Joint Polar Satellite System (JPSS) Proving Ground and Risk Reduction Program

Supporting the NOAA Mission through Applications and Research

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Challenge

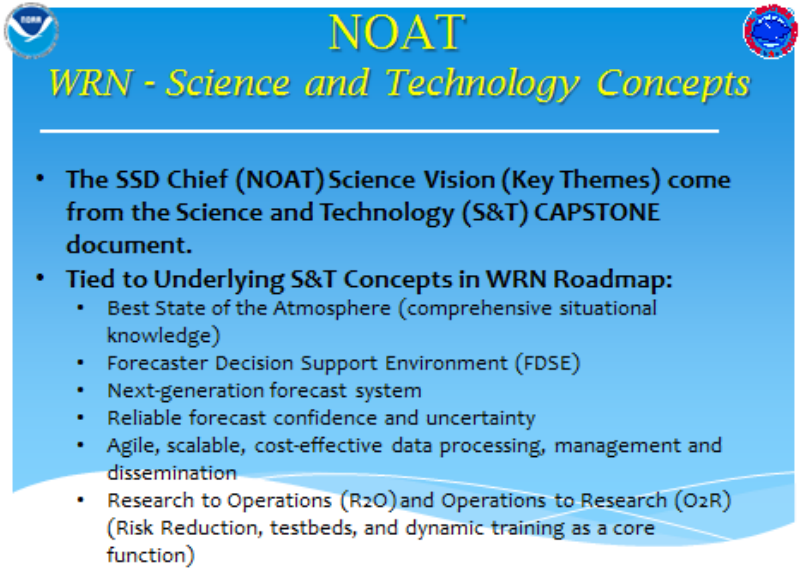
- **Move from Products to End User Applications**
- **Ensure users are ready for NPP/JPSS data and improve their key operational and research product and services**
  - ✓ Severe weather forecasts and warnings
  - ✓ Aviation weather forecasts and warnings
  - ✓ Improve fire and air quality forecasts and 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 NPP/JPSS data and to identify improvements needed for products and applications**
- **To meet this challenge, the NOAA JPSS Office has established a JPSS Proving Ground and Risk Reduction Program**

Proving Ground and Risk Reduction Application Areas

- **Weather Forecasting (Improving Global, Regional forecasts)**
  - Tropical Cyclones
  - Severe Weather (Nowcasting)
- **Ocean/Coastal (Coral Bleaching, Harmful Algal Bloom alerts)**
- **Land (Droughts, Agriculture)**
- **Hazards (Smoke, Fire, Volcanic Ash, Air Quality)**
- **Hydrological (Precipitation, Floods, Soil Moisture, Snow/Ice, River Ice)**
- **Climate (integrated products, real-time anomaly products)**
- **Education and Training**
- **Infrastructure (Direct Readout and Software (CSPP), Airborne campaigns)**

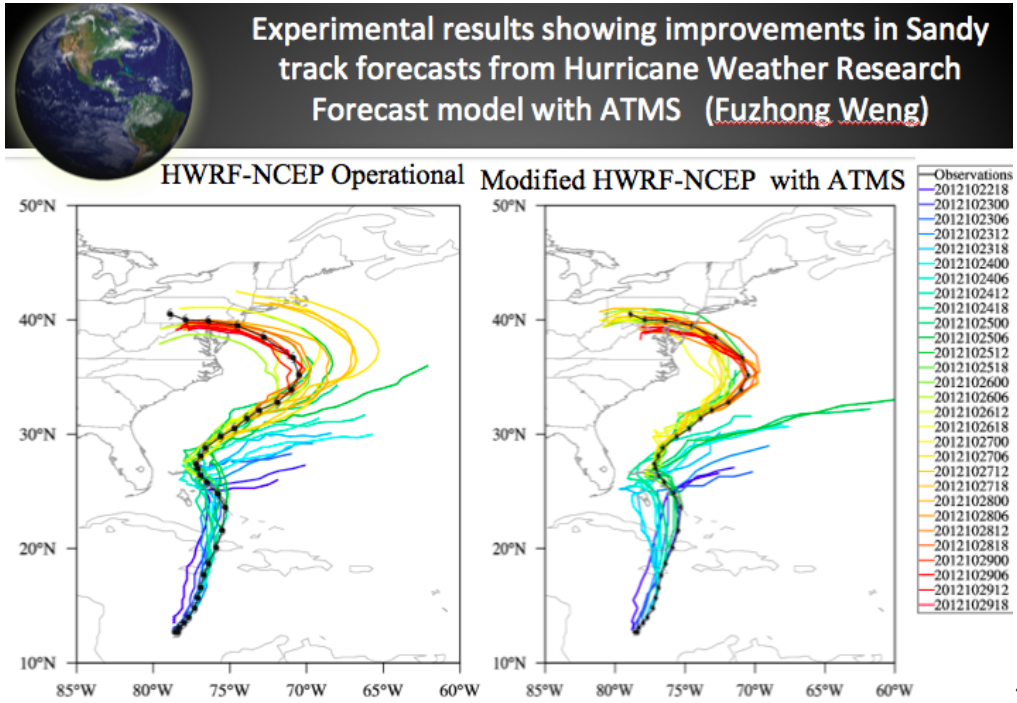
CSPP is a critical component of the JPSS Proving Ground!

Mapping NOAT Priorities to JPSS PGRR



PGRR Projects

- **Soundings/Radiances for Hurricane Intensity and Track**
- **Sounding applications over Alaska including nearcasting**
- **Soundings in AWIPSII**



Mapping NOAT Priorities to JPSS PGRR

NOAT
WRN - Science and Technology Concepts

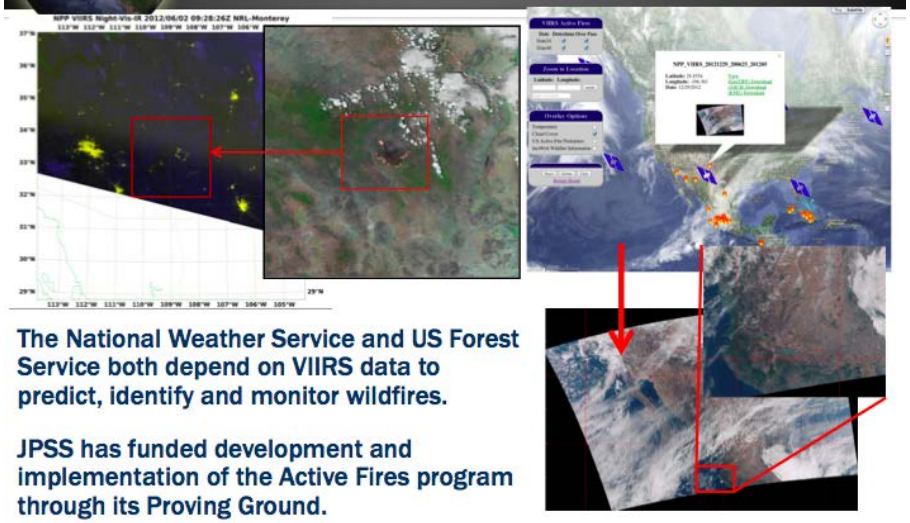
Impacts and Issues:

- Initial zero hour of the forecast database and data assimilation
- Initial conditions to next generation modeling systems
- Forecaster assist in monitoring /QCing the forecast database
- Forecaster situational awareness
- Verification
- Better boundary layer depiction, especially low level distribution of moisture
- Enable concept of "Warn on Forecast"
- Improved QPE/QPF
- Development of general convection anticipated
- Improved boundary layer forecasts of cloud, fog and visibility
- Improved architecture for IDSS
- Input into advanced DS systems (Avn NextGen, fire wx, environmental/ecosystems)

How do you fit?

Smoke and dust
Moisture/clouds
Derived winds
Fire hot spots
QPE
SST
TPW
Snow/ice cover
Sea ice
Volcanic ash
Low clouds/fog
Visibility
CI
Overshooting Tops
Enhanced V
Lightning Jump
Stability Indices
Hurricane Intensity
Moisture profile
Nearcast, etc

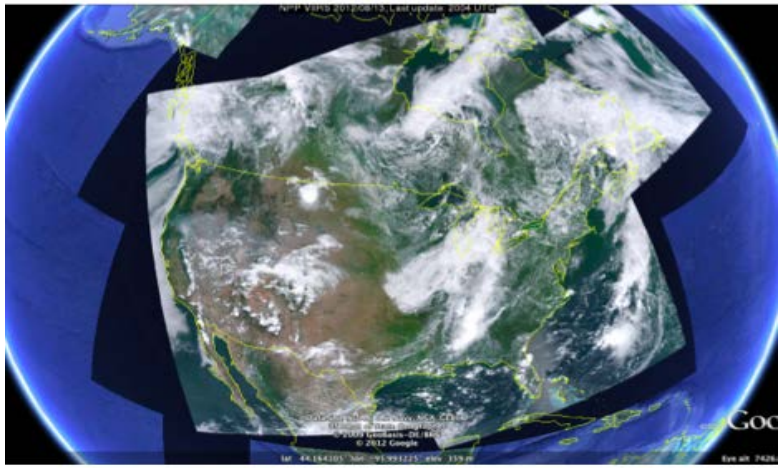
JPSS Supporting Weather Ready Nation through VIIRS Fire Detection



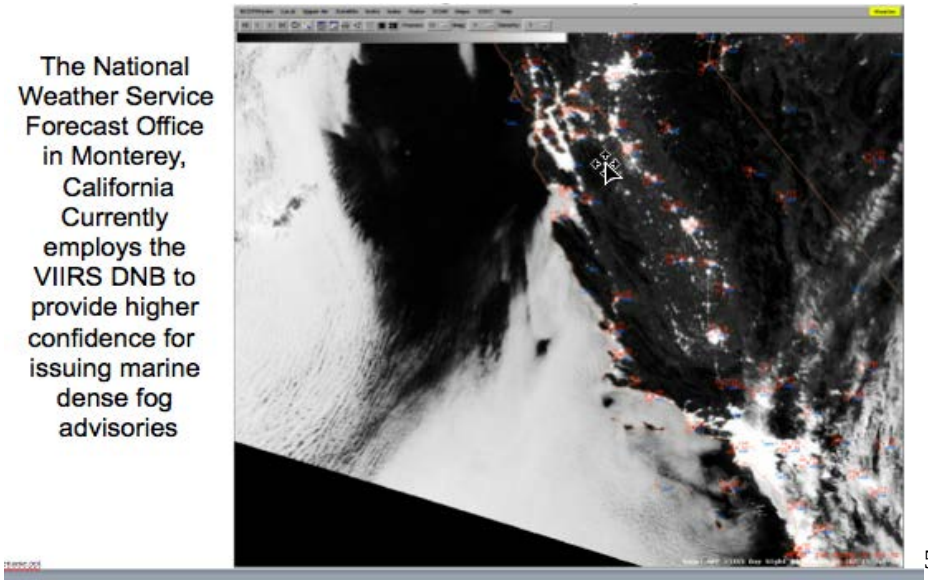
The National Weather Service and US Forest Service both depend on VIIRS data to predict, identify and monitor wildfires.

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

Direct Broadcast Through the CSPP
Data Faster - Greater Operational Impact



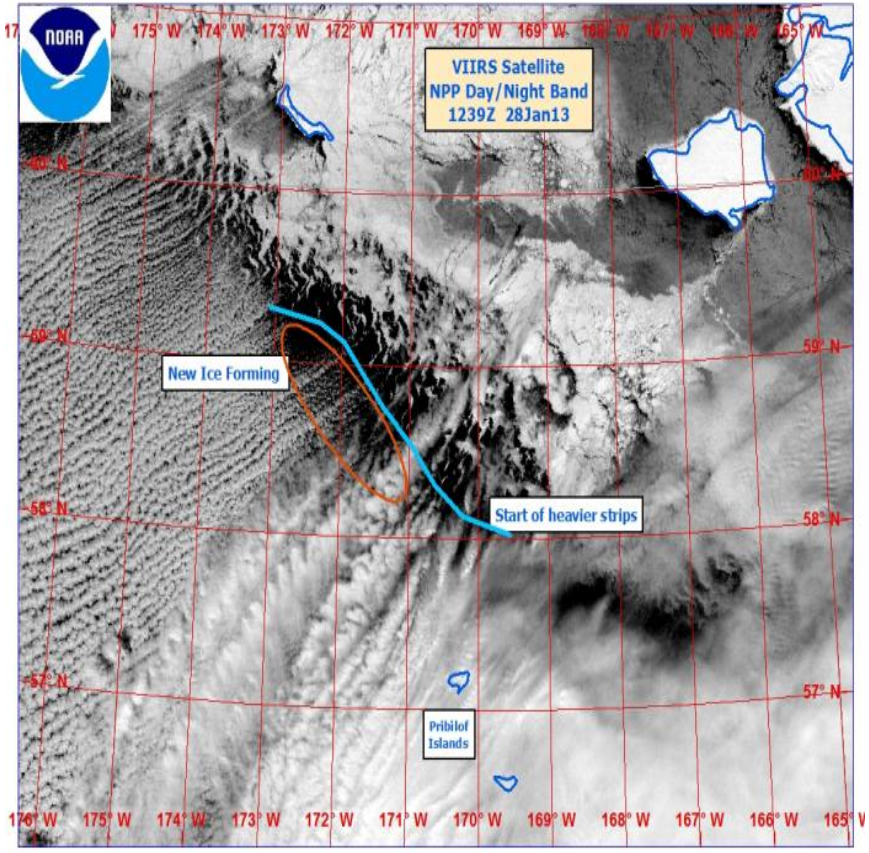
The National Weather Service Forecast Office in Monterey, California Currently employs the VIIRS DNB to provide higher confidence for issuing marine dense fog advisories



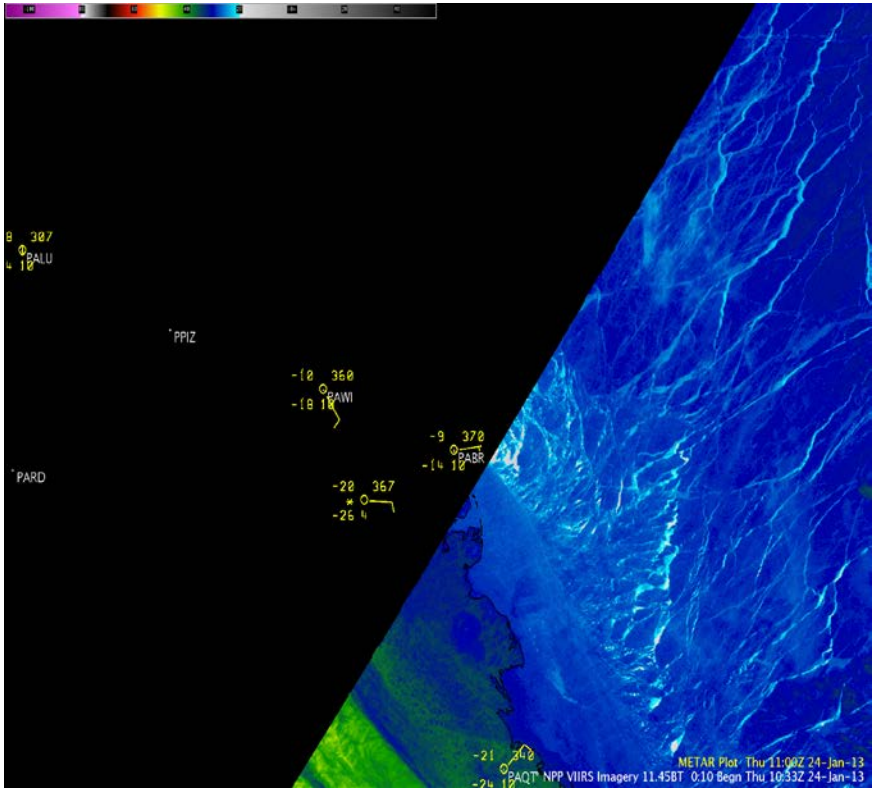
NWS in Alaska, through the JPSS Proving Ground, has become a primary and proactive user of VIIRS products and imagery.

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.

Mapping NOAT Priorities to JPSS PGRR

NOAT
NWS Operational Advisory Team

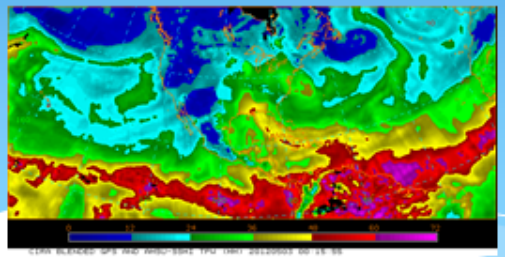
NCEP Considerations

- Central Guidance (EMC/NCO)
- Improved analysis and NWP forecasts a big target for operational use of observations
  - Aim for future operational modeling/data assimilation systems
  - Coordinate via Joint Center for Satellite Data Assimilation
- Service Centers (AWC, TPC, OPC, SWPC, SPC, and WPC)
  - Centers appreciate new sensors, science and products
  - Discriminator for successful RR and PG products will depend on effective collaboration via respective Testbeds

NOAT
WRN - Science and Technology Concepts

An Operational Example: Blended TPW

Multisensor (GPS, AMSU-SSMI) product well used by forecasters because it dealt with a significant issue: moisture distribution



Why we need this?

Atmospheric Rivers
Heavy rain/snow
Flood/Blizzard
Drought
Convective Storms

NOAT
WRN - Science and Technology Concepts

More thoughts:

1. Leverage the concept of the "enterprise/framework" satellite system
   - Use the consistent upstream algorithms (when feasible)
2. Think strategically
   - Realize some of these ideas involve a "moving target" (e.g., next generation forecast and warning system/s, integrated obs system, etc.)
   - Try to "hit the target" vice development focused on current operations
3. Take time to understand how the forecaster does his job
   - Understand their job/challenges
   - See how they use the information in an operational setting (does it provide SA, or is it a DS tool?)
4. Embrace emerging requirements
   - Wind and solar energy
   - Ecosystems
5. Decision Support
   - Does it help the forecaster make decisions?
   - Does it help the customer make decisions?

- **Fund JCSDA for data assimilation and data denial studies**
- **Blended TPW project**
- **Enterprise algorithms – ABI algorithms being used on VIIRS for clouds, volcanic ash, aerosols, etc in NDE**

JPSS PGRR NWS Roster

Andy Harris	Assimilation of VIIRS SSTs and Radiances into Level 4 Analyses
Ralph Petersen	CriS/ATMS sounding applications for nearcasting severe weather over Alaska
Jeff Key	Development, Generation, and Demonstration of New JPSS Ice Products in Support of a National Ice Center JPSS Proving Ground and Risk Reduction Activity
Ivan Csiszar	A rapid delivery system of enhanced VIIRS active fire data for fire management and fire weather applications
Shobha Kondragunta	Application of NPP/VIIRS Fire and Aerosol Optical Thickness (AOT) Products for Air Quality (focus on Alaska)
Donglian Sun	Application of NPP/JPSS Data for Improved Flood Mapping and Inundation Area Estimates
Naira Chaouch	River and Lake Ice mapping using NPP/JPSS VIIRS sensor To support NOAA NWS
Jerry Zhan	Enhance agricultural drought monitoring using NPP/JPSS land EDRs fro NIDIS
Steve Miller	'Seeing the Light': Exploiting VIIRS Day/Night Band Low Light Visible Measurements in the Arctic
Andy Heidinger	Advancing Nighttime VIIRS Cloud Products with the Day/Night Band
Bill Smith	CrIS/ATMS sounding applications for nowcasting convective initiation for severe weather and turbulence (focus on Alaska)
Fuzhong Weng	Improve Hurricane Structure Monitoring and Intensity Forecast Using NPP ATMS and GCOM-W AMSR2
Jun Li	Near real-time assimilation system development for improving tropical cyclone forecasts with NPP/JPSS soundings
Mark Demaria	Application of JPSS Imagers and Sounders to Tropical Cyclone Track and Intensity Forecasting
Huang	Community Satellite Processing Package
Boukabara	JCSDA - improvements to data assimulation
Wolf/Schott	JPSS Risk Reduction VIIRS ABI algorithms
conell	Virtual Lab training in coordination with CGMS and WMO
Pingping Xie	Infusing JPSS PMW Retrievals to CMORPH Precipitation Estimates for Improved Weather, Climate, and Water Applications
Heinrich	Alaska Proving Ground - Direct Readout Exploitation
Spangler	COMET Education Resources - Training modules for JPSS

Track Progress via Quarterly Reports and Monthly JPSS Science Seminars

JPSS Proving Ground Periodic Reporting

Project Team: CIRA, GINA

Reporting Period: Oct 2012 - Dec 2012

Team Lead: Steve Miller

Team Members: Tom Heinrichs, Gary Hufford, Jay Cable, Jiang Zhu, Dayne Broderson, Tom Lee

Project Title: 'Seeing the Light': Exploiting VIIRS Day/Night Band Low Light Visible Measurements in the Arctic

Executive Summary

This project focuses on the demonstration of the unique and unprecedented capabilities of the Visible/Infrared Imager/Radiometer Suite (VIIRS) Day/Night Band (DNB) low-light visible nighttime imagery in the Arctic, with a special emphasis on exploiting moonlight illumination during the Winter season when conventional solar illumination is limited or unavailable and where polar-orbiter temporal refresh is most practical to operational users. These demonstrations will be conducted in close cooperation with University of Alaska-Fairbanks (UAF) Geographic Information Network of Alaska (GINA) and its suite of operational partners, and coordinated under the auspices of the Satellite Proving Ground (and specifically in association with the High Latitude Proving Ground) to ensure a close connection and dialogue with end users. New capabilities for detecting low cloud/fog, snow cover, volcanic ash, sea ice and ice-free passages, auroral boundaries, and other parameters exploiting the 740 m spatial resolution of the VIIRS/DNB low-light visible measurements coupled for the first time with spatially/temporally co-located multi-spectral shortwave and thermal infrared bands, will be demonstrated in near real-time as part of this research project. Application development will leverage tools and techniques for lunar availability and irradiance prediction as well as hands-on experience with VIIRS/DNB data gained via concurrent participation in the JPSS VIIRS Cal/Val program. Training on DNB imagery capabilities and interpretation for these new observations is an implicit component of this work, and examples derived from this research will provide subject matter for those involved in formal training efforts connected with the Proving Ground and more generally with the environmental satellite user community.

Overall Status: Green

	Green [1] (Controlled)	Yellow [2] (Caution)	Red [3] (Critical)	Deviation Summary [4]
Budget	■	□	□	None
Schedule	■	□	□	Late start (Sep, due to funding arrival in late Aug)
Scope	■	□	□	Expand opportunistically to other regions

[1] *Project is within budget, scope and on schedule.*
[2] *Project has deviated slightly from the plan but should recover*
[3] *Project has fallen significantly behind schedule, is forecast to be significantly over budget, and/or has taken on tasks that are out of scope.*
[4] *Details of deviations provided in subsequent section of report*

Comments:

Scheduled Milestones / Deliverables

Year 1 Milestones	Approved Schedule	Forecasted Completion	Actual Completion	Status
Milestone Title				
Meet with user groups, present DNB capabilities, determine schedule & protocol for interactions.	Jul-Sep 2012	30 Sep 2012	5 Oct 2012	completed
Develop automated processing scripts for basic DNB imagery.	Jul-Dec 2012	31 Dec 2012		Nearly completed
Conduct selected DNB nocturnal product demonstrations.	Sep 2012-April 2013	30 Apr 2013		Started
Gather initial user feedback	Jan-Jun 2013	30 Jun 2013		Pending

Note: Bold milestones are key external project deliverables

Status Definition: Green (will meet schedule), Yellow (milestone will be delayed), Red (milestone cannot be met on current path)

Accomplishments & Plans

Accomplishments during this Reporting Period:

- An important aspect of this project is demonstrating the utility of non-solar sources of visible light.
- Continue to participate in other aspects of VIIRS (cal/val), including interactions with Northrop Grumman (NG) on various aspects of Day/Night Band performance, including the problem of stray light which will affect high latitudes for a substantial portion of the year. NG is developing a statistically based stray light correction algorithm which should improve performance. An important role of this project will be to evaluate this algorithm in the high latitude regions and provide feedback and suggestions to NG on performance and issue resolution. This is a good example of synergy between the various projects. During the period, Stephanie Weiss (NG) produced stray-light-corrected granules for assessment of night glow imagery performance. We found that night glow reflectance features were retained, although some artifacts that appear to be related to the corrections appear as well.
- Work continues on evaluation of the lunar reflectance product, which will play a central role in quantitative DNB applications. A copy of the code was supplied to SSEC/CIMSS who are doing Alaska Region DNB demonstrations in AWIPS. This expanded interaction will assist in evaluating the lunar reflectance product.

Summary

An understanding of how JPSS data used throughout NOAA is pivotal to evolving and maintaining a robust satellite mission that serves the needs of all Line Offices.

- This is why guidance from the NOAT is important to prioritize how best to use JPSS data in combination with other data to improve critical product and services
- Alaska proving ground is an excellent example of rapid use and deployment of Suomi NPP data.

JPSS continues to engage the NOAA user community, ensuring that both the best product and new, enhanced products (via the Proving Ground) are made available in the most timely manner possible.