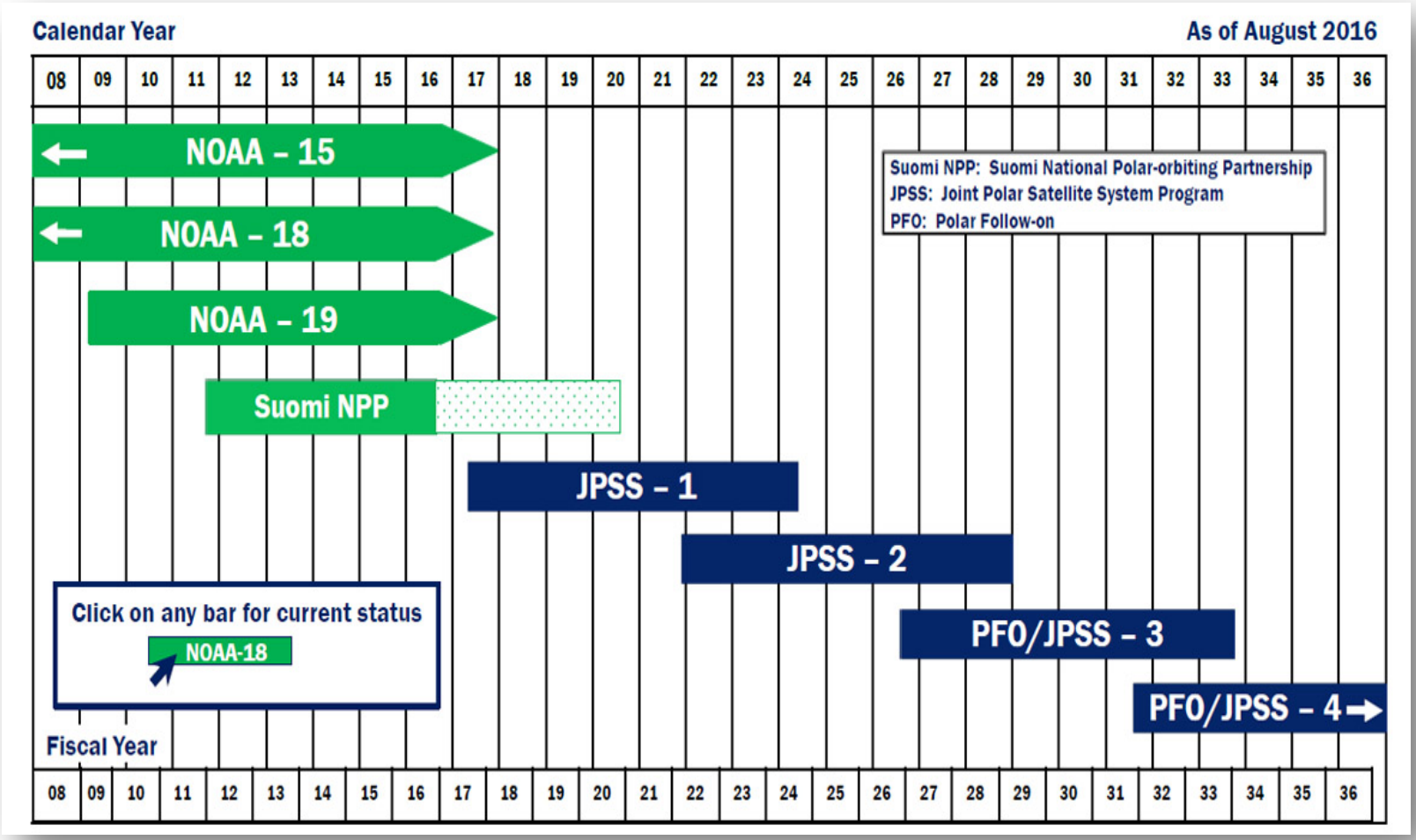
THE JOINT POLAR SATELLITE SYSTEM THROUGH PROVING GROUND INITIATIVES

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

CPO meeting January 30, 2017

JPSS will provide critical observations for the next two decades and JPSS also provides a science program



Robust Science Program

- User requirements and prioritization
  - Determining and prioritizing products user needs - Critical, Supplemental High, Supplement Low(subset of critical becomes Key Performance Parameters (KPP) via LORWG, TPIO, NOSC
  - User input gathered via the LORWG, chaired by Program Scientist.
  - User workshops/conferences to reach broader community
  - Assessing solutions to meet requirements, does the proposed system satisfy the need?.
- Algorithms and Cal/Val
  - Develop algorithms to generate products- meeting requirements (accuracy, precision, latency)
  - Develop tools to visualize /validate the products
  - Generate validation reports, understanding and correcting outliers
  - Provide science and R2O maturity artifacts (Enterprise Life Cycle)
    - ATBDS, Cal/Val Plans, User manuals, Preliminary and Critical Design Reviews, Algorithm and Operational Readiness Reviews
  - Reprocess mission data to maintain consistency of products after algorithms errors are corrected or improvements are made to the algorithm, and deliver reprocessed data to NCEI
  - Delivery of software packages to operations & CSPP (Direct Broadcast package)

Robust User Readiness Program

- User Readiness (Proving Ground)
  - User engagement and priorities through JPSS Proving Ground Executive Board and Satellite Development Executive Board and Proving Ground and User Readiness Meeting.
  - Projects to improve NOAA products and services throughout NOAA LOs via infusion of JPSS data into applications (prioritized by PGED/SDEB).
  - Proving Ground Initiative Process for improved user interactions
  - Training for better understanding of how to best use our products in key applications
- New Science (Risk Reduction)
  - To meet user needs (e.g. flood mapping and river ice, improved data fusion of multiple data source)
  - User of Direct Readout to test new algorithms or to further reduce latency.

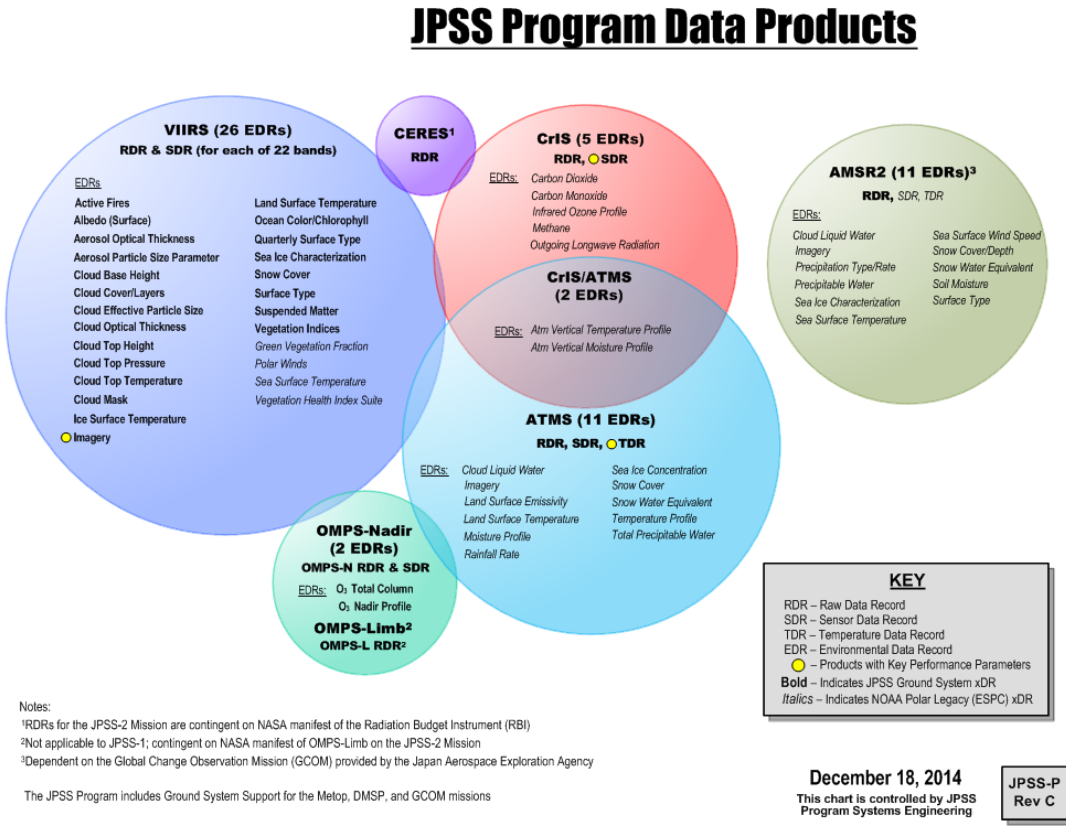
Challenge

User Readiness: Products to Applications

Ensure users are ready for JPSS data and improve their key operational and research product and services

- ✓Severe weather forecasts and warnings
- ✓Aviation weather forecasts and warnings
- ✓Improve fire and air quality forecasts and warnings
- ✓Improve warnings and prediction of poor water quality in coastal regions
- ✓Improve drought, precipitation, snow and ice assessments and predictions

Periodic feedback from keys users on the impact of JPSS data and to identify improvements needed for products and applications



5

Work through Service Areas

National Weather Service	National Marine Fisheries Service	National Ocean Service	Oceanic & Atmospheric Research
Weather Ready Nation!	***Healthy Oceans!***	***Resilient Coasts!***	***Climate!***
1. Aviation Weather and Volcanic Ash 2. Fire Weather 3. Hydrology and Water Resources 4. Marine Weather and Coastal Events 5. Hurricane/Tropical Storms 6. Routine Weather 7. Severe Weather 8. Space Weather 9. Tsunami 10. Winter Weather 11. Environmental Modeling Prediction **12. Science, Services and Stewardship**	1. Ecosystem Monitoring, Assessment and Forecast 2. Fisheries Monitoring, Assessment and Forecast 3. Habitat Monitoring and Assessment 4. Protected Species Monitoring **5. Science, Services and Stewardship**	1. Coastal Water Quality 2. Marine Transportation 3. Planning and Management 4. Resilience to Coastal Hazards and Climate Change **5. Science, Services and Stewardship**	1. Assessments of Climate Changes and Its Impacts 2. Climate Mitigation and Adaption Strategies 3. Climate Science and Improved Understanding 4. Climate Prediction and Projections **5. Science, Services and Stewardship**

Proving Ground Initiatives

What is an initiative? An interagency group of developers, service area providers, and stakeholders that frequently interact in a structured forum to address challenges in NOAA and partner service areas.

Initiative activities

- Products/capabilities are evaluated to ensure their optimal use in these focus areas.
- Based on user feedback, changes to these capabilities are considered to increase their effectiveness
- Actions to transition these capabilities to user operations are identified and implemented

Why are initiatives successful?

- Well defined objectives established and specific actions worked
- Stakeholders are actively participating with engagement of the user advocate.
- Products and capabilities are evaluated in operational environments
- Monthly and bi-monthly meetings ensure proposed improvements can be worked on and then implemented quickly

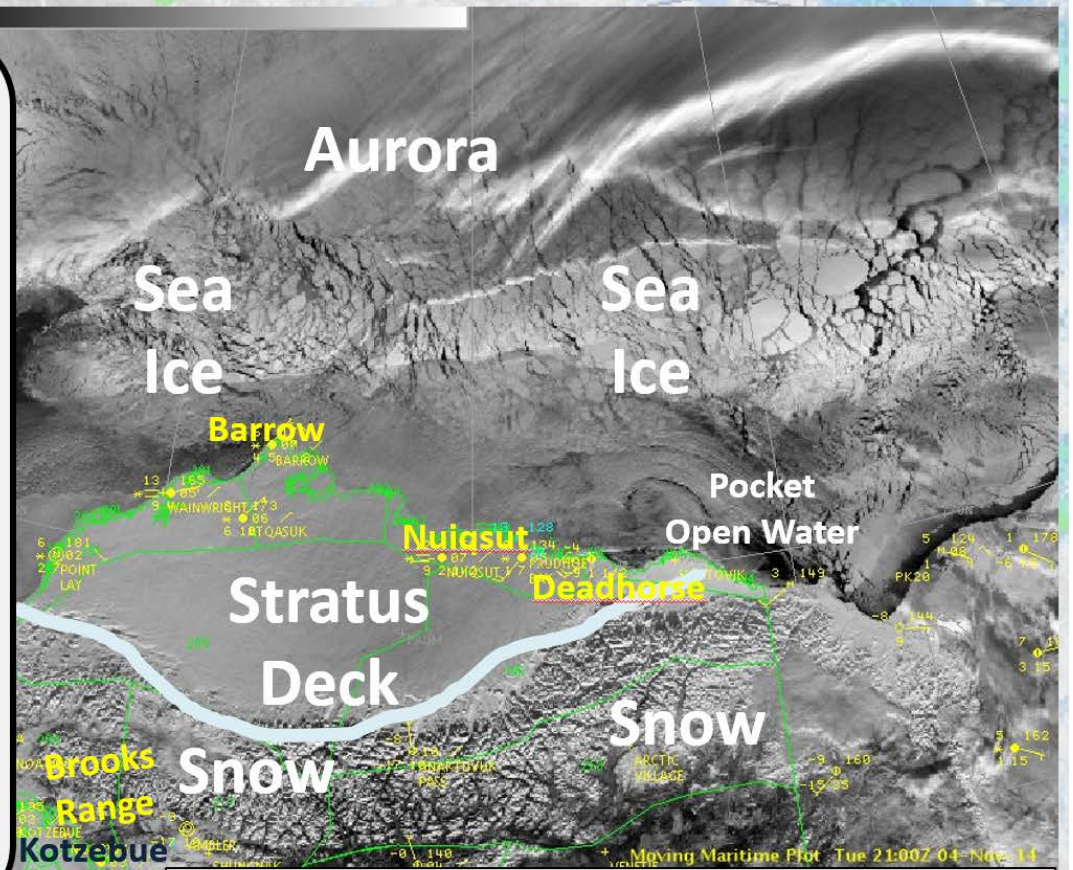
PGRR Proving Ground Initiatives

- River Ice and Flooding
- Fire and Smoke (Aerosols)
- Sounding Applications
- NWP Data Assimilation
- Imagery/Nowcasting
- Ocean and Coastal
- Hydrology
- Arctic
- Land Data Assimilation
- Atmospheric Chemistry

NWS utilizing JPSS Data

SATELLITE IN OPERATIONS

- Sea Ice Analysis
- Land Impacts
  - Fog/Stratus
  - Coastal ice
  - Snow
  - Combined Winds and Satellite data: Blowing Snow
- Marine Impacts
  - Coastal Erosion



SNPP VIIRS Day Night Band (DNB) at 2110z on Nov 4, 2014

NWS River Forecast Centers utilizing JPSS Data

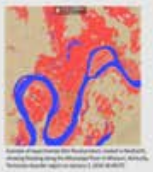
A Case Study of the 2015-2016 Mississippi River Basin Flood Using Suomi-NPP VIIRS Flood Products

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.

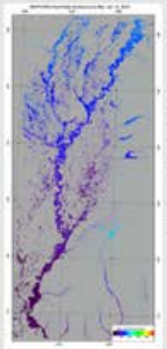
One new source of observed data utilized was the **Flooded Area imagery from the Suomi-NPP VIIRS satellite**, developed by George Mason University. This experimental product has been under development since 2014 and proved valuable in determining the flood inundated areas, providing forecasters and decision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

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.

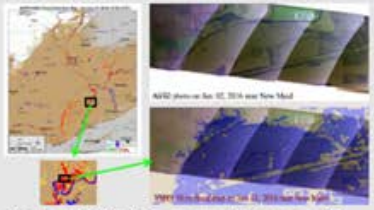


Above: Scatter plot between VIIRS retrieved water surface levels and water levels from river gauge observations during 2016's Midwest flood event.

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

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 downscaled from the native 375 M resolution to 30 M high resolution images available in the web based Real Earth viewer at CIMSS.



The downscaled 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-veg/bare soil 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-veg/bare soil floods.
- ✓ Daytime 375-m resolution JPSS VIIRS Flood Products are distributed to forecasters in AWIPS and to the general public via RealEarth (a web-based mapping service).
- ✓ Products available online or via mobile app

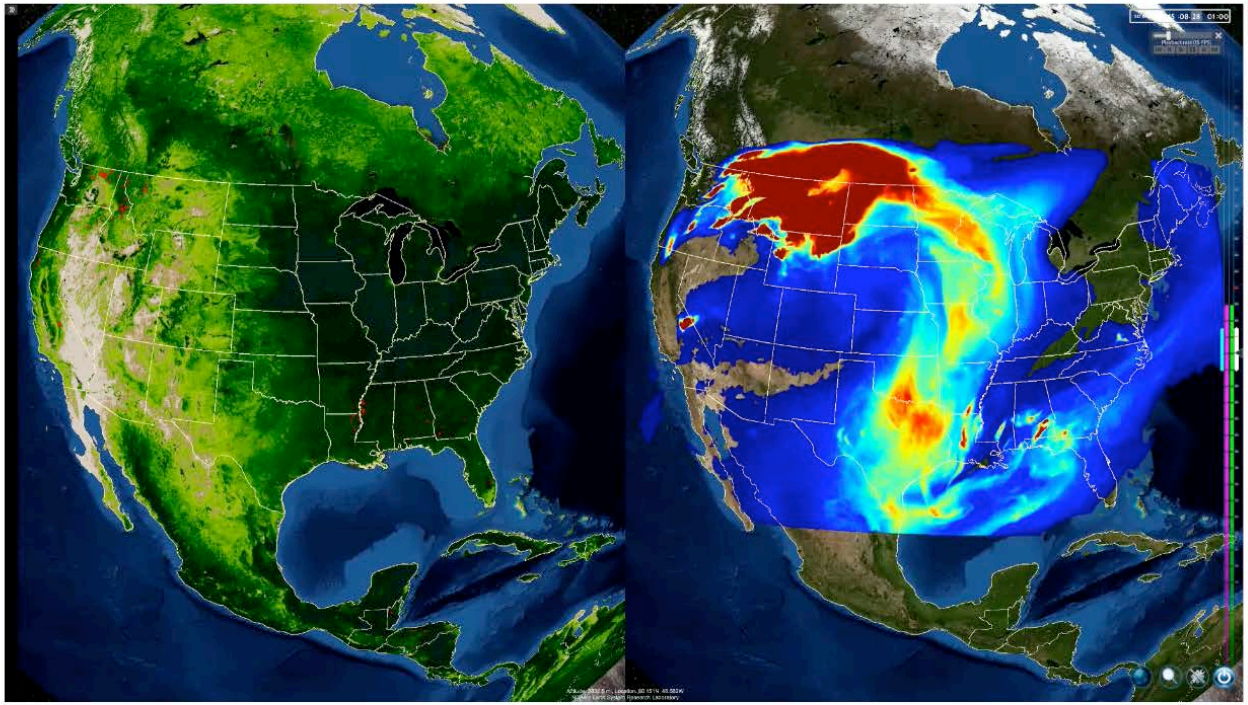
http://realearth.ssec.wisc.edu/

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.

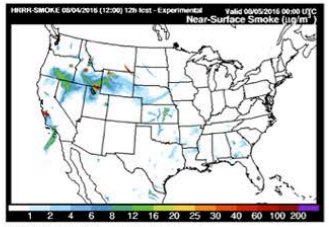
NOAA's OAR utilizing JPSS data

Improving smoke forecasting



NOAA experiments with forecasts for wildfire smoke

Bill Gabbert
August 4, 2016
research, smoke



Wildfire smoke forecast for 6 p.m. MDT August 4, 2016

The National Oceanic and Atmospheric Administration is experimenting with a system that produces forecasts for the distribution of smoke from wildfires.

The examples of their products created at 6 a.m. MDT August 4 for near-surface smoke are included here — predicting conditions for 6 p.m. MDT August 4 (above) and 6 p.m. August 5 (below). Click the images to see larger versions.

Developers are collecting feedback from users to improve the model before it is considered for transfer into operations.

The HRRR-Smoke air quality modeling system simulates the emissions and transport of smoke from wildfires detected by the VIIRS/JPSS satellite fire product in high spatial resolution (3km) over the CONUS domain. Currently the model is run every 6 hours (00, 06, 12 and 18 UTC) to produce smoke forecasts for next 36 hours. The forecast products of near-surface and vertically integrated smoke concentrations are visualized on a GSD web-site in real time: http://rapidrefresh.noaa.gov/HRRRsmoke/

MOST VIEWED POSTS LAST 24 HOURS

Three firefighters killed in Chile wildfire

Analyzing the fire that burned into Gatlinburg

Credit: Ravan Ahmadov, OAR and Jeff Stewart, CIRA

Next steps for Proving Ground management

- We are meeting with service area providers to establish initiatives with clearly defined objectives and benefits with senior level management endorsement.
- Why endorsements?
  - We want to make sure that any investments we make are aligned with service areas strategic goals and will contribute to the service area