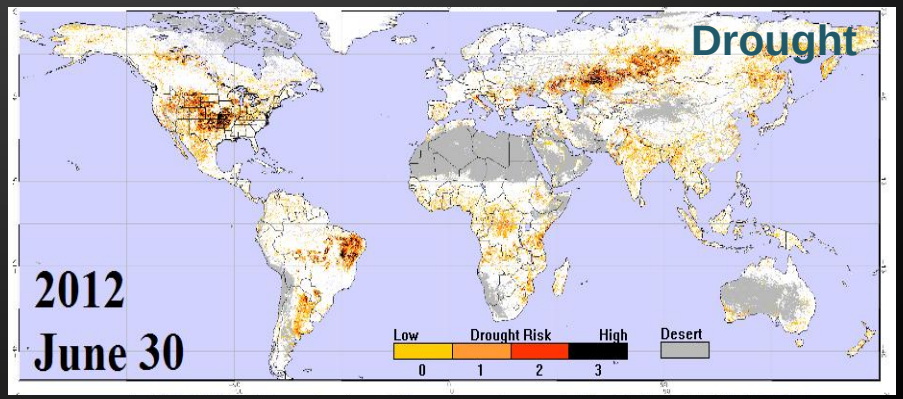
JPSS Supporting Land and Ecosystem Monitoring through VIIRS



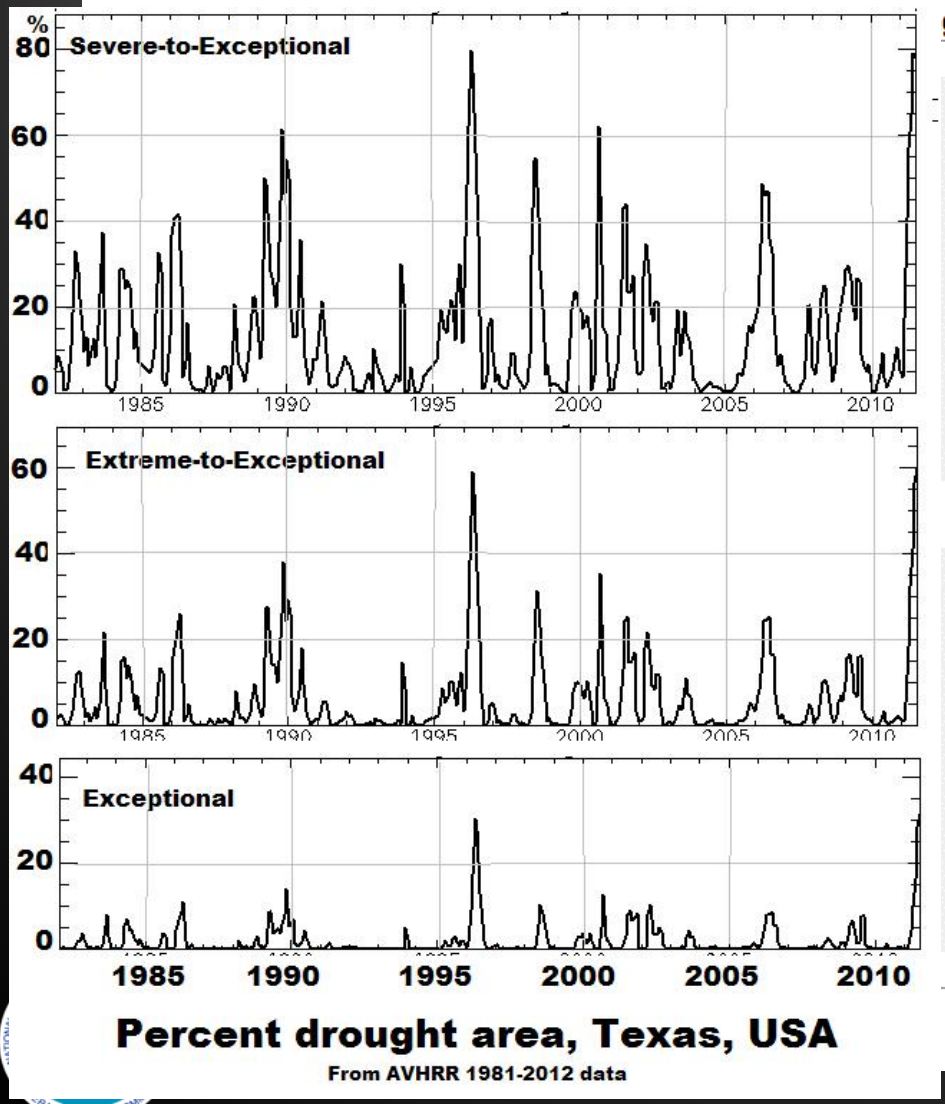


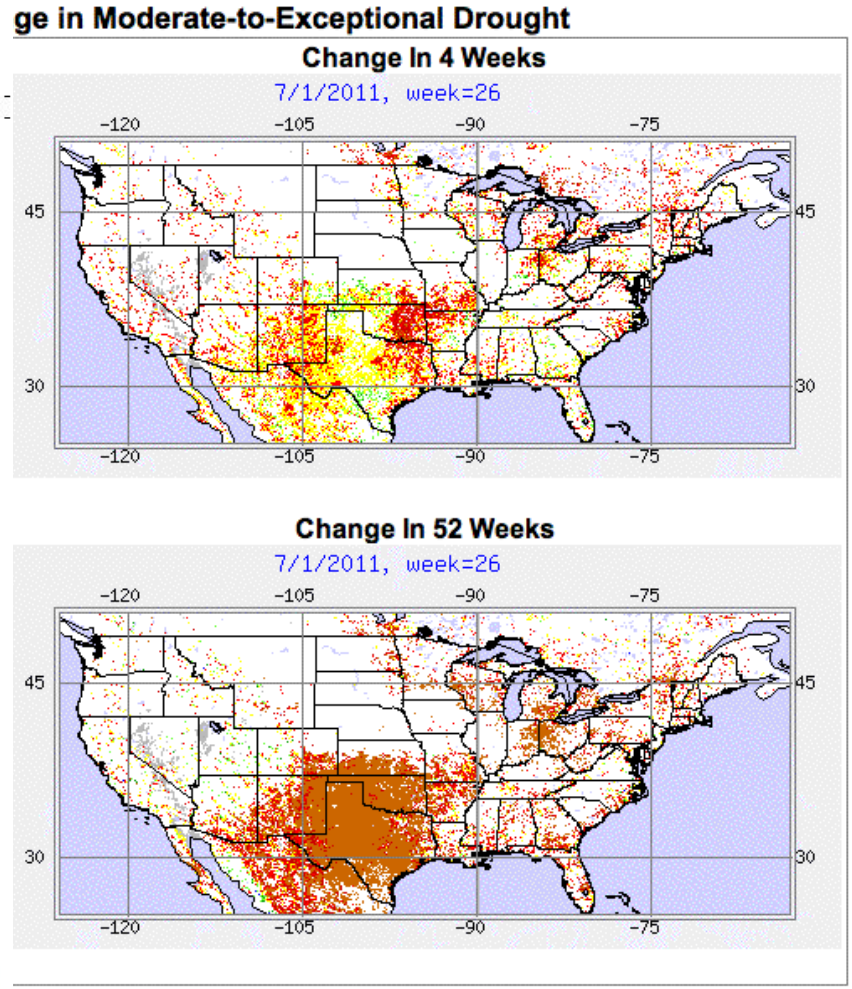
Understanding climatically-induced changes allows for NOAA to better support land, ecosystem and drought monitoring to provide decision support to US stakeholders





2011 TEXAS Drought Assessment using AVHRR (replaced by VIIRS)





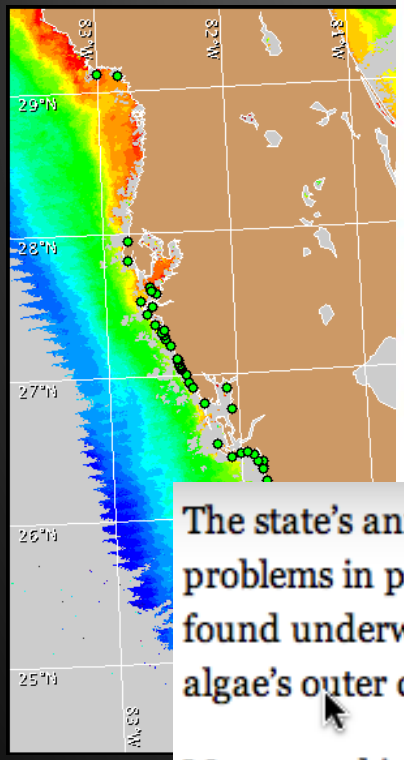
The New York Times April 7, 2013 Environment

Harmful A

Florida Algae Bloom Leads to Record Manatee Deaths

Julio Cortez/Associated Press

A manatee off Peanut Island, Fla.



nditions Reports

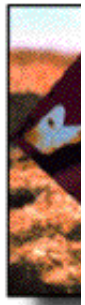
ulfside region of the Lower to Middle Florida through Wednesday, with moderate impacts ngshore southwest Florida today through

egion. No impacts are expected. Last

The state's annual red tide affects a wide range of aquatic animals and can cause problems in people. The algae contain a nerve poison known as brevetoxin that is not only found underwater but that is also blown through the air when waves break open the algae's outer casing.

Manatees, birds, dolphins and other animals can be killed by consuming the poison, either by accidentally eating the algae or by ingesting small organisms clinging to sea grass that have soaked up the poison while filtering seawater.

Residents and tourists regularly have respiratory problems after inhaling brevetoxins while strolling on beaches near red tides. People can also become ill after eating oysters and clams that have absorbed the toxin.

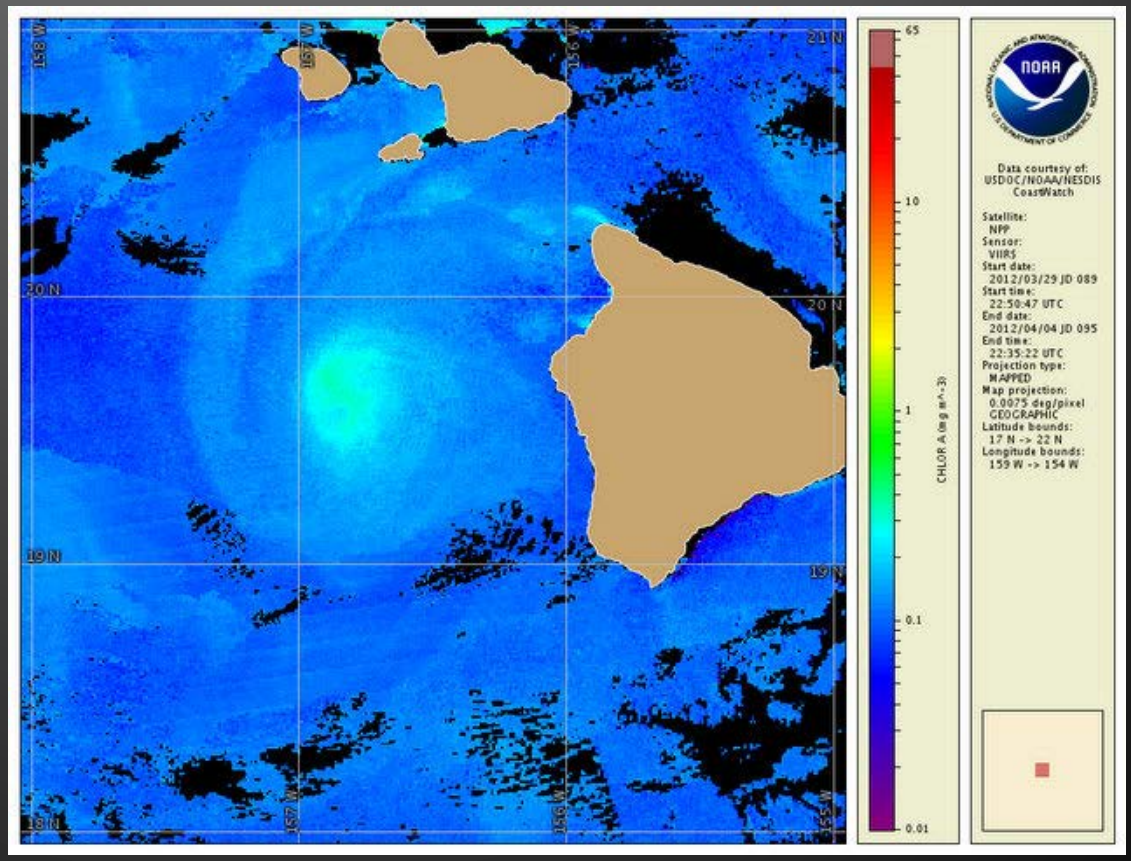


Data courtesy of:
USDOC/NOAA/NESDIS
CoastWatch

Satellite:
NPP
Sensor:
VIIRS
Date:
2012/04/09 JD 100
Start time:
19:20:39 UTC
End time:
19:19:12 UTC
Projection type:
MAPPED
Map projection:
0.83 km/pixel
MERCATOR
Latitude bounds:
16 N -> 32 N
Longitude bounds:
100 W -> 78 W

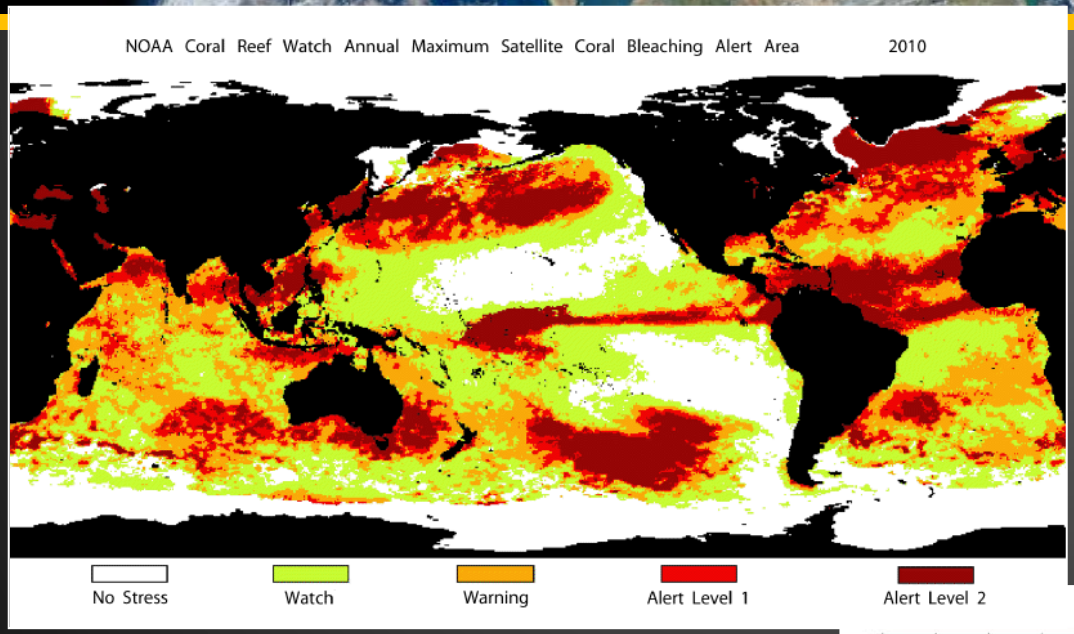
Managing marine resources via monitoring ocean nutrients

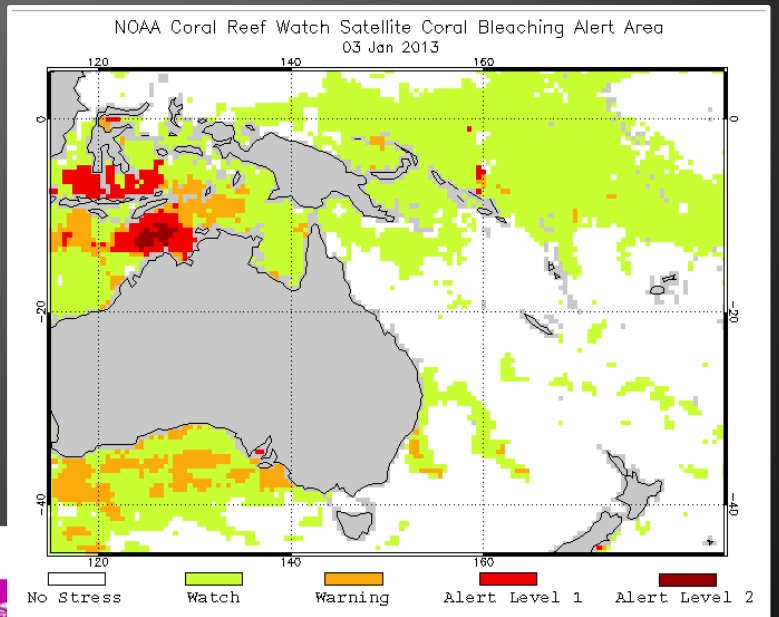
The cyclonic spin of the eddy causes the nutricline at its core to shoal, bringing deep nutrients to surface waters resulting in increased phytoplankton. These eddies appear to create food webs resulting in foraging habitat for apex species including tunas and cetaceans off the coast of Hawaii.



VIIRS ocean color derived Chlorophyll-A

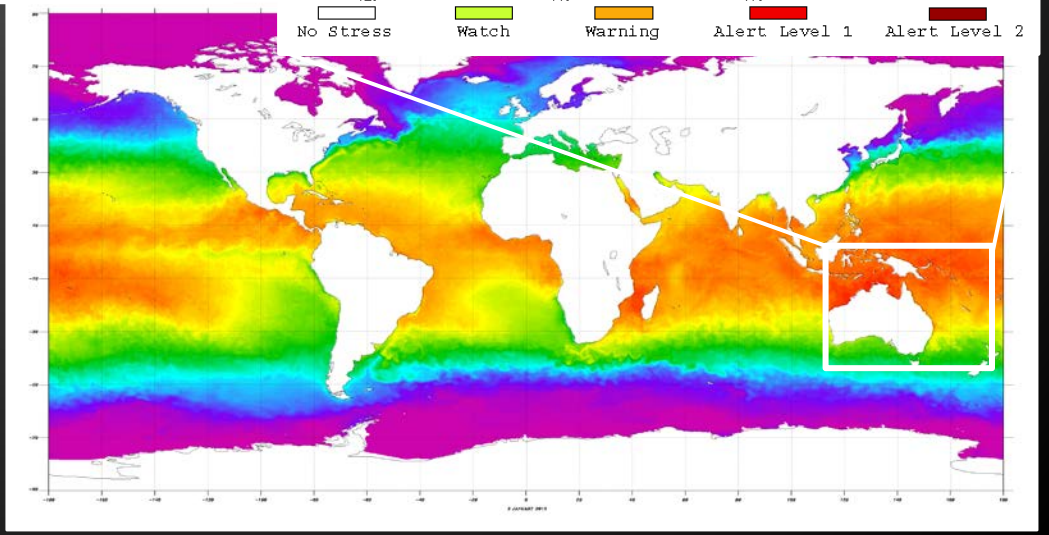
JPSS Supporting Healthy Oceans and Reefs through VIIRS





In 2010, major bleaching occurred to coral reefs throughout much of the Indian Ocean, Southeast Asia, the Coral Triangle, and the Caribbean

Coral Reef Watch (using AVHRR) provide a nowcast of current bleaching environmental conditions as derived from sea surface temperature anomalies



OMPS- Ozone Mapping and Profiler Suite

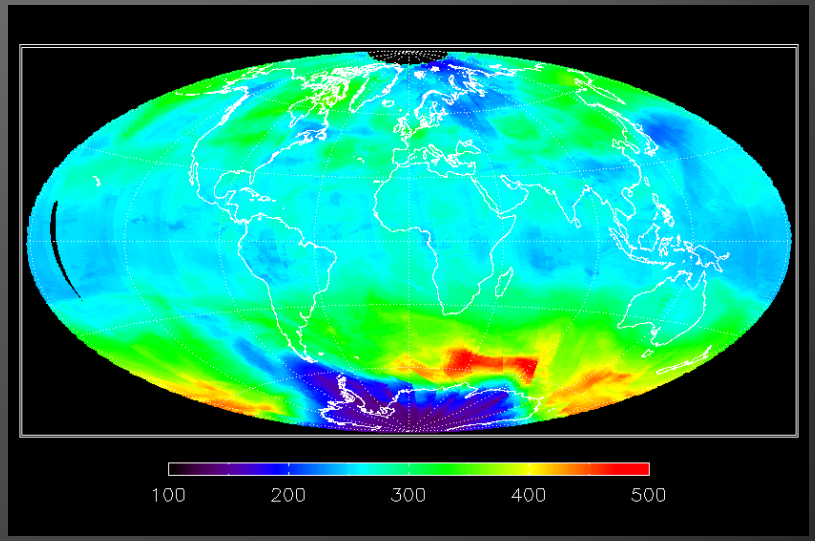
Advanced Features

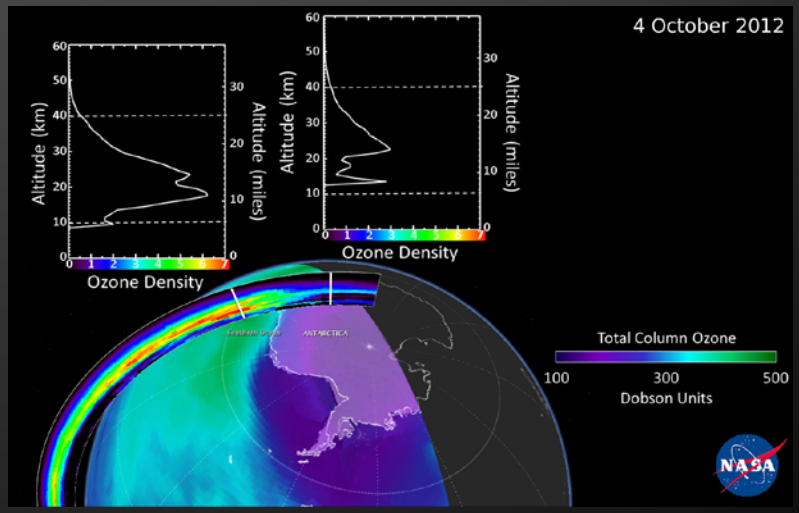
Three hyperspectral imaging spectrometers:

Nadir Mapper: 50 km spatial with 2600 km swath

Nadir Profiler: 250 km spatial, 8 km vertical resolution

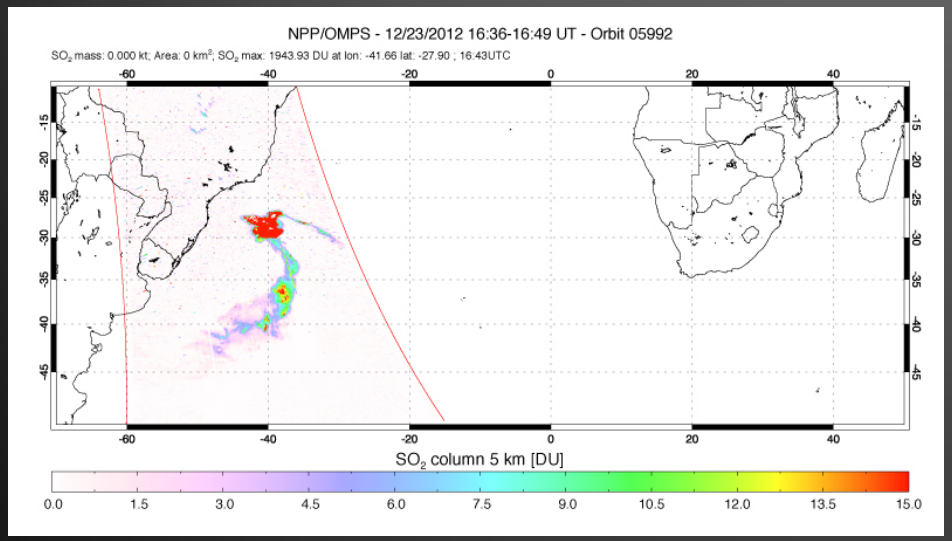
Limb: 3 km vertical, three cross-sections separated by 500 km



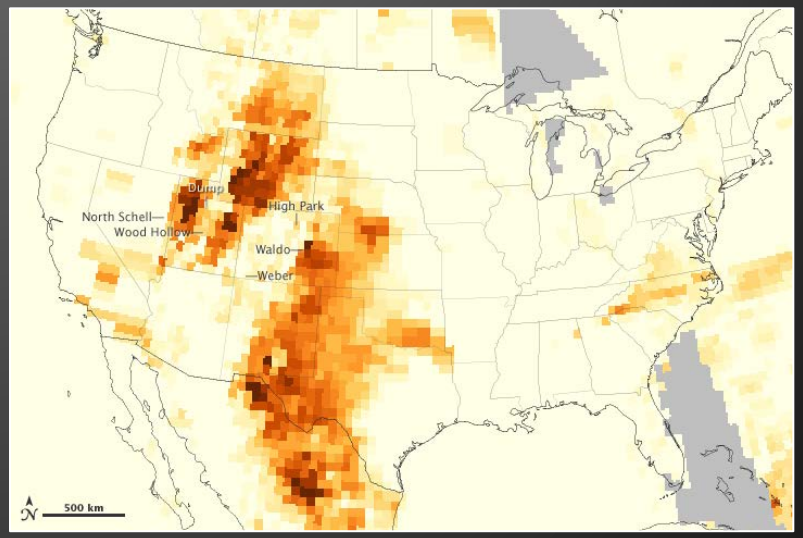


OMPS Aerosol and SO_2 Index

Copahue Eruption Dec. 13, 2012

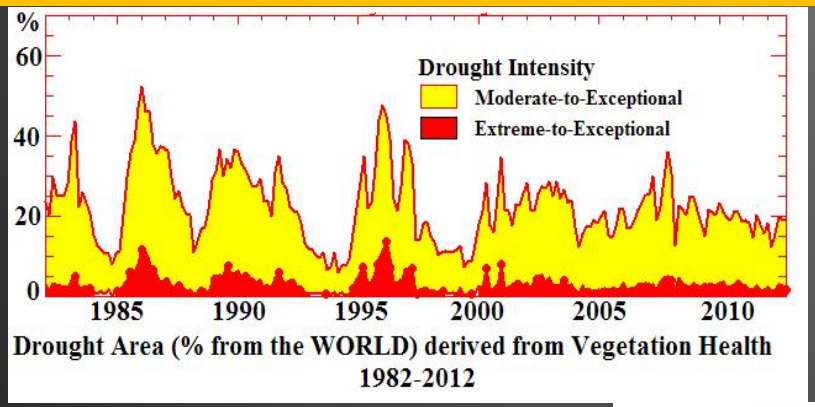


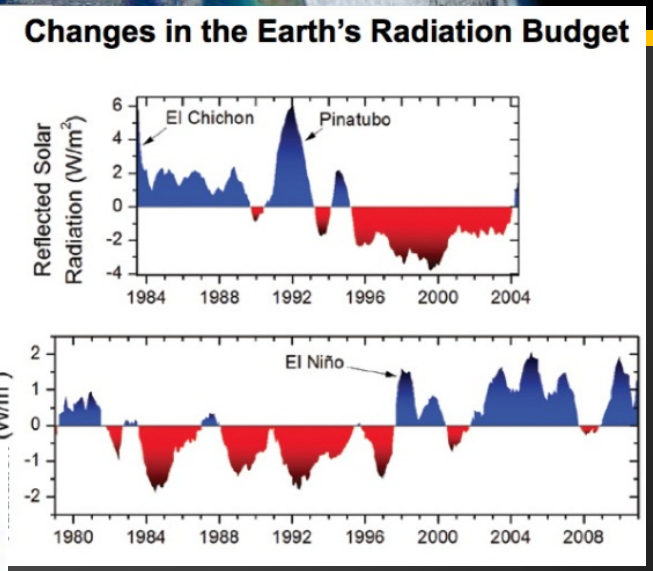
June 23, 2012

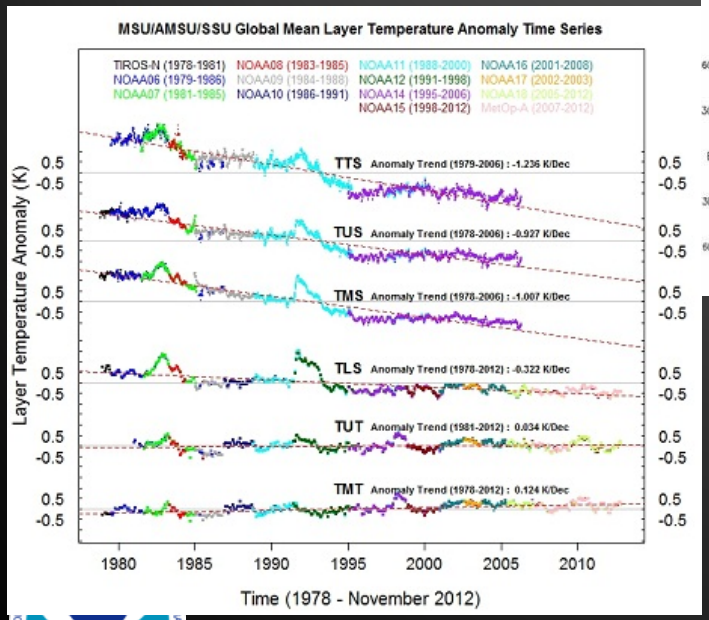


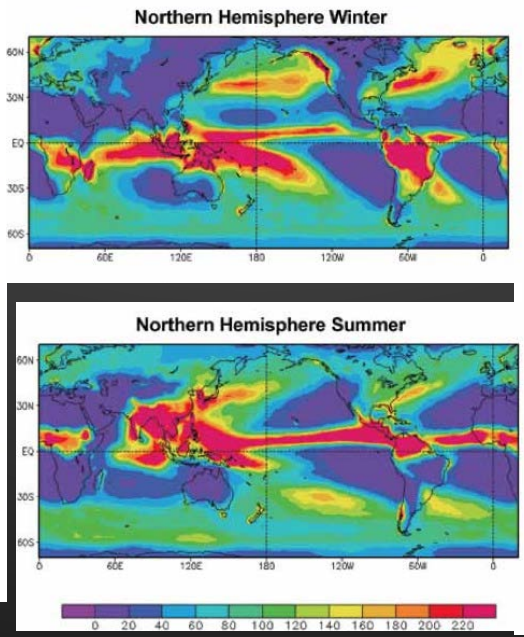
(NASA Science Team)

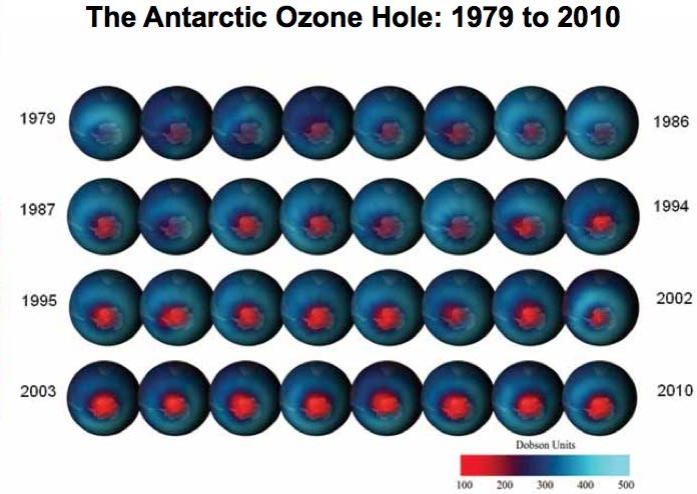
JPSS provides Critical Observations to Extend Climate Data Records











JPSS ENVIRONMENTAL PRODUCT PRODUCTION

VIIRS (28 EDRs)

RDR & SDR (for each band)

EDRs

- ACTIVE FIRES
- ALBEDO (SURFACE)
- AEROSOL OPTICAL THICKNESS
- AEROSOL PARTICLE SIZE PARAMETER
- CLOUD BASE HEIGHT
- CLOUD COVER/LAYERS
- CLOUD EFFECTIVE PART SIZE
- CLOUD OPTICAL THICKNESS
- CLOUD TOP HEIGHT
- CLOUD TOP PRESSURE
- CLOUD TOP TEMPERATURE
- CLOUD MASK
- ICE SURFACE TEMPERATURE
- ● IMAGERY
- LAND SURFACE TEMPERATURE
- OCEAN COLOR/CHLOROPHYLL
- QUARTERLY SURFACE TYPE
- SEA ICE CHARACTERIZATION
- SEA SURFACE TEMPREATURE
- SNOW COVER
- SURFACE TYPE
- SUSPENDED MATTER
- VEGETATION INDICES
- *Green Veg Fraction Index*
- *Ocean Color/Chlorophyll*
- *Polar Winds*
- *Sea Surface Temperature*
- *Vegetation Health Index Suite*

GCOM AMSR-2 (11 EDRs)

RDR, *SDR, TDR*

EDRs

- *Cloud Liquid Water*
- *Imagery*
- *Precipitation Type/Rate*
- *Precipitable Water*
- *Sea Ice Characterization*
- *Sea Surface Temperature*
- *Sea Surface Winds-Speed*
- *Snow Cover/Depth*
- *Snow Water Equivalent*
- *Soil Moisture*
- *Surface Type*

CrIS/ATMS (4 EDRs)

EDRs

- *Atm Vert Moisture Profile*
- *Atm Vert Temperature Profile*
- Atm VERT MOISTURE PROFILE
- Atm VERT TEMPERATURE PROFILE

ATMS (11 EDRs)

RDR, ● SDR, TDR

- *Cloud Liquid Water*
- *Imagery*
- *Land Surface Emissivity*
- *Land Surface Temperature*
- *Moisture Profile*
- *Rainfall Rate*
- *Sea Ice Concentration*
- *Snow Cover/Depth*
- *Snow Water Equivalent*
- *Temperature Profile*
- *Total Percipitable Water*

TSIS[1]

RDR & *SDR*

CrIS (4 EDRs)

RDR & ● SDR

CO *CO_2* *CH_4*

Infrared Ozone Profile

A-DCS

PLATFORM REPORTS[4]

SARR & SARP

DISTRESS BEACON REPORTS[5]

OMPS (3 EDRs)

OMPS-N RDR & SDR

OMPS-L RDR[2] & SDR[3]

EDRs

- O_3 TOTAL COLUMN (OMPS-N)
- O_3 NADIR PROFILE (OMPS-N)
- O_3 LIMB PROFILE (OMPS-L)[3]

CERES (2 EDRs)[1]

RDR & SDR

EDRs

- REFLECTED SOLAR RADIATION (TOA)
- OUTGOING LW RADIATION (TOA)

RDR = Raw Data Record
SDR = Sensor Data Record
EDR = Environmental Data Record
TDR = Temperature Data Record
● = EDRs w/Key Performance Parameters
BOLD CAPS = JPSS Ground System EDR
Italics = ESPC EDR

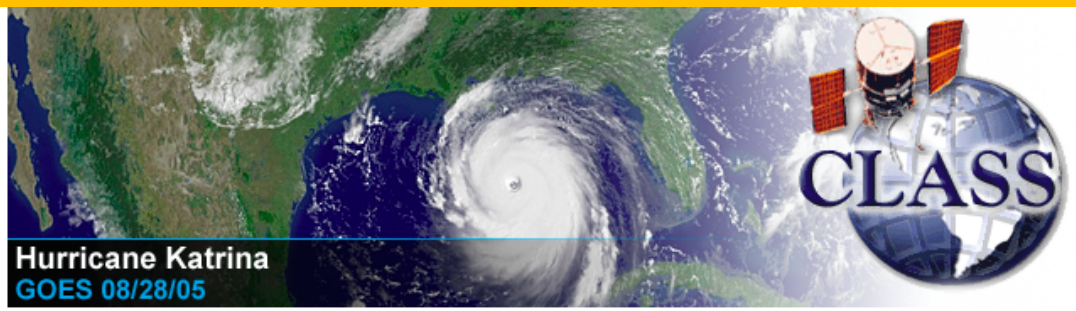
KEY

- JPSS Mission (NPP, JPSS- 1 & 2)
- GCOM-W1 Mission
- Free-flyer Mission

1 CERES and TSIS Climate Data Record (CDR) production is outside the scope of JPSS.
2 NPP and JPSS-2 Threshold requirement.
3 JPSS-2 Threshold requirement. OMPS Limb not flown on JPSS-1.
4 The JPSS program does not process the A-DCS Platform Reports. These reports are downlinked from the spacecraft to the local/regional (HRPT) ground stations who will deliver the data to CLS.
5 The JPSS program does not process the SARR Distress Beacon Reports. These reports are downlinked from the spacecraft to the SARSAT Local User Terminals, which then forward the data to one or more of the SARSAT MCCs.

02/12/13 JDW V5

Non-Real-Time User Access Products from CLASS



NEWS

Attention Metop users::
Except for the HIRS 1b data all Metop-B level 1b satellite data is now publicly available beginning on January 15, 2013. Data collected prior to that date remains restricted. We will post another message on the HIRS data once it becomes available. For any questions or assistance in obtaining the data please contact the CLASS Help Desk

Attention CORS users:
The National Geodetic Survey's CORS data is now available for ordering from the CLASS archive. Older data are currently in the process of being migrated from the NGDC archive to CLASS. While every effort is made to retain data in the original at-sampling rate, there may be cases where only the 30-second decimated rate data exists. For more details select 'Continuously Operating Reference Stations (CORS)' from the product drop down menu and click on Go.

Suomi NPP data access status:
Below is a list of S-NPP products released to the public and now available through CLASS. The complete list of products along with the begin dates of product availability are located on the Suomi NPP FAQ page. The remaining NPP products will be released to the user community over a time frame of several months. Please note that all newly released products are at 'Beta' maturity level as defined in the Product Maturity Level page. Details of high priority issues related to the data quality are contained in the Readme files provided by the NPP Project Scientist. Please read these before ordering and using the data!

ATMS
Readme for released S-NPP ATMS SDR data

CrIS
Readme for released S-NPP CrIS SDR data

CrIMSS
Readme Readme for released S-NPP CrIMSS EDR data

OMPS
Readme for released S-NPP OMPS Nadir Ozone Profile data
Readme for released S-NPP OMPS SDR data

NOAA User Latency Requests

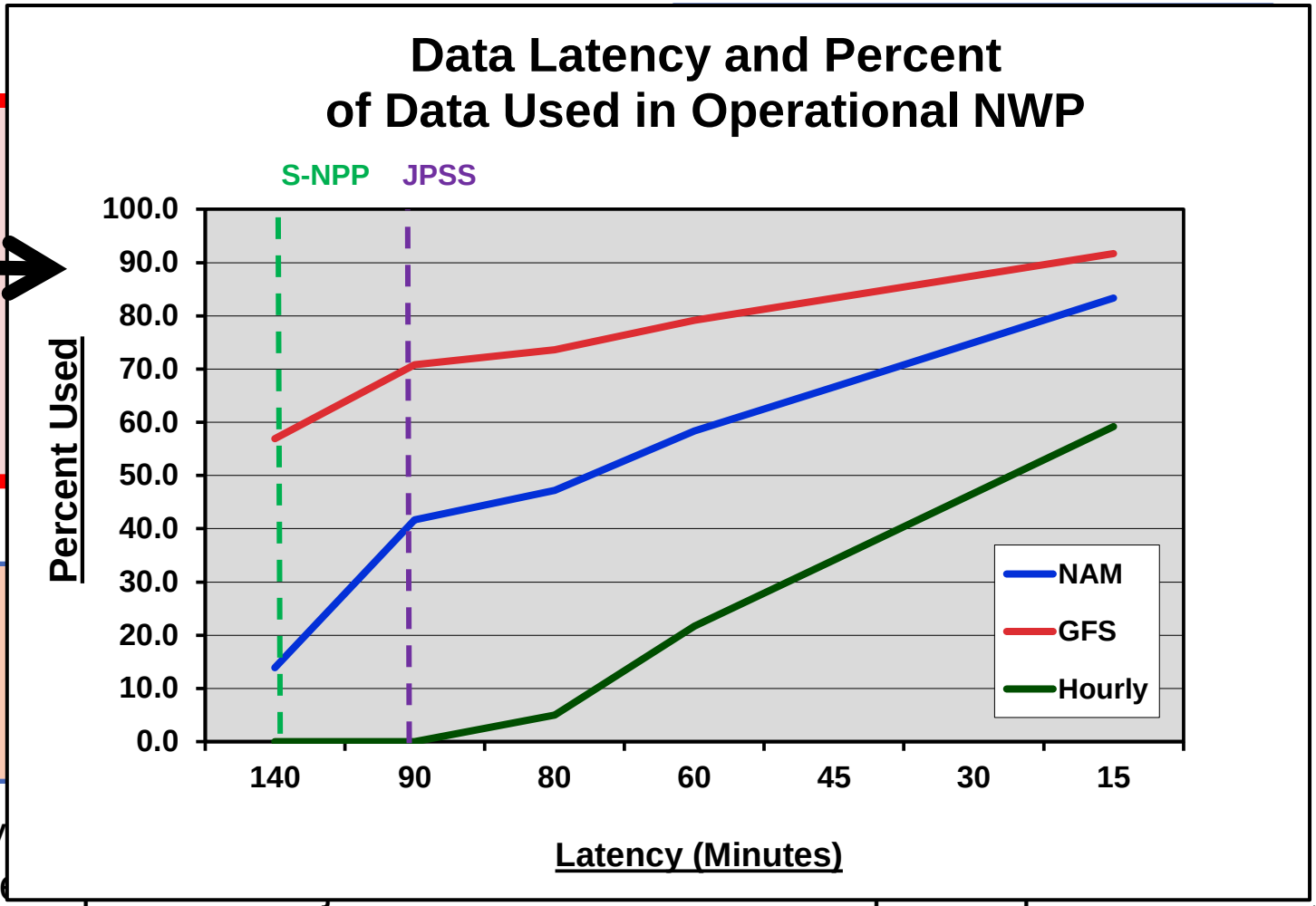
- **NOAA operational Line Offices have provided true latency values for their respective critical products (focusing on the near-real time requirements)**

30 minutes

NWS:
ATMS
SDR
TDR
CrIS SDR
VIIRS Imagery EDR
(Alaska Region)

60 minutes

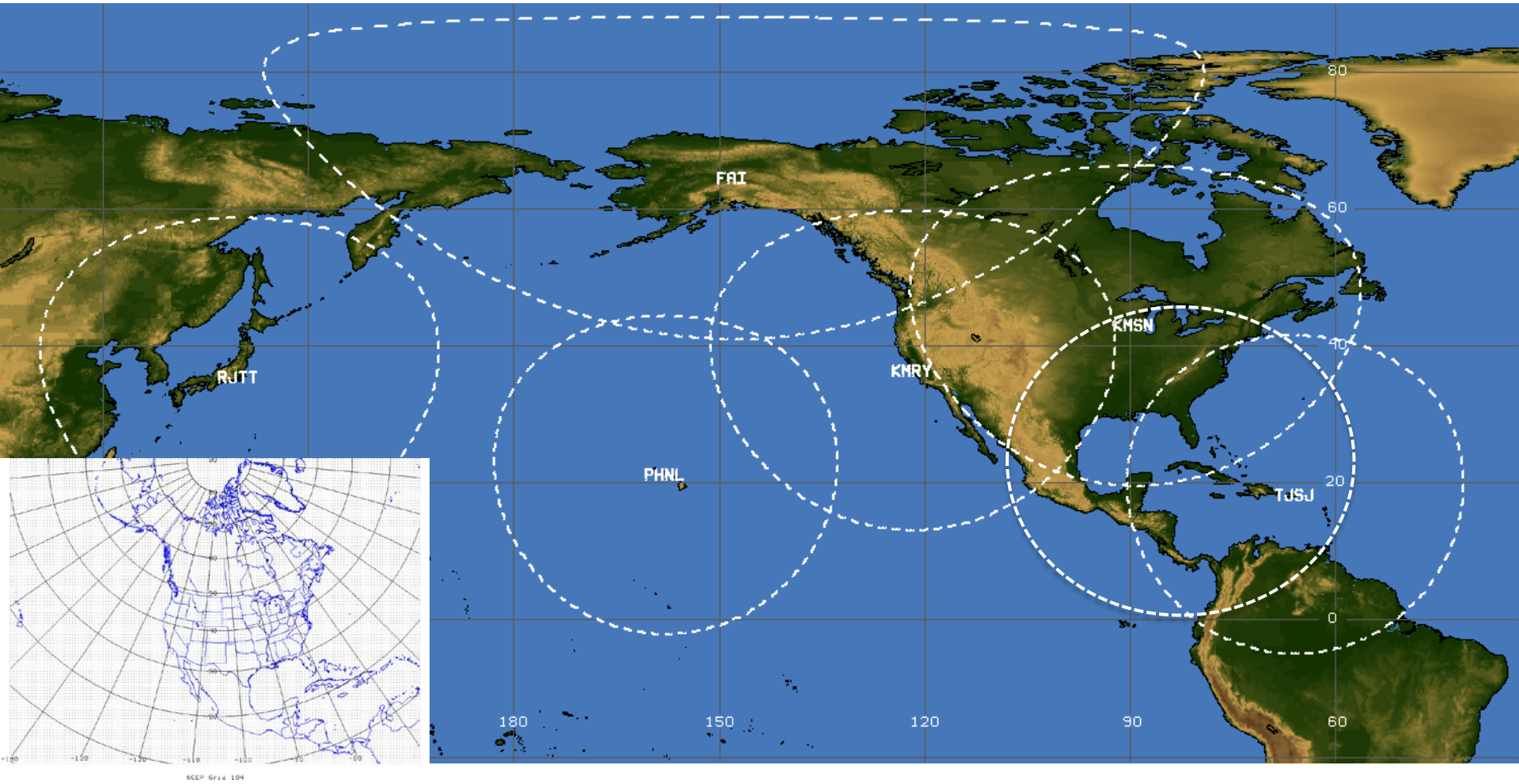
NESDIS:
SARSAT Data



Any latency
minutes) ar

Future JPSS Proving Ground DB Demo

CSPP sites



Community Supported Processing Package (CSPP) demonstrates the value of 30 minute latency for nowcasting and regional forecast model applications by establishing a network of direct readout stations

Survey Questions

- **To be provided later during this meeting:**

- **Understand your requirements**
- **Feedback on CSPP**
- **Prioritize CSPP algorithm development**
  - CSPP include algorithms to generate products from SNPP/JPSS and METOP, and studying options for products from Chinese (CMA) and Russian (Roshydromet/Roshcosmos) satellites
- **Understand need for applications**
  - Air quality, tropical cyclone intensity

Summary

JPSS is a major contributor to the global observing system.

Suomi NPP instruments are performing exceptionally well!!

Many applications will benefit

International partnerships are essential.

Direct readout provides excellent opportunities for full resolution data and low latency for critical applications. Also solves problem of access/distribution of data from centralized processing centers

.