An Overview of Suomi-NPP VIIRS Capabilities: One Year Following Launch

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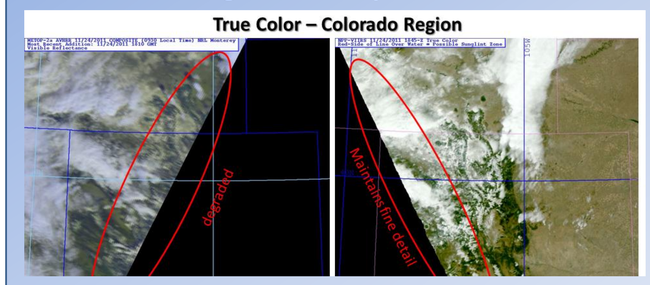
Introduction

The launch of the Suomi National Polar-orbiting Partnership (S-NPP) satellite in October 2011 has ushered in a new era of technological advancements of low earth orbiting satellite (LEO) sensors. This effort focuses on the Visible Infrared Imager Radiometer Suite (VIIRS), an imaging sensor that incorporates many of the best features from its heritage sensors: Advanced Very High Resolution Radiometer (AVHRR), Operational Linescan System (OLS), and Moderate-Resolution Imaging Spectroradiometer (MODIS). The Naval Research Laboratory in Monterey, California (NRL-MRY) is part of the Suomi-NPP VIIRS Imagery and Visualization Team, providing VIIRS imagery and derived products via its two web sites: NRL-VIIRS and NexSat (see below).

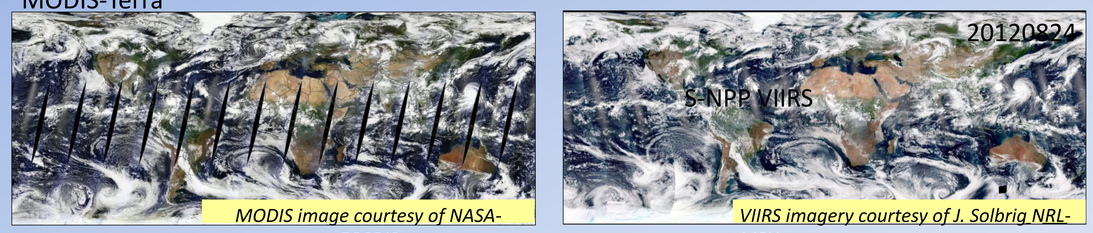
VIIRS Performance

Edge of Scan Improvements



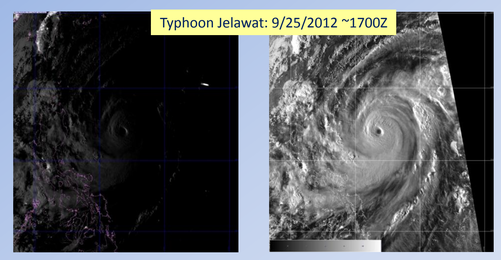
VIIRS borrows from DMSP OLS cross-track scanning technology that maintains the fine detail from nadir to edge of scan. In contrast, MODIS and AVHRR imagery become increasingly degraded away from nadir.

Daily Coverage Improvements with VIIRS



The VIIRS cross track scanning swath is 3000 km (similar to OLS) as compared to 2300 km for MODIS and 2048 km for AVHRR. This results in continuous coverage (no data gaps) within the mid-latitude regions (right image). Additionally, the detail in VIIRS is far superior to any of its heritage counterparts.

Unprecedented Fine Detail at Night

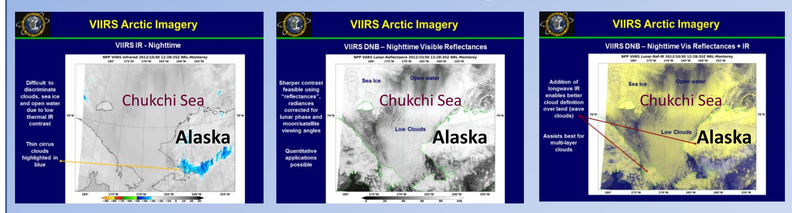


With the addition of lunar irradiance prediction model, a form of "normalization" converts the large dynamic range of radiances (left image) toward significantly improved reflectance enhancements (right image), resulting in day-like detail. (*Miller and Turner, IEEE Trans. Geosci. Remote Sens., 47, No. 7, 2009)*

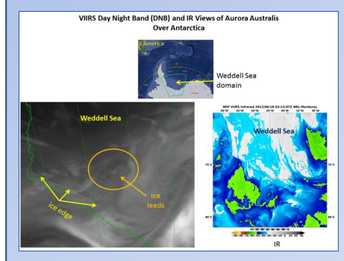
VIIRS Monitors 2012 Weather Events

The following examples reflect recent activity at NRL-MRY in developing and demonstrating the unique next generation abilities of VIIRS. Of the 22 available channels, NRL-MRY has placed great emphasis on the Day Night Band (DNB), a low light sensor that improves upon DMSP OLS technology in providing high fidelity, finer spatial resolution and significantly improved 14-bit digitalization vs 6-bit (64 gray shades) for OLS.

Polar Monitoring

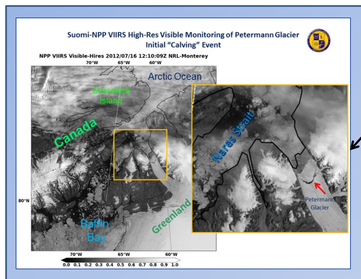


This panel sequence shows the progression of products toward improved viewing of sea ice and cloud features over the Chukchi Sea. The middle and right images incorporate a lunar irradiance model (refer to top right panel) for a brighter and more accurate depiction.



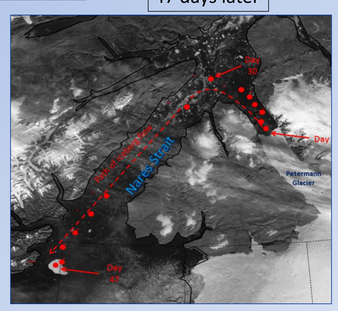
Aurora Australis (lower left image) as sensed by the VIIRS DNB. The lighting from the Aurora was enough to illuminate the annotated features.

In contrast, the VIIRS IR product (lower right image) is sensitive to the cloud field only.



Initial break

47 days later



Tracking an Arctic iceberg following break off from the Petermann Glacier (NW Greenland) using VIIRS High Res. (0.37 km) visible channel. Image on right shows the southward path.

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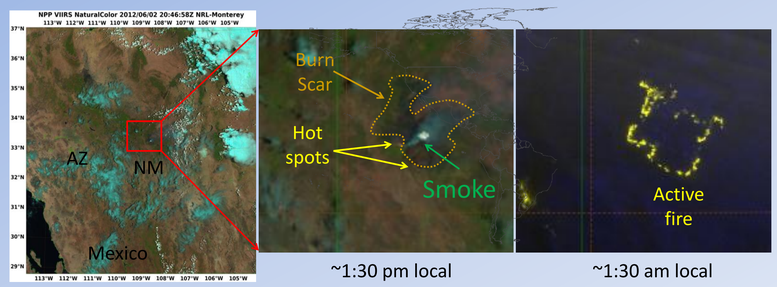
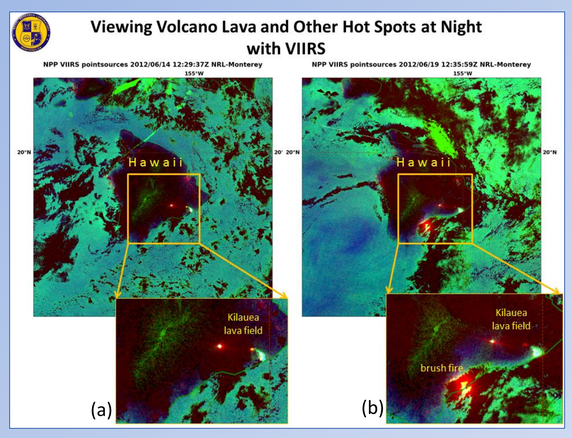
Hotspot Monitoring



Natural (false) color during the day and DNB at night capture the intense wildfire at the New Mexico Whitewater Baldy Complex

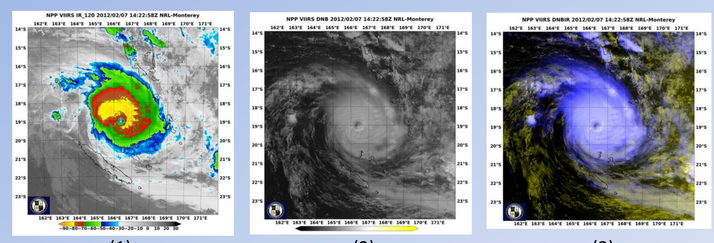


VIIRS-derived "pointsource product" using DNB and IR channels. Two "hotspots" within the lava flow consisting of a yellow dot within a red dot interpreted as a thermal signature within a broader light signature.
(a) Just below the Kilauea lava field the left bright dot is at Kilauea's summit vent, while the small dot to the east is the Puu Oo eruptive vent on Kilauea's east rift zone. Cyan feature extending from Puu Oo to the coast is the lava flow field.
(b) In addition to the ongoing volcanic activity, a rather large brush fire occurred during this time within the lower central region.

NRL-MRY website resources > **www.nrlmry.navy.mil/VIIRS.html**
www.nrlmry.navy.mil/NEXSAT.html

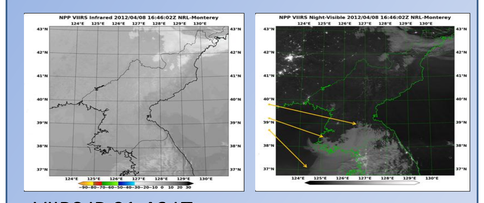
Tropical Cyclone (Jasmine) at night

located in the South Pacific near New Caledonia



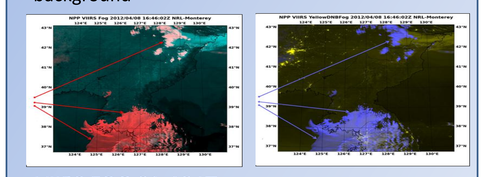
(1) VIIRS IR band - cold cloud tops associated with the tropical cyclone inner core
(2) VIIRS day night band (DNB): depicting reflection of lunar illumination from cloud tops including convective details, near full moon.
(3) Multi-spectral combination (IR+DNB) distinguishes low clouds (yellow) and high clouds (light blue) while still retaining texture of the eyewall convection.

Low Clouds at Night



VIIRS IR 01:46 LT
Poorly resolved low clouds/fog due to small thermal separation from background

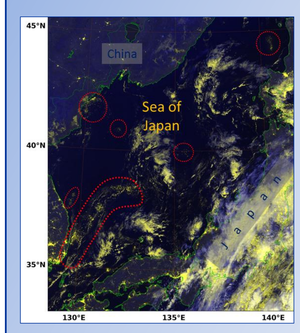
VIIRS DNB 01:46 LT
Low clouds/fog extend offshore into northern portions of S. Korea



VIIRS FOG 01:46 LT
Multi-spectral imagery enables cloud layer identification, low clouds=red, hi clouds=cyan

VIIRS DNB+IR 01:46 LT
Multi-spectral imagery enables cloud layer identification, low clouds=cyan, high clouds=yellow

Fishing Activity



DNB + IR view of typical fishing activity at night (yellow dots red annotations) in the Sea of Japan.

Acknowledgements

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