An Update to the NRL NexSat Webpage

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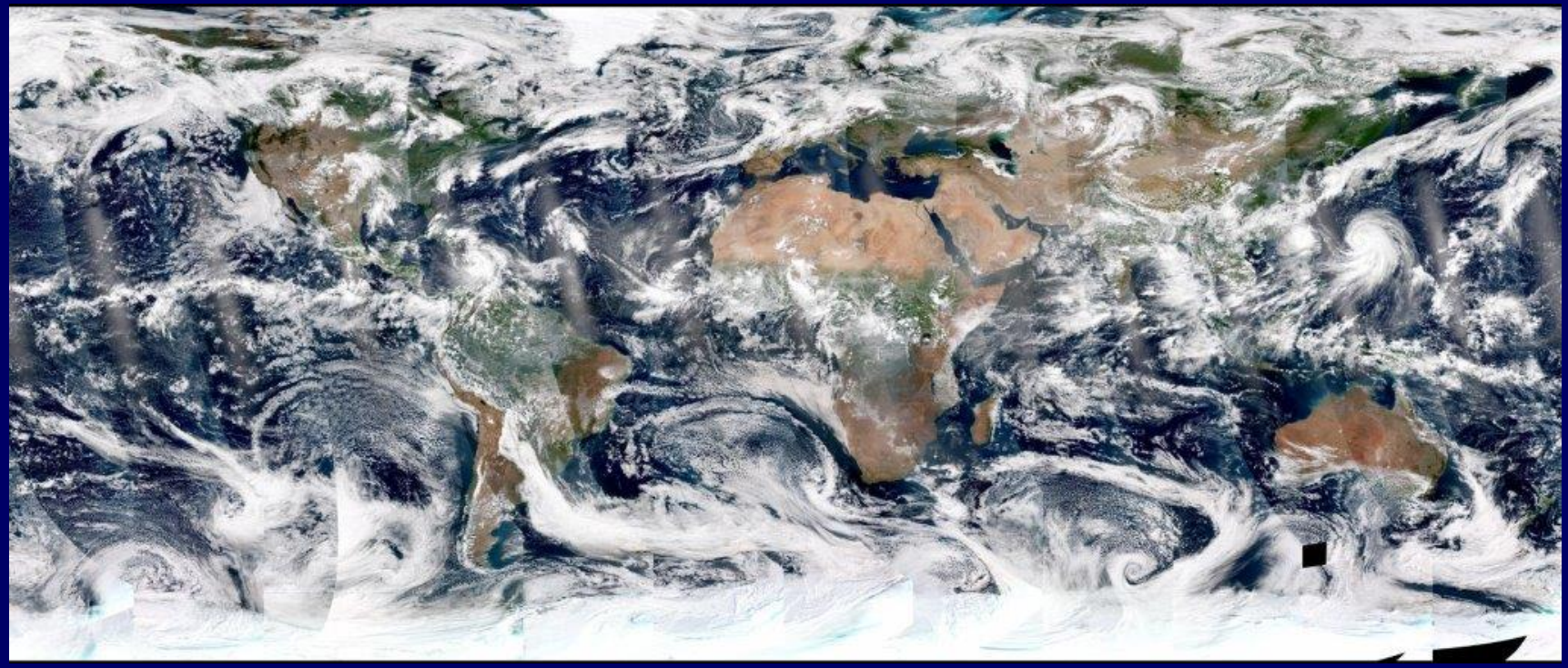
1 Cooperative Institute for Research in the Atmosphere (CIRA),
2 Science Applications International Corporation (SAIC)

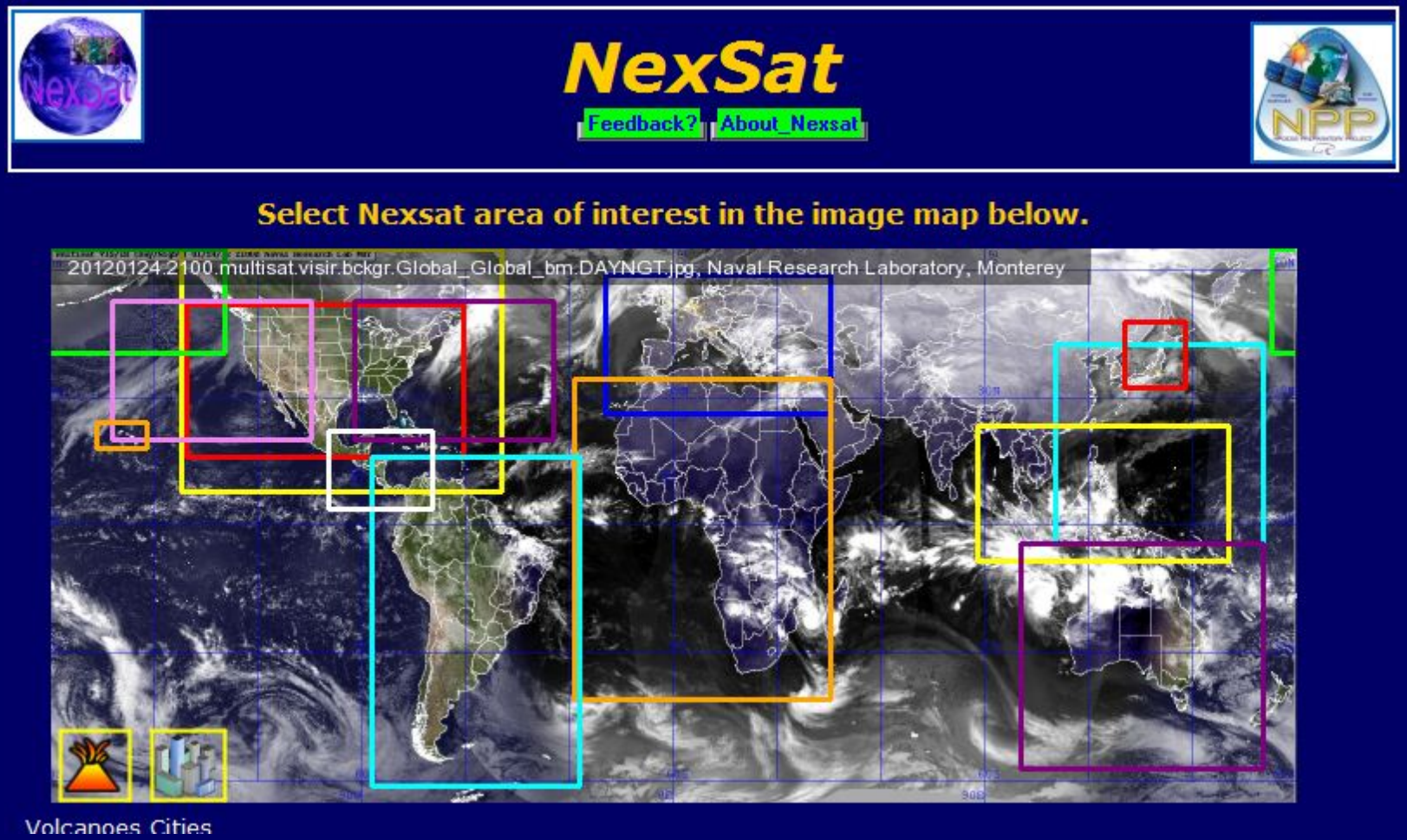


Outline

1. Overview of NexSat website
2. VIIRS products hosted on NexSat
   - Current day and nighttime applications
   - Environmental Data Records (EDR)
   - Future developments
3. Applying the Lunar Irradiance Model
4. Near Constant Contrast EDR
5. Social Media, outreach and training efforts

NexSat Home Page

http://www.nrlmry.navy.mil/NEXSAT.html



NexSat Product Suite

Standard Products
Visible (daytime)
Visible (night time)
Infrared
Water Vapor
True Color
Pseudo/GEO True Color
Rain Rates
Rain Totals – 3, 6, 12, 24 hours – 2, 3, 4, 5, 6, 7, 10, 12, 14 days
*Winds – speed and direction – low level – middle level – upper level

Cloud Products
Cloud layers (snow, low-middle, high)
CloudSat (cloud profile)
Cirrus cloud detection
Contrail detection
Low cloud detection (night)
Convective cloud top height
Cloud properties –effective radius –optical depth –cloud top temperature –cloud top height –cloud type

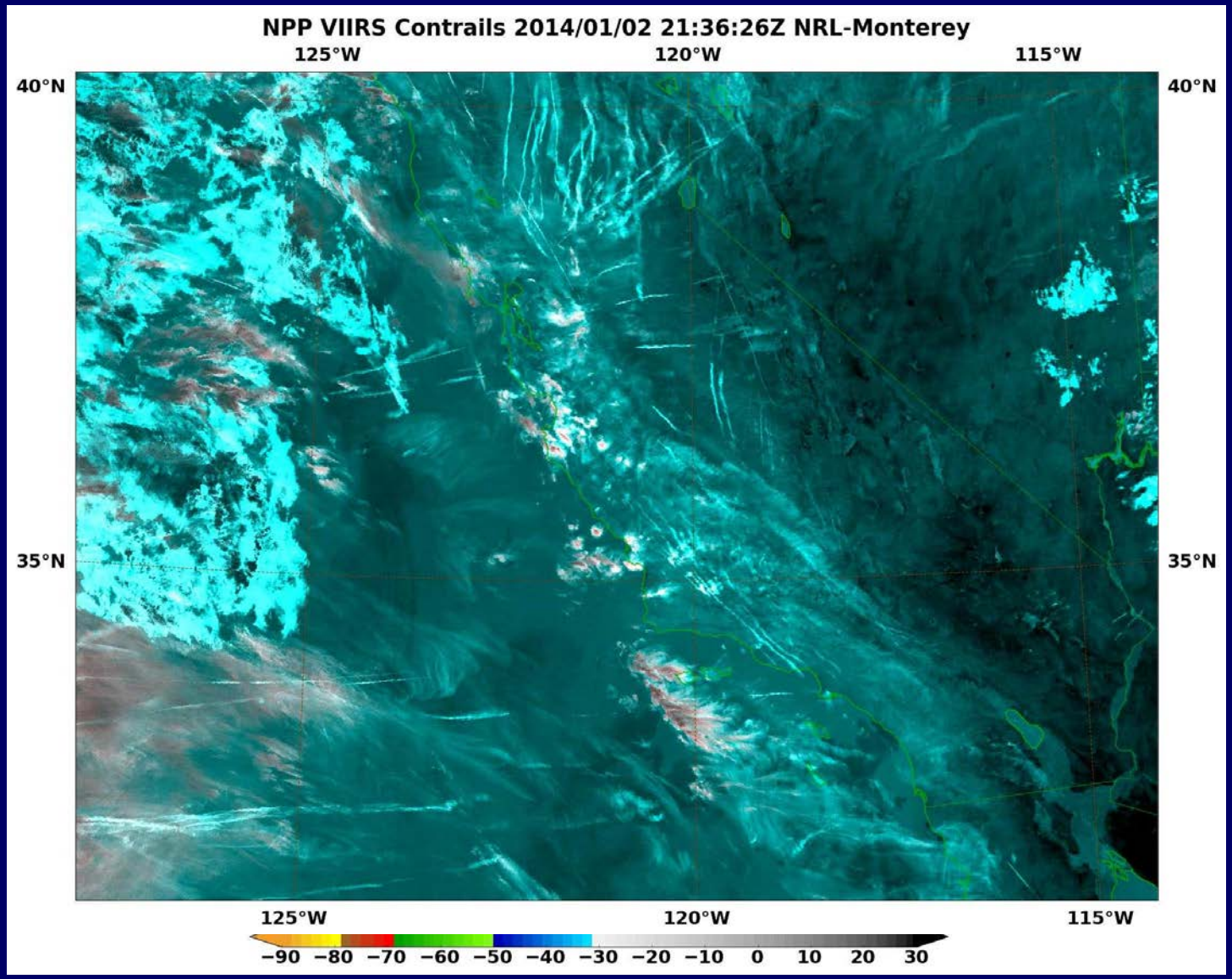
Environmental Products
Aerosol amounts (optical depth)
Biomass (vegetation type)
Dust detection
Fire detection (hot spots)
Lightning detection
Snow cover (surface)

*NWP model overlays
Sea Level Pressure
500 mb Heights
sfc, 700 500 300 mb Winds
1000-500 mb Thickness
Surface Temperature
Jet Stream

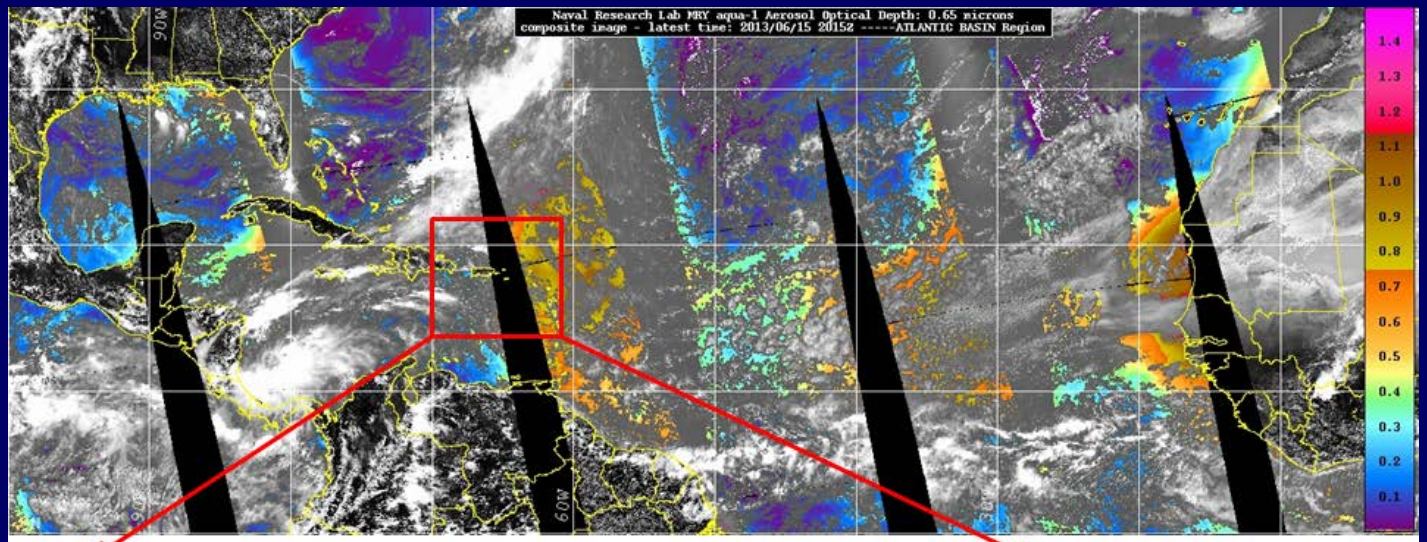
* NAVGEM and COAMPS®

VIIRS products in orange

Product Suite via Co-Registered Navigation



Monitoring SAL using VIIRS Dust Product Supporting NWS in Puerto Rico



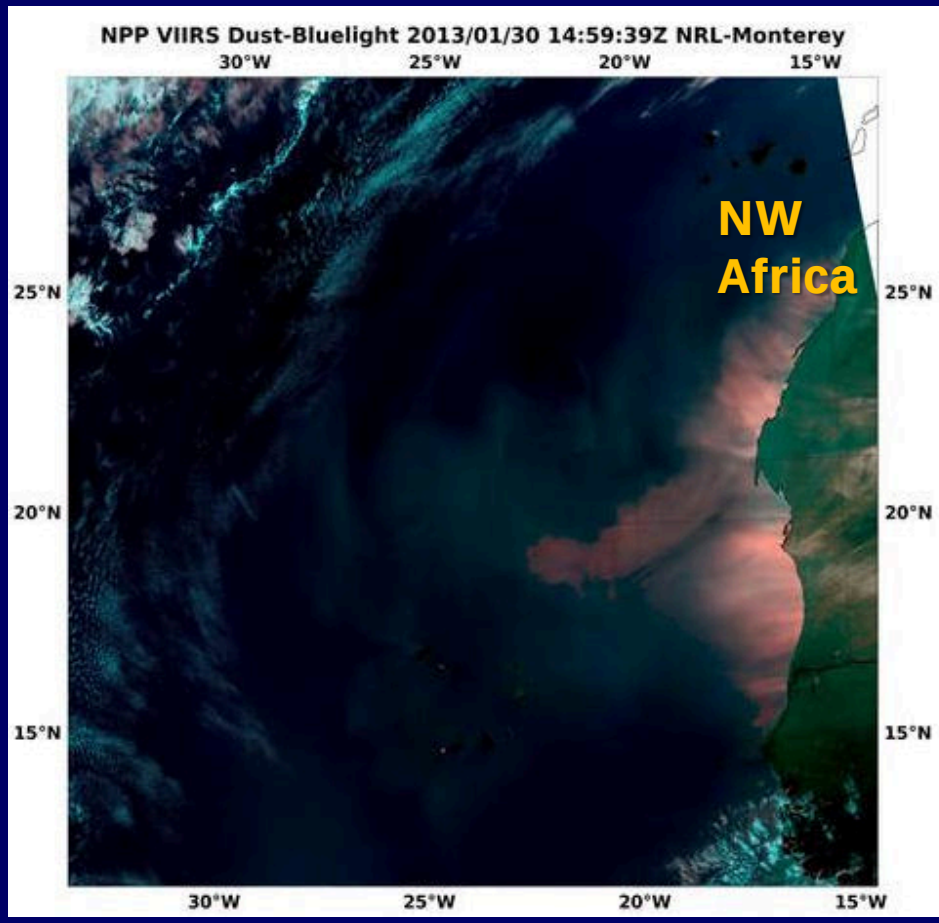
MODIS AOD

VIIRS Dust (pink shades)

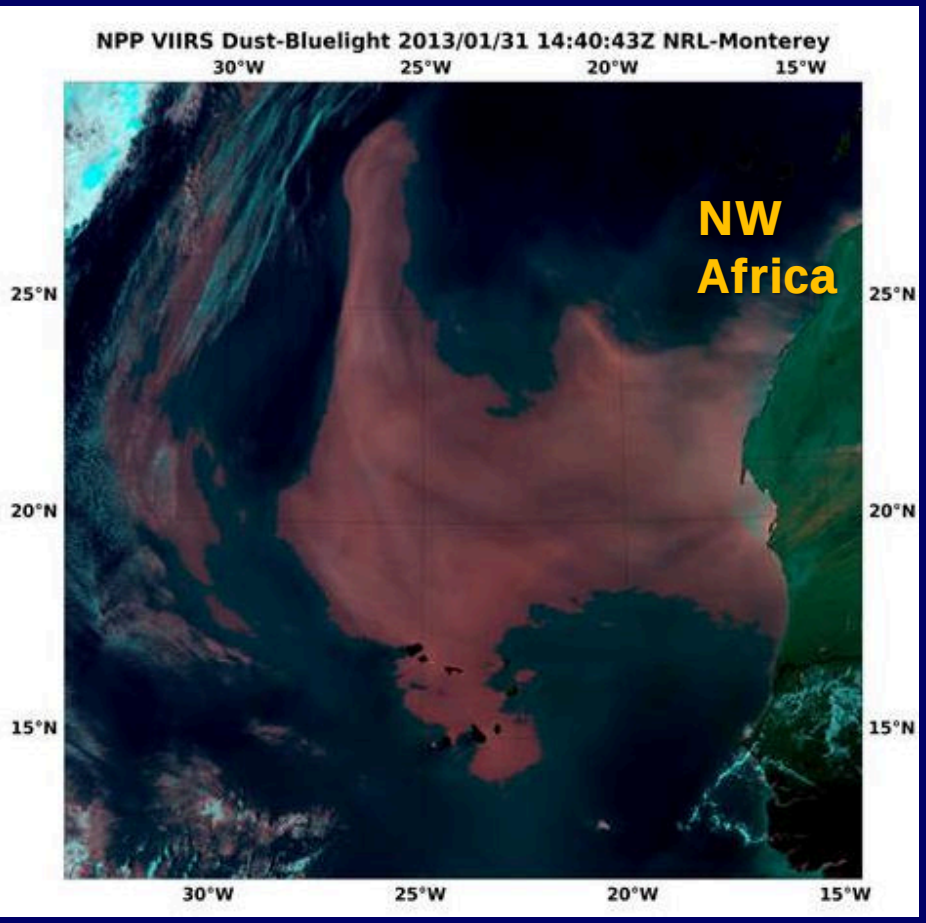
Puerto Rico Region

VIIRS Dust Product
Monitoring SAL Outbreaks

Day 1

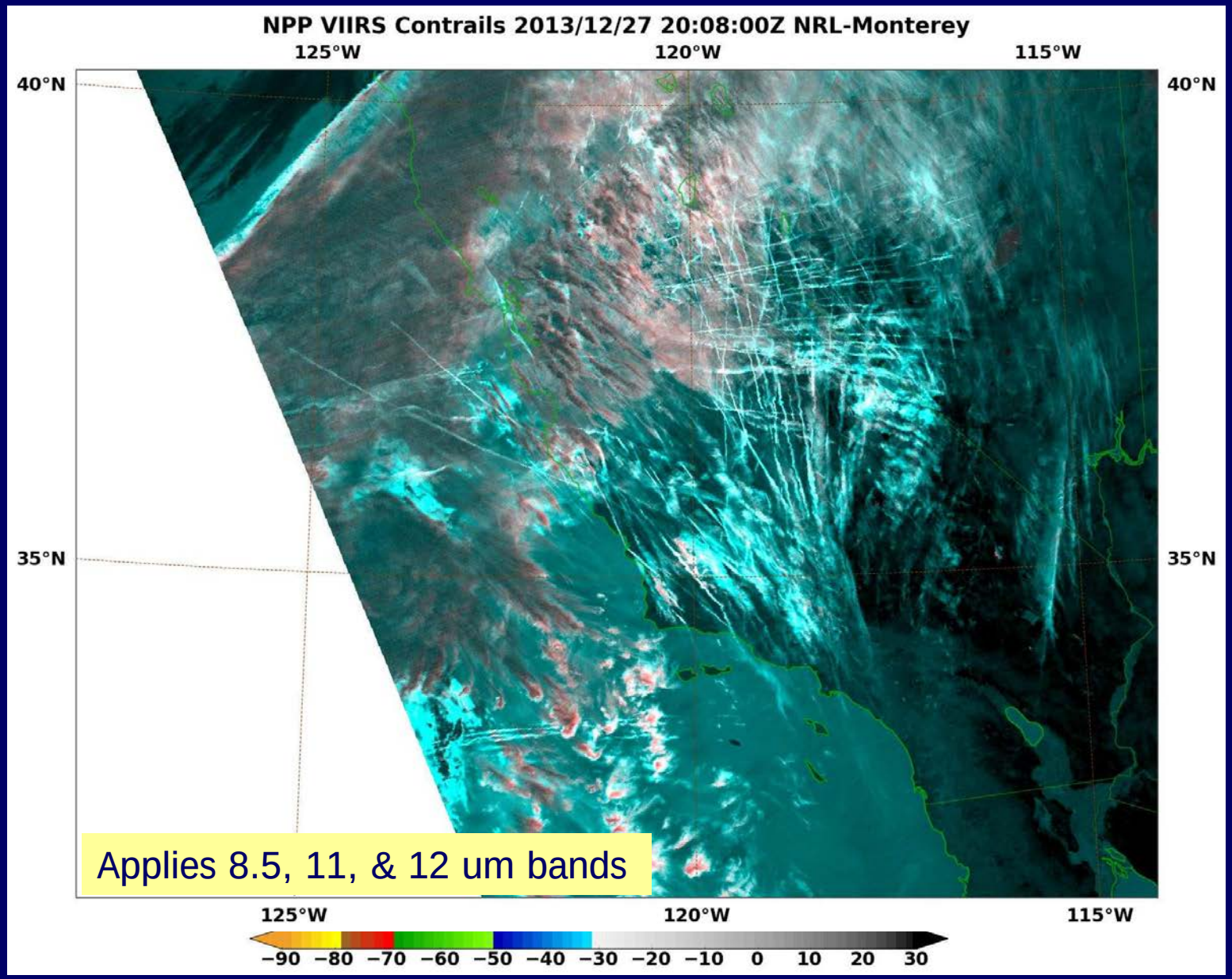


Day 2



adapted from the MODIS blue-light algorithm

VIIRS Contrails

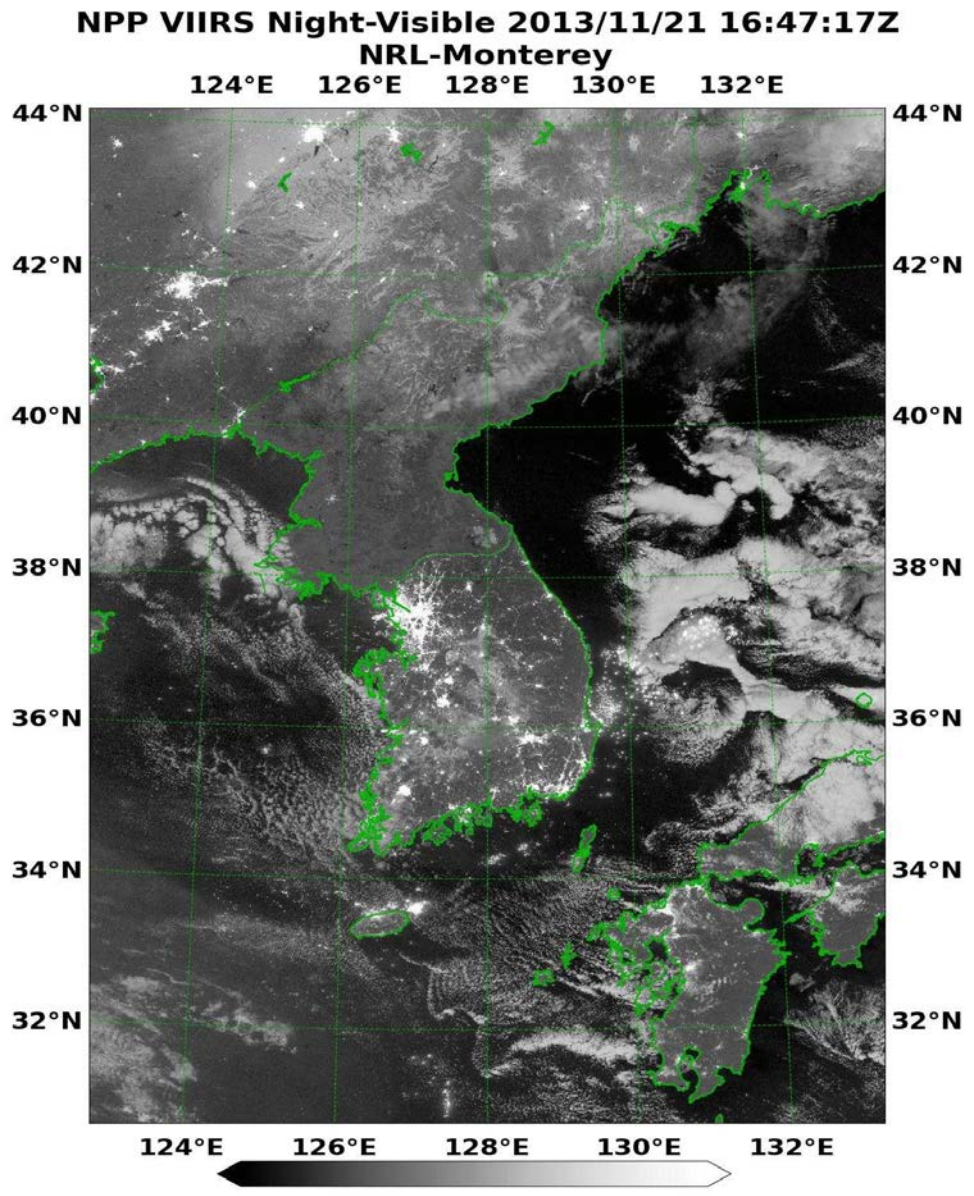


Applies 8.5, 11, & 12 um bands

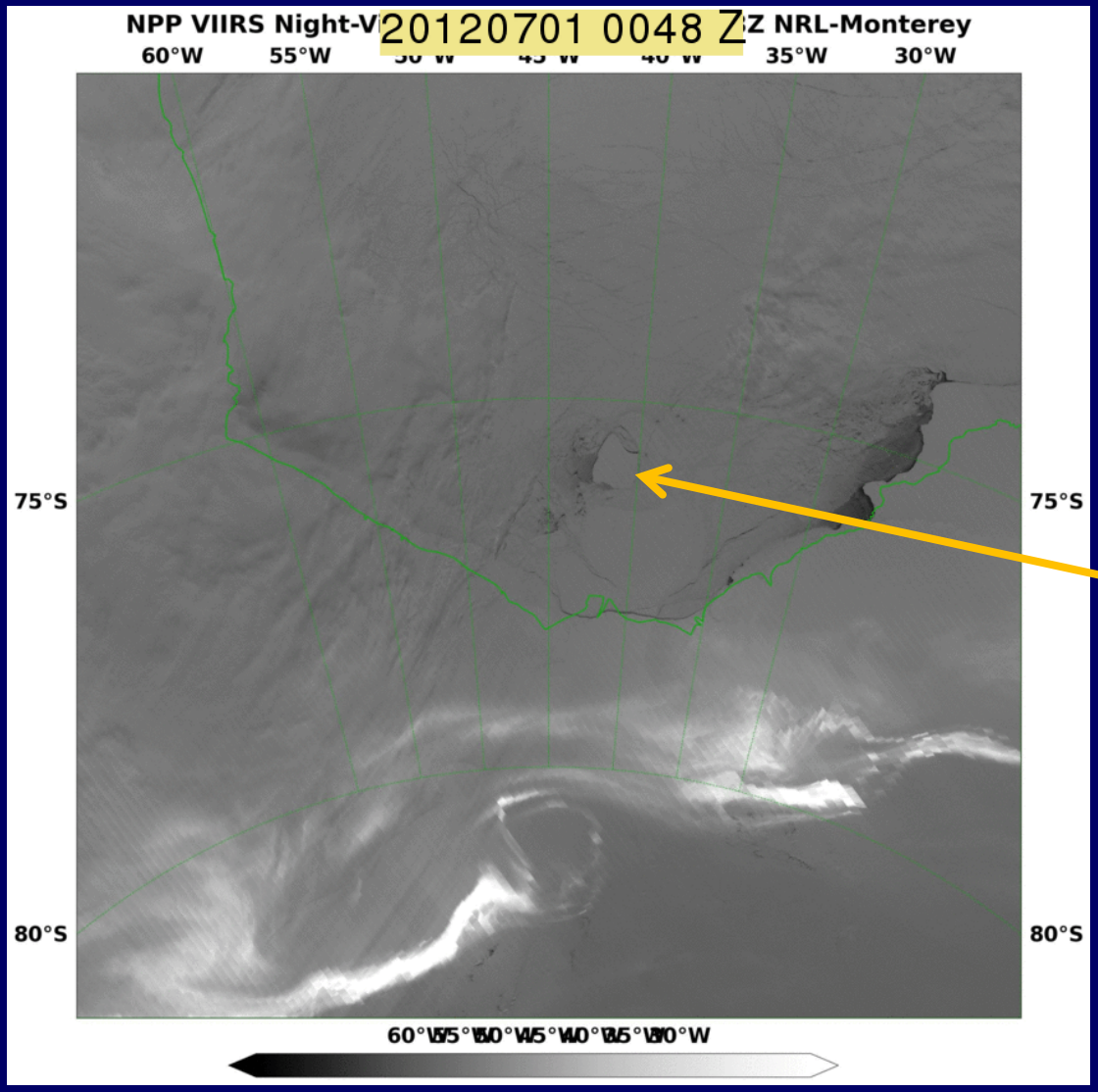
Fishing Fleet Monitoring

Fishing fleet lights: Nov 21 – Dec 6, 2013

Daily Day Night Band Imagery



Antarctic Sea Ice/Aurora Monitoring using VIIRS DNB



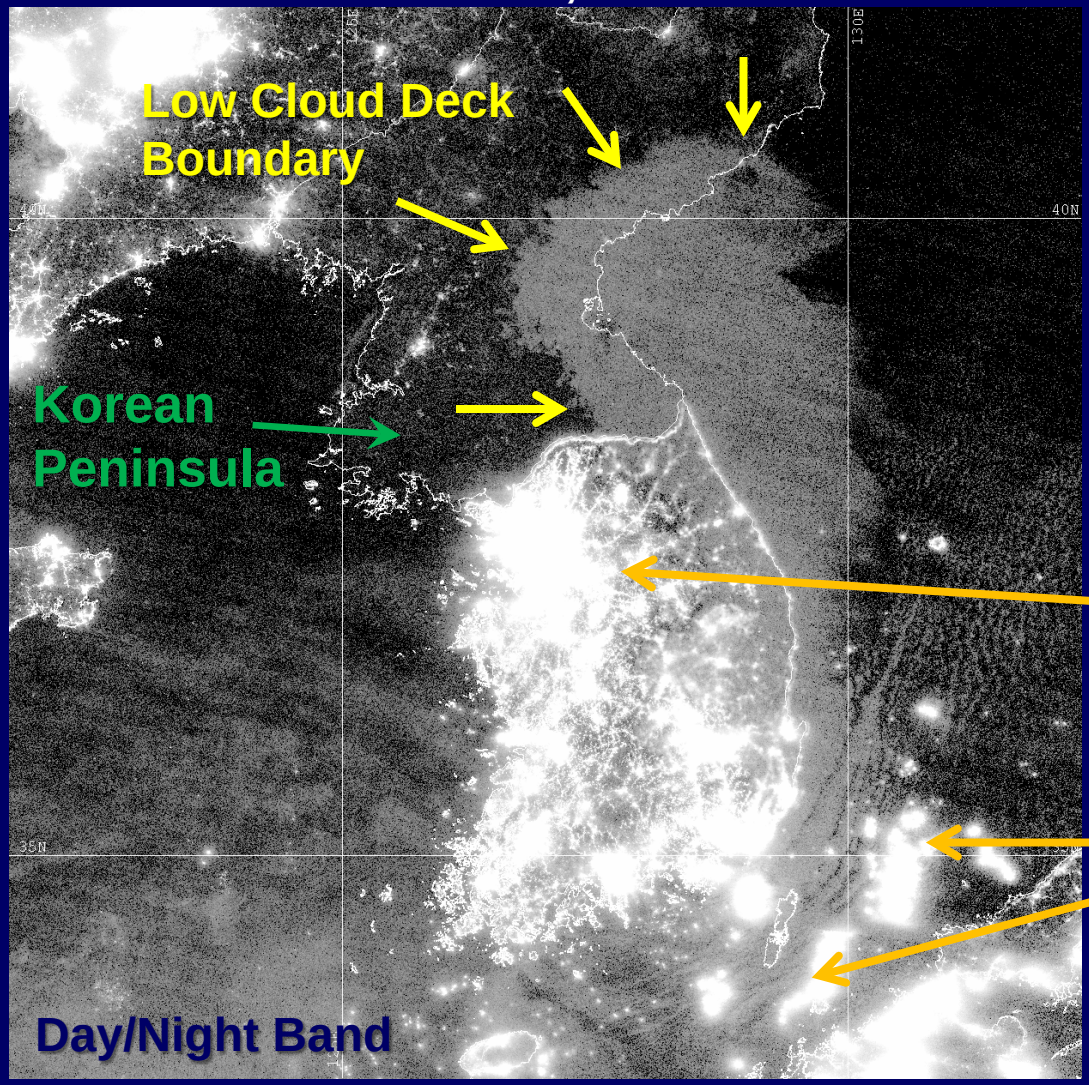
Tabular Iceberg

A23A
44 x 40 nm

Weddell Sea

Low Clouds & Fog Detection

Feb 23, 2012



Airglow provides sufficient illumination to "light up" low clouds

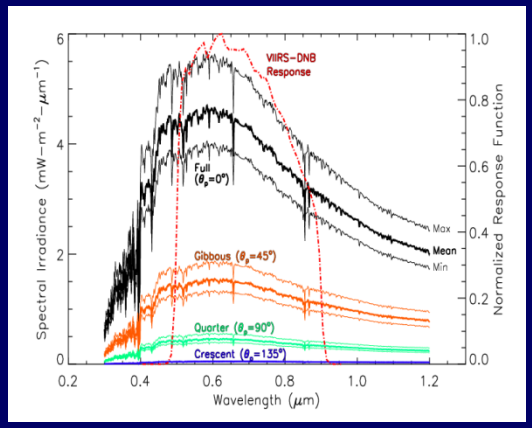
City lights

Fishing boats

Tools for Quantitative Lunar Applications from the VIIRS/DNB

- A lunar irradiance prediction model to allow conversion from DNB radiance to reflectance units

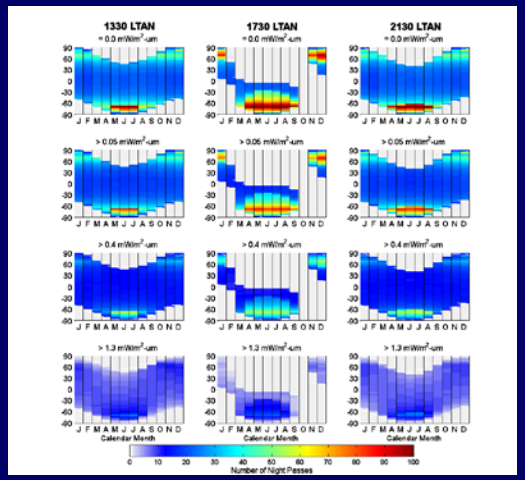
$$R = \pi I^{\uparrow} / [\cos(\theta_m)\mathbf{E_m}]$$



- Enables quantitative applications from measurements of reflected moonlight

Miller and Turner, 2009. *IEEE Trans. Geosci. Rem. Sens.*, **47**(7), 2316-2329.

A lunar availability assessment for the VIIRS/DNB to determine when and where nighttime lunar applications are possible for NPP and other polar orbits.



- ~45% all nights at mid-latitudes offer sufficient levels of moonlight

Miller et al.. 2012. *J. Atmos. Ocean. Tech., In Press.*

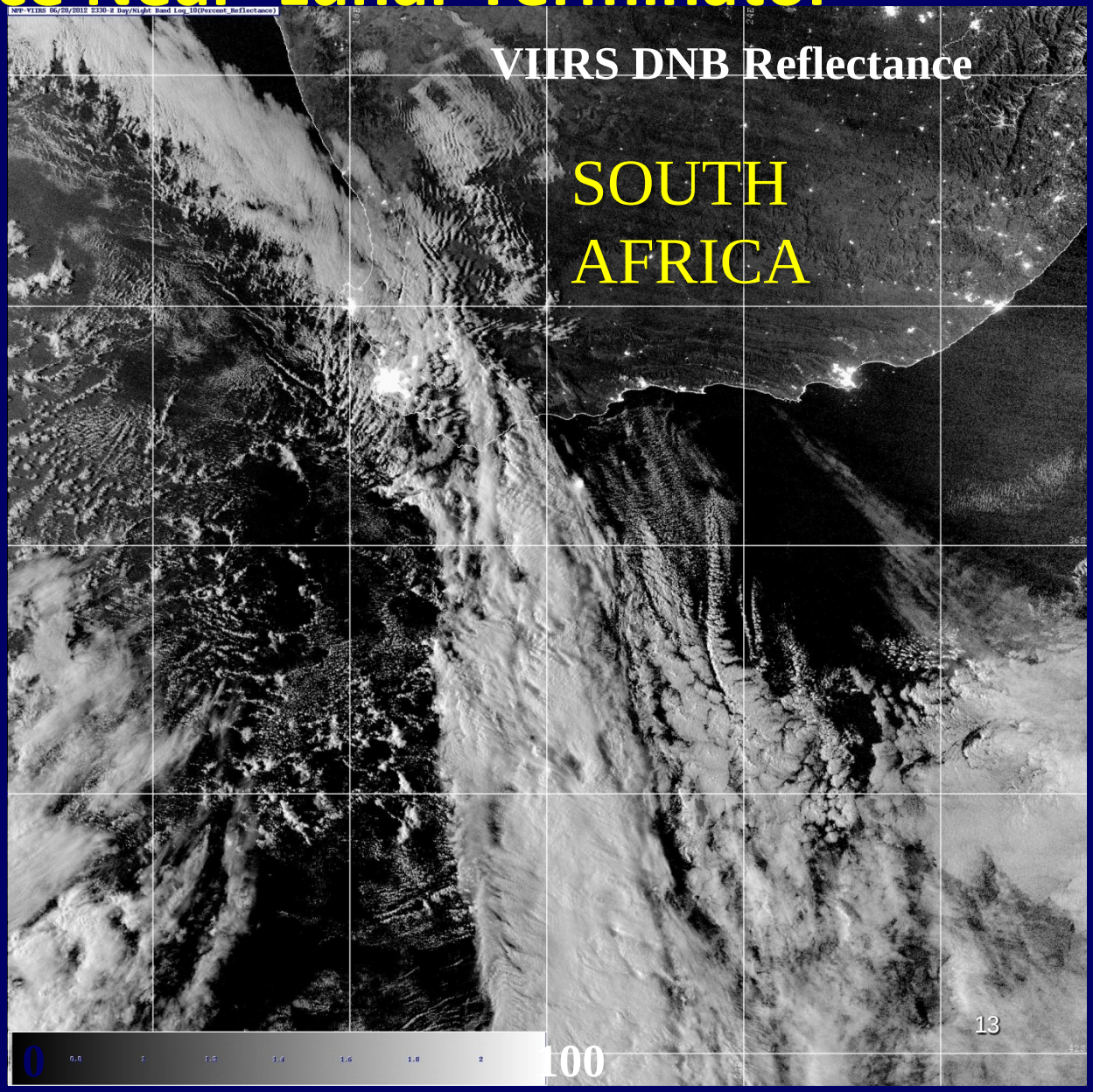
Lunar Irradiance Model
Reflectance Near 'Lunar Terminator'

The lunar model can be used to produce a form of near constant contrast (NCC) imagery.

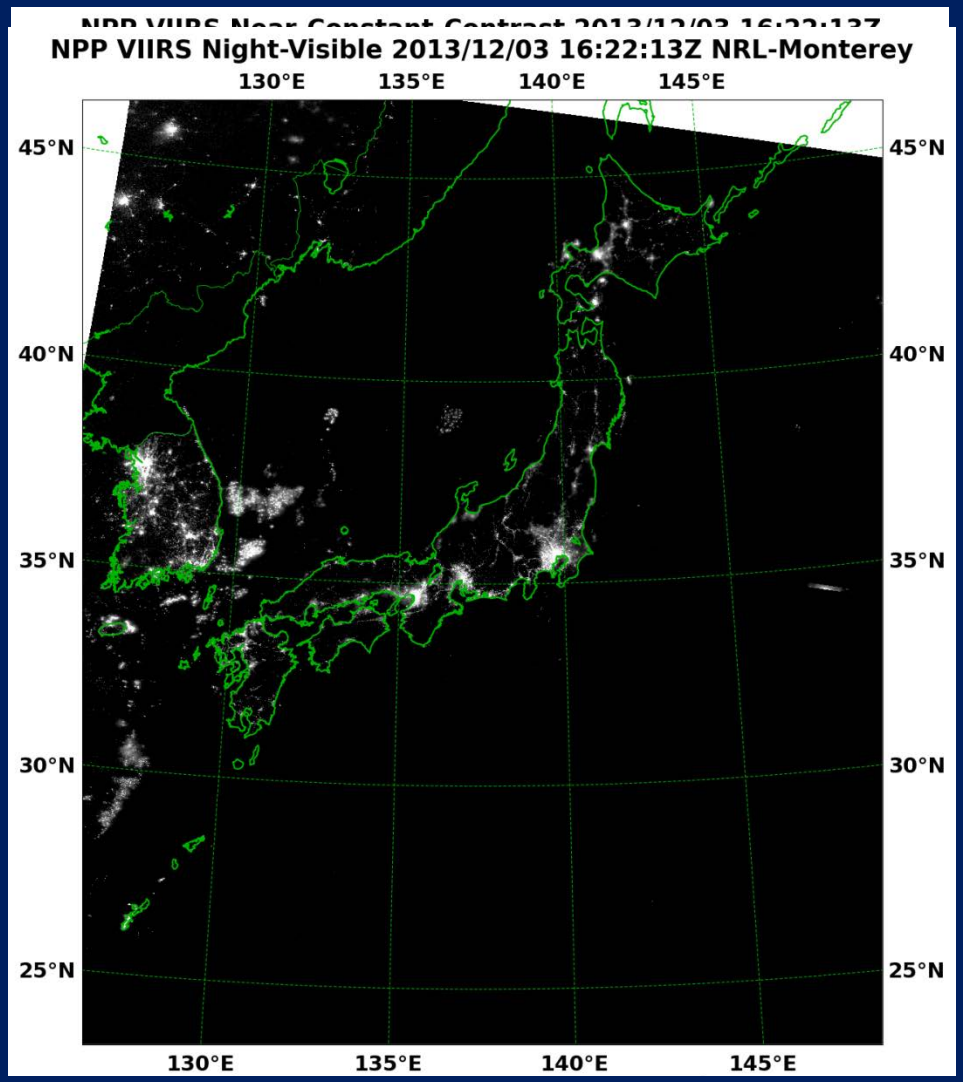
Applicable to ***night-only*** (i.e., to lunar observations at different times in the lunar cycle, especially near lunar terminator.

Not applicable to the day/night terminator where solar signal is present.

(28 June 2012, South Africa, around first-quarter Moon) shown here… → Moon is setting in the west at the time of the DNB nighttime overpass.

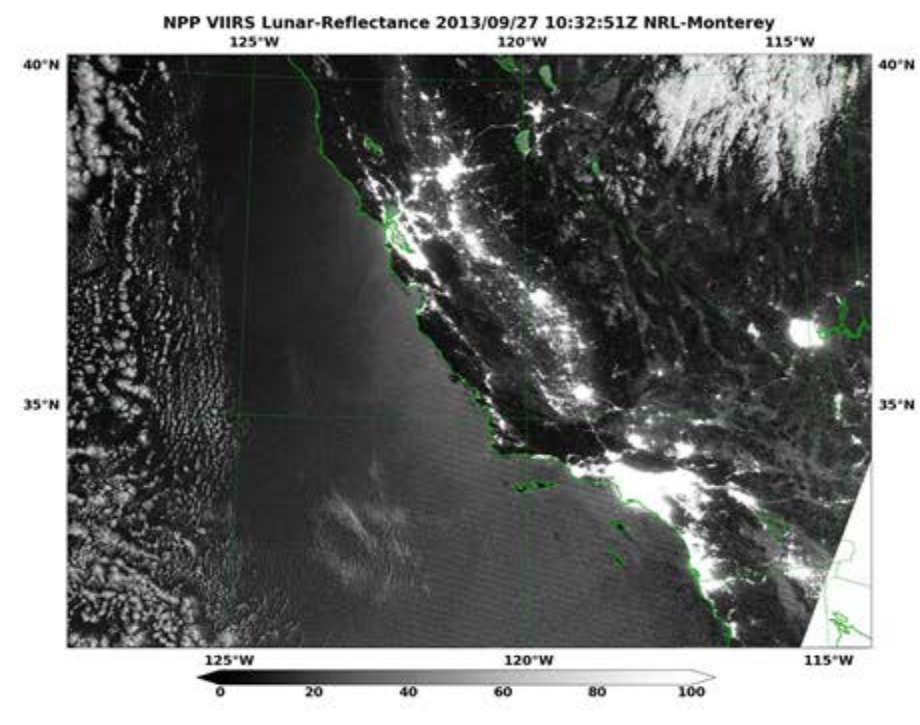


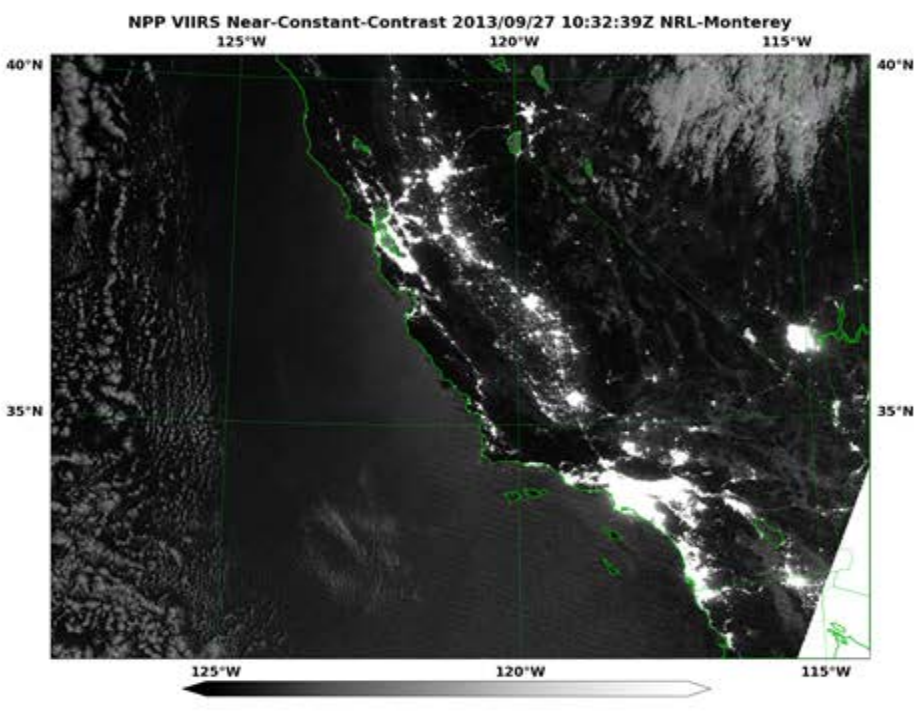
VIIRS Near Constant Contrast (NCC)



1. Contrast enhancement for cloud detection under faint illumination
2. Take advantage of highly variable air glow opportunities

VIIRS Lunar Reflectance vs NCC





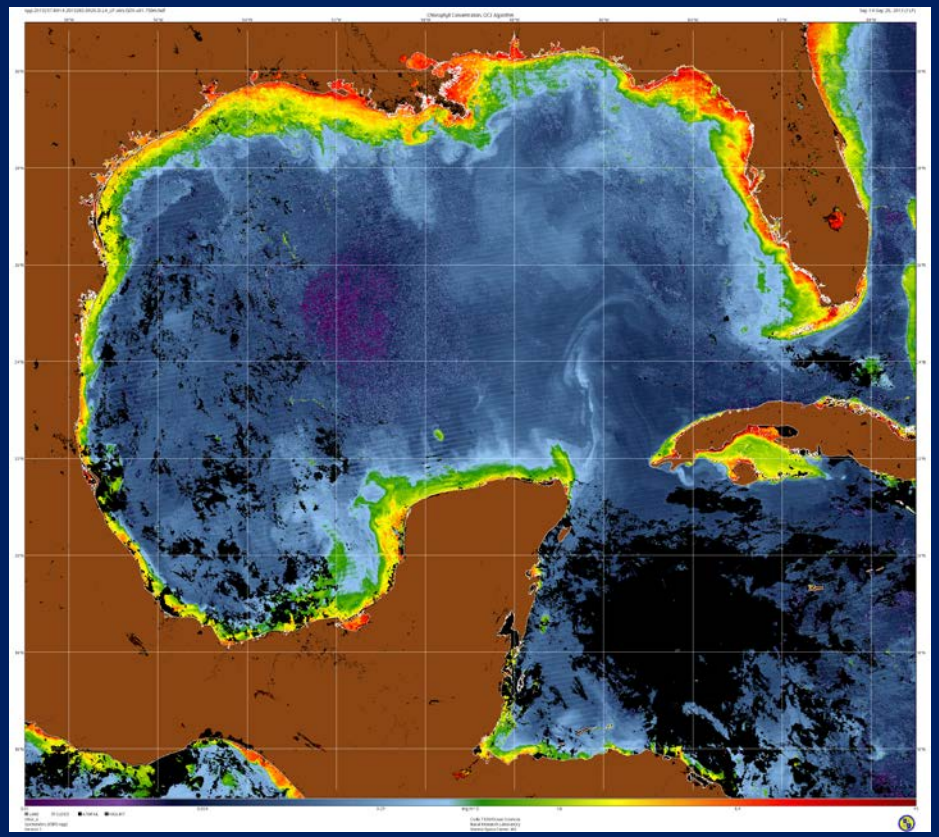
1. Better land surface details in the desert SW.
2. Improved cloud detail and contrast of clouds with land/ocean backgrounds.
3. Moonglint region--better illustration of the island wake calm waters (SE of Catalina Island) for surface wind speed and direction inference.
4. Not only is it a nice image, but it's *quantitative* information which can be translated into various physical properties like cloud optical depth.

NexSat Hosting: Cal/Val Ocean Color

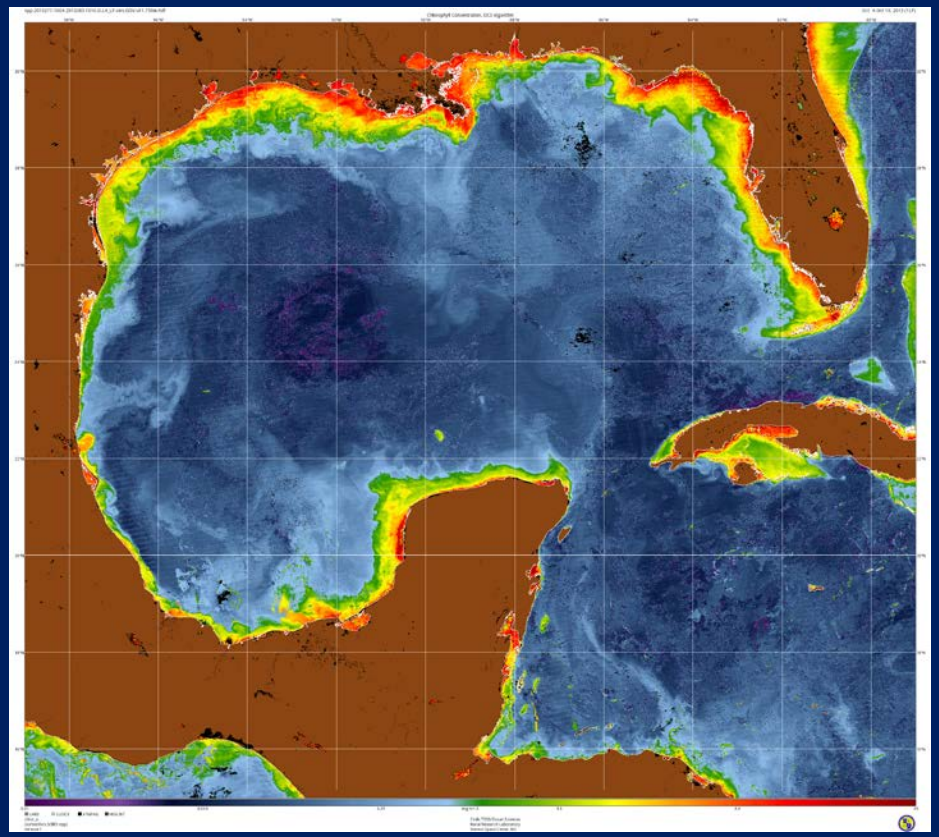
7 day running composites

courtesy:
Sherwin Ladner, NRL-SSC

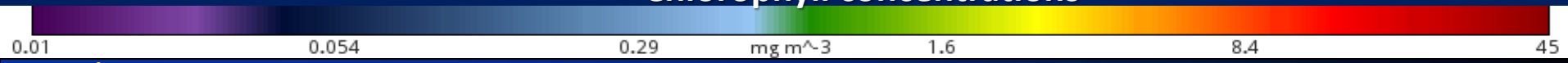
Sep. 20 – Oct. 01 2013



Oct. 10 – Oct. 22 2013



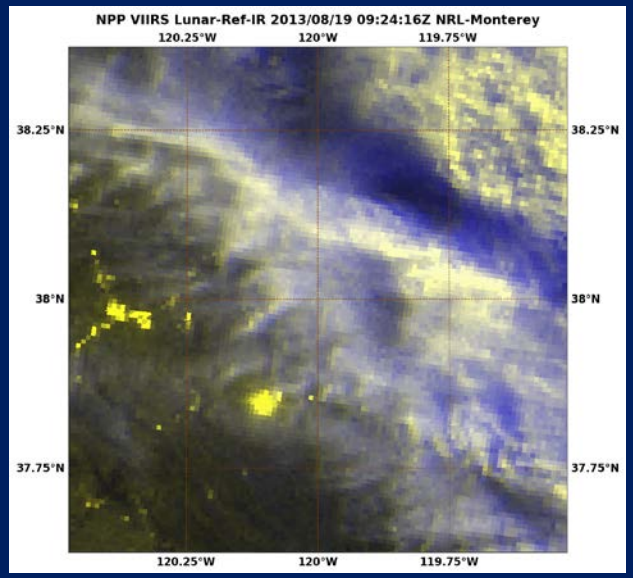
Chlorophyll concentrations

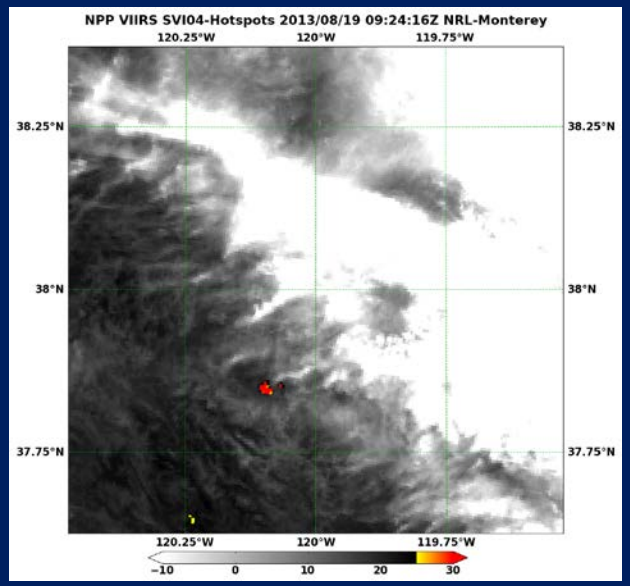


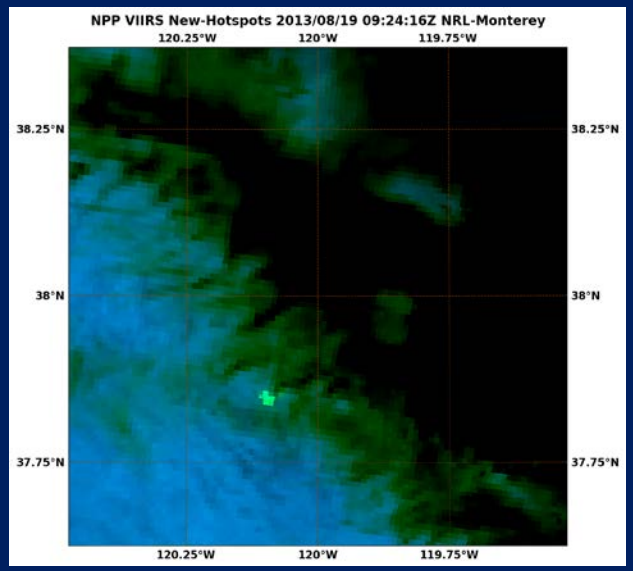
VIIRS Developments at NRL-MRY

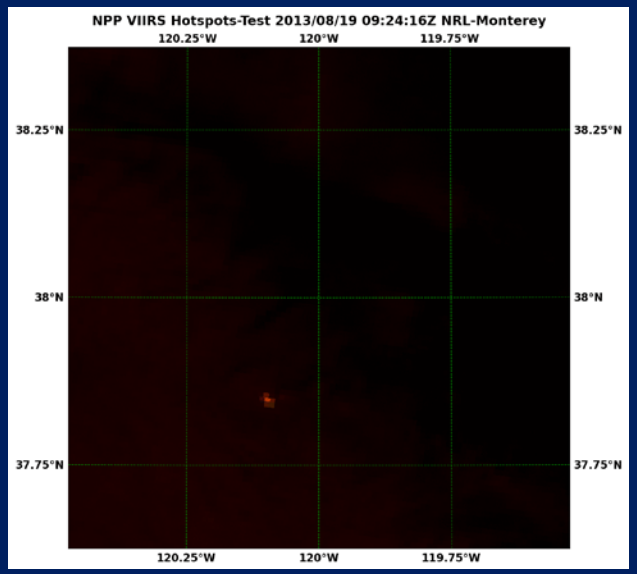
- Several select channels from 22 channel suite
- Nocturnal low cloud
- Snow/cloud
- Fire/Hot spot
- Dust - adapting MSG DEBRA (Steve Miller, CIRA)
- AOD day and night
- Cirrus

Fire/Hot spot Monitoring Techniques Using VIIRS DNB & IR Channels (night)





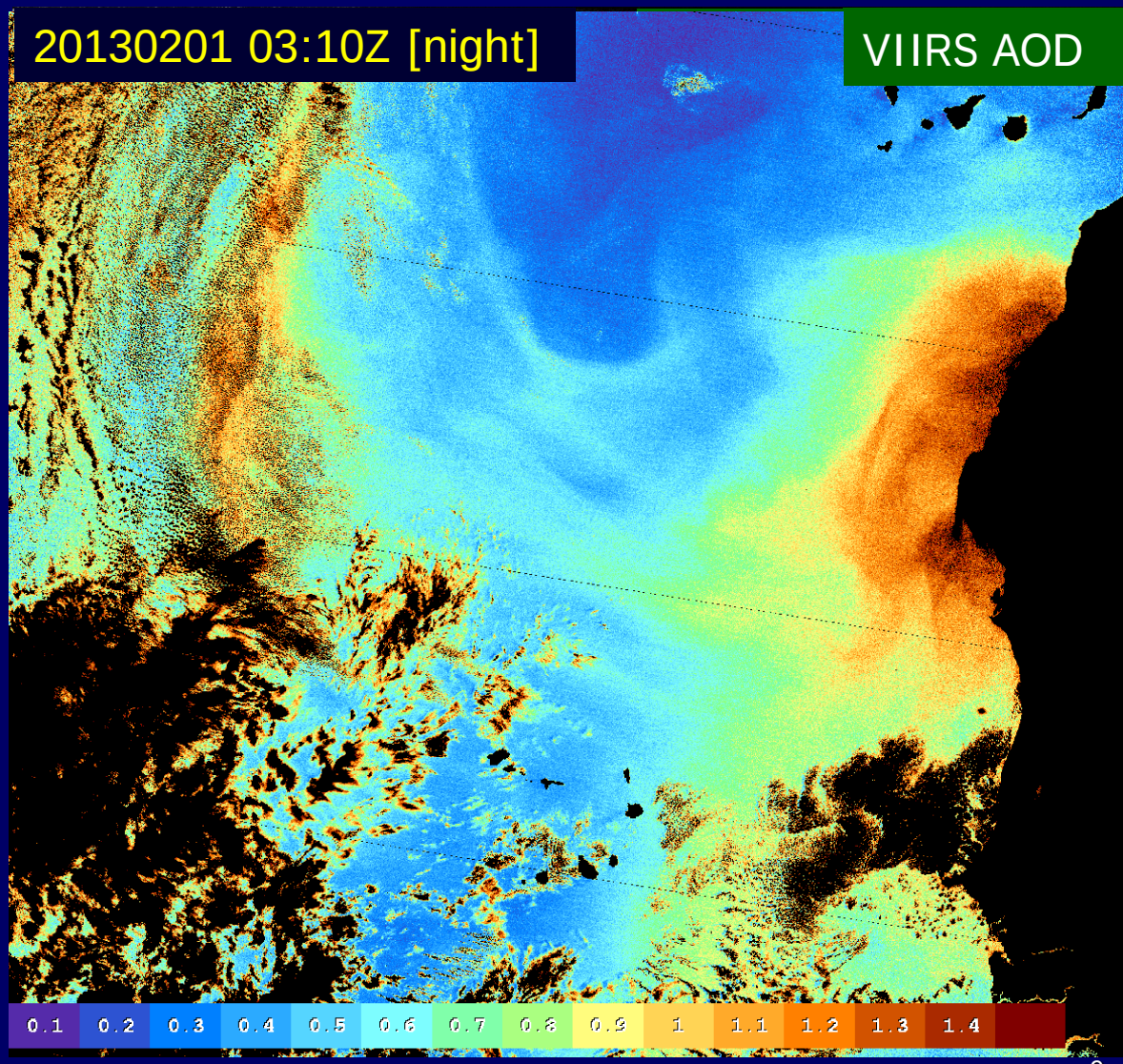




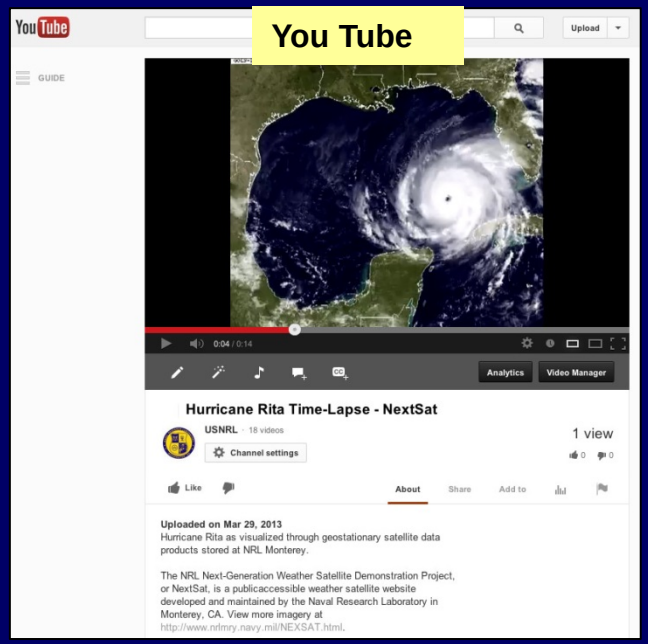
VIIRS-DNB AOD at Night *(under development)*

Saharan Dust Outbreak

- ✓ AOD product adapted from NRL/NPS over water algorithm
- ✓ Utilizes lunar irradiance model
- ✓ Applies stand desert dust phase function and SSA
- ✓ Better cloud mask and physics needed
- ✓ Potentially, unprecedented resource to models



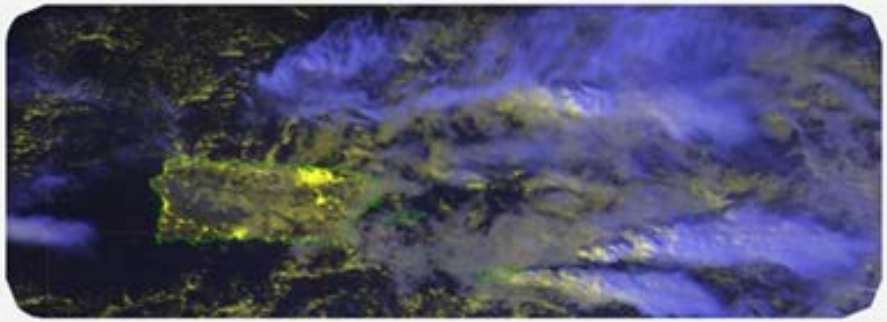
Social Media Posts from NRL



Outreach: Puerto Rico NWS Support

New Satellite Tools

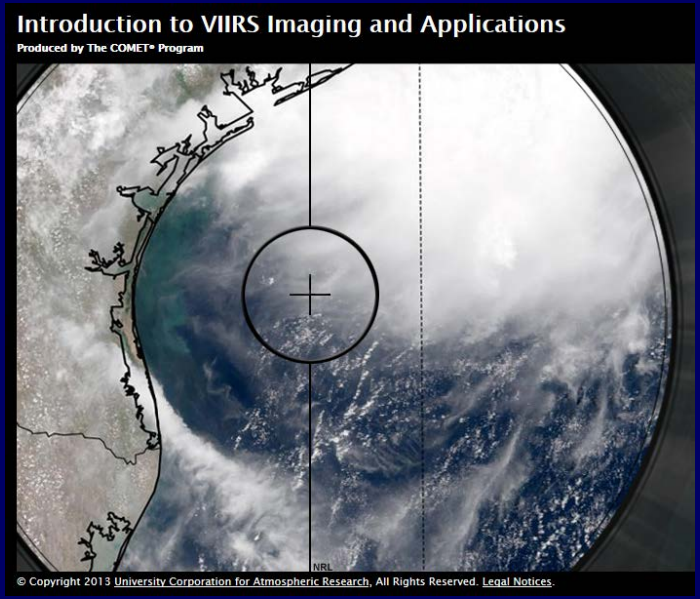
By: Luis Rosa



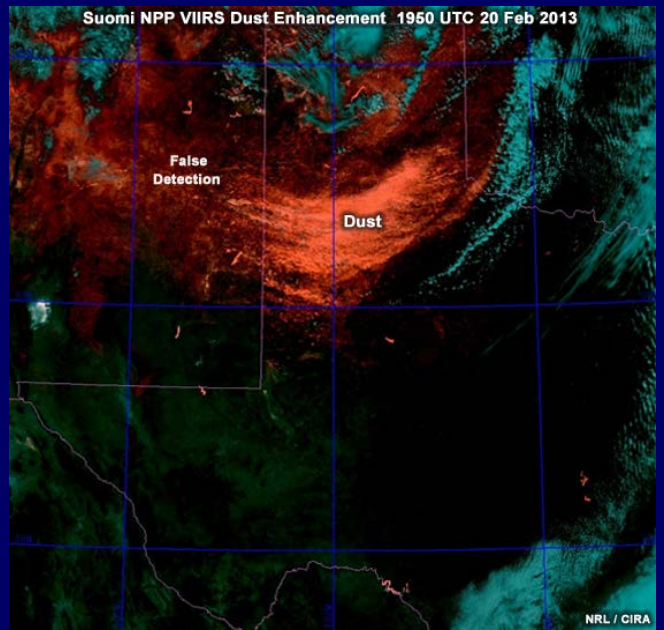
The NWS San Juan is very pleased to announce a customized domain of satellite imagery for Puerto Rico courtesy of the Naval Research Laboratory in Monterey, CA (NRL-MRY). The NexSat (Next-Generation Weather Satellite Demonstration Project) website displays high-resolution imagery from the newest sensor Visible Infrared Imager Radiometer Suite (VIIRS) that flies on the Suomi NPP (National Polar-orbiting Partnership) polar orbiter, the Moderate Resolution Imaging SpectroRadiometer (MODIS) on board NASA's Aqua and Terra satellites, the Advanced Very High Resolution Radiomenter (AVHRR) from NOAA's and EUMETSAT satellites, and the Operational Linescan System (OLS) from the Defense Meteorological Satellite Program (DMSP). The VIIRS instrument has significant improvements over its heritage instruments AVHRR, MODIS and OLS in which its 3000 km wide scanning swath overlaps previous scans providing complete coverage of tropical regions at least twice daily sometimes twice in less than two hours. The satellite also maintains the same resolution

across the entire swath retaining its sharpness at the scan edges and minimizing the negative impact that edge-of-scan blurring

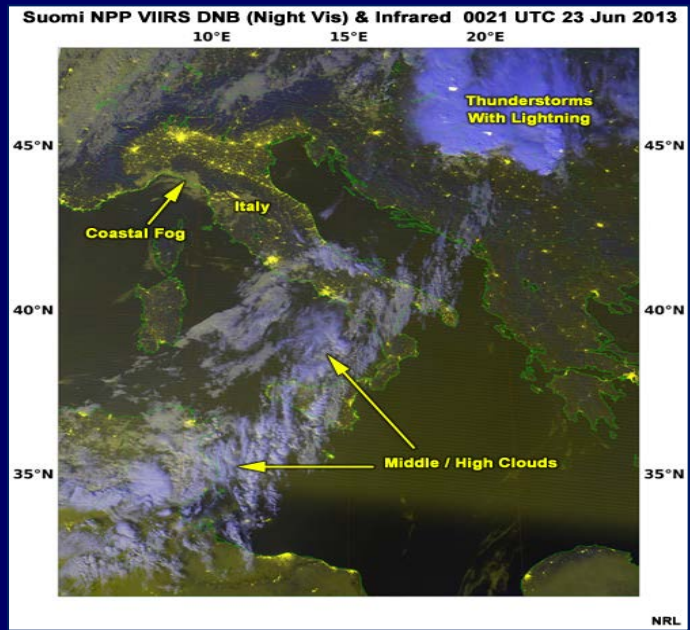
VIIRS COMET Training



Dust Detection

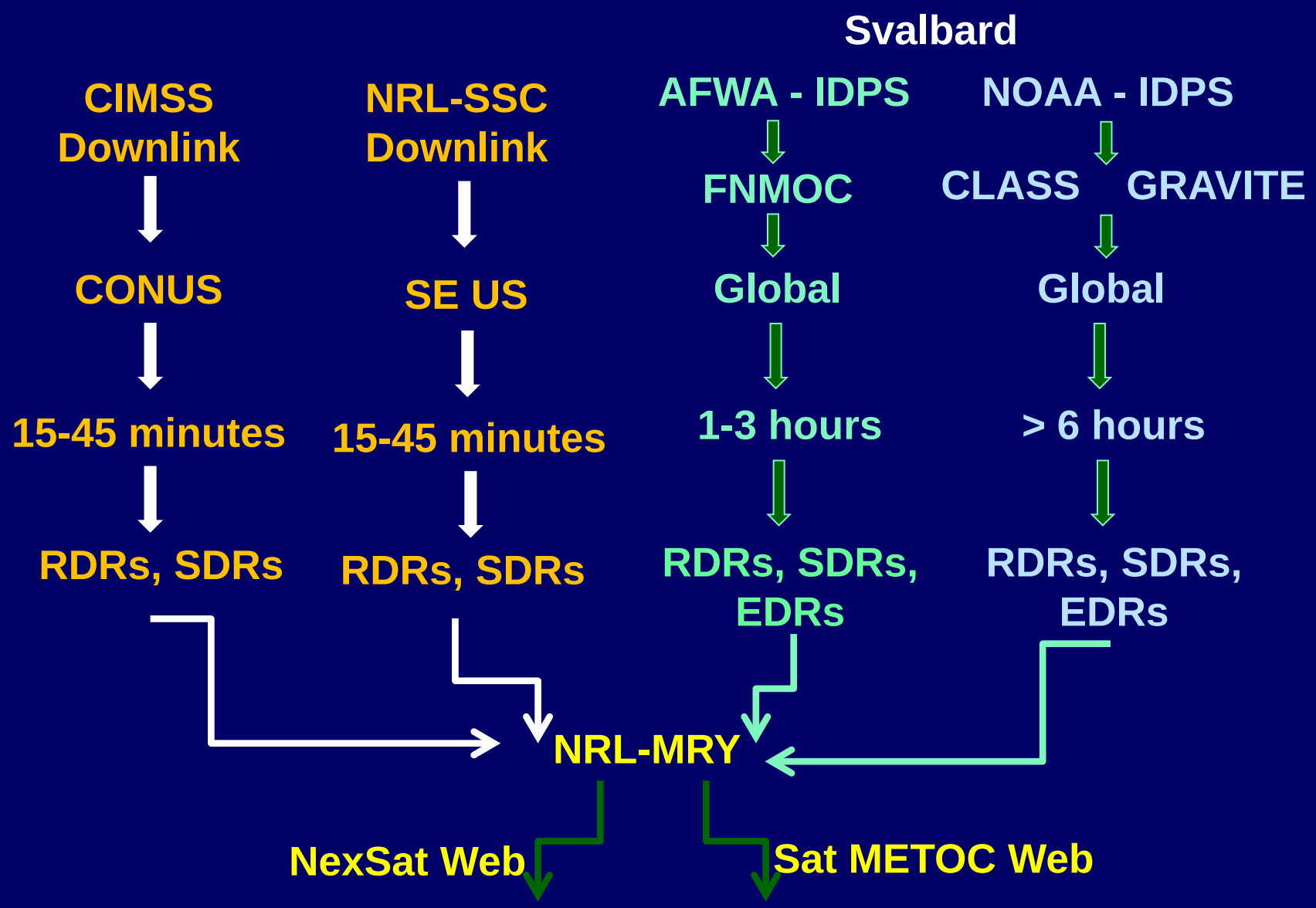


DNB + IR

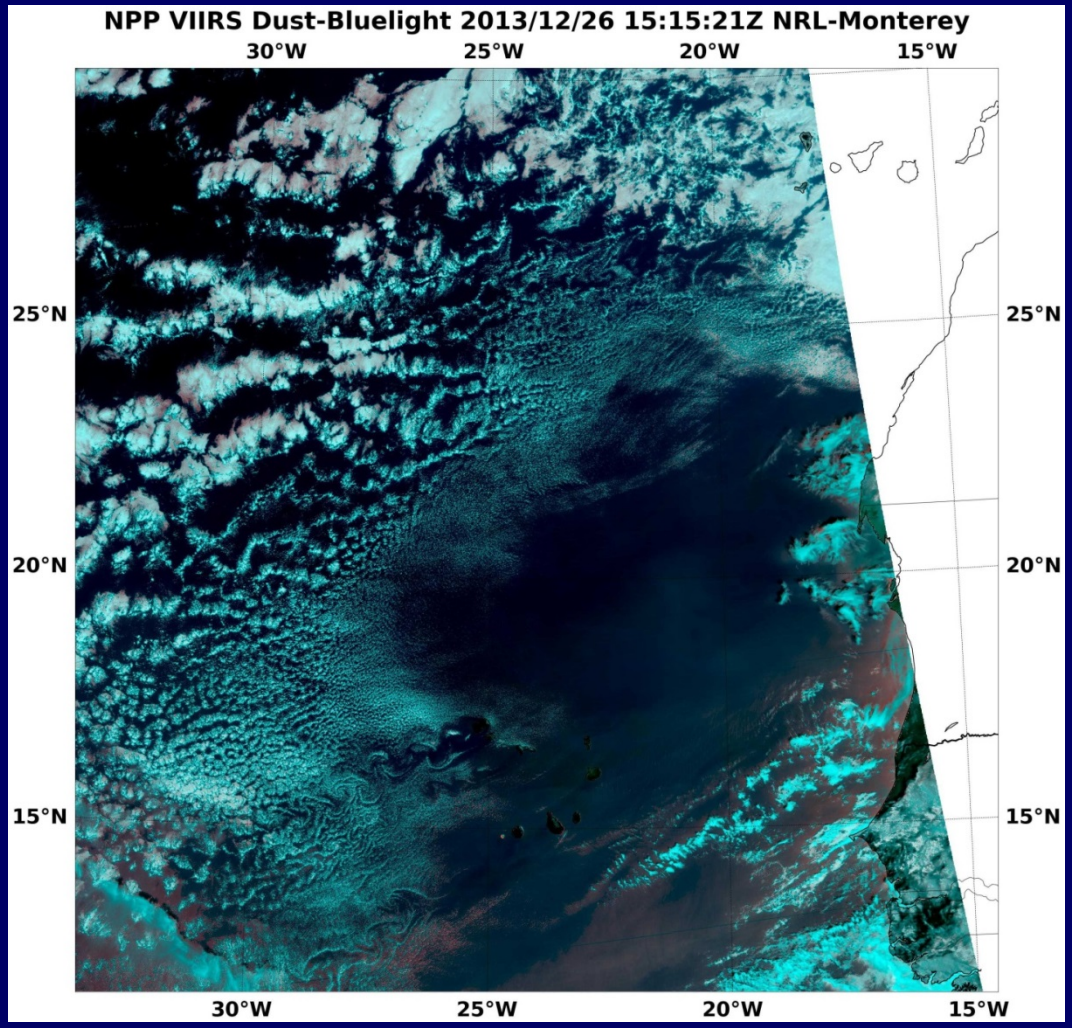


Extra slides

NRL-MRY VIIRS Data Latency



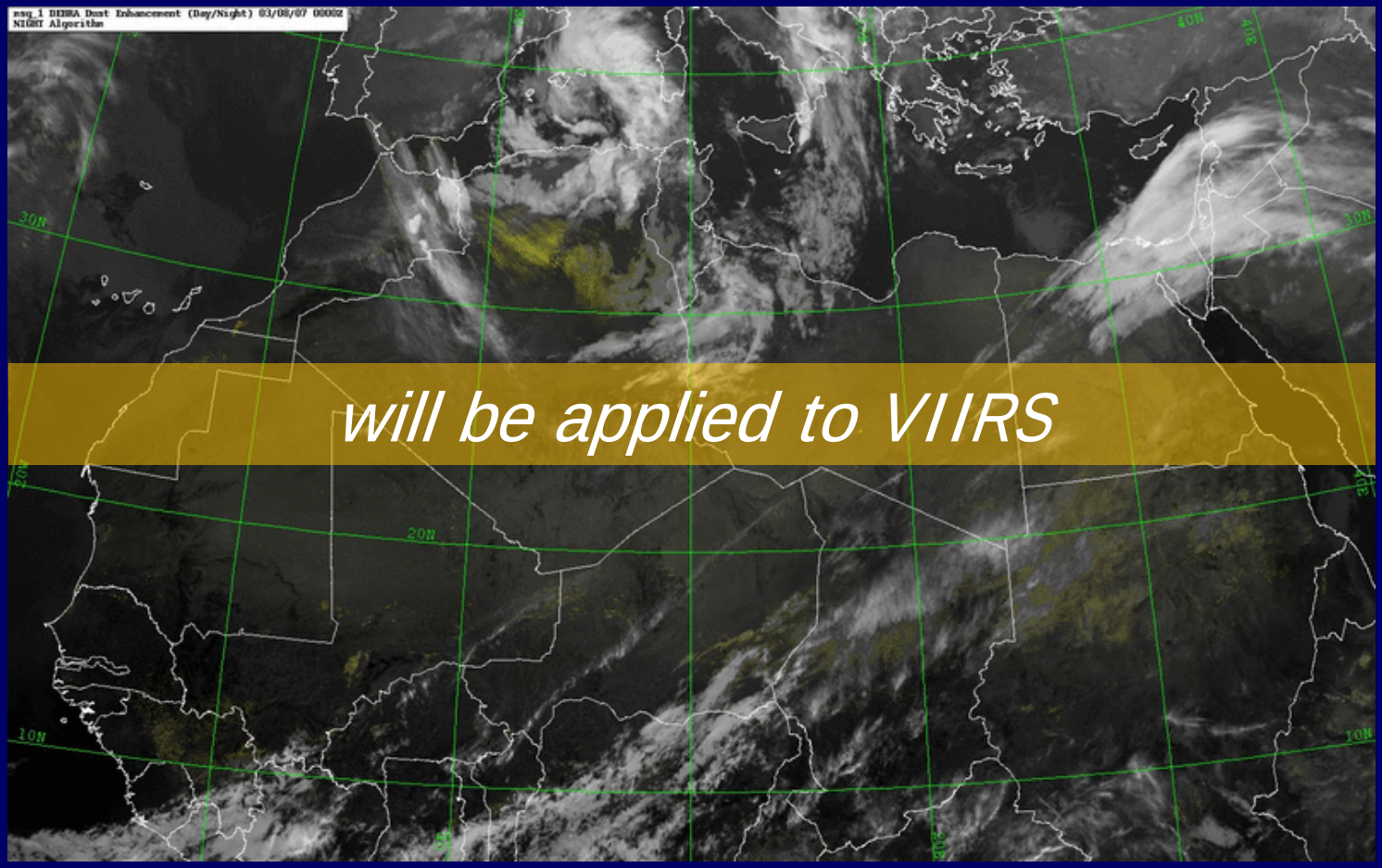
VIIRS Dust Product
Monitoring SAL Outbreaks



adapted from the MODIS blue-light algorithm

DEBRA (MSG SEVIRI)

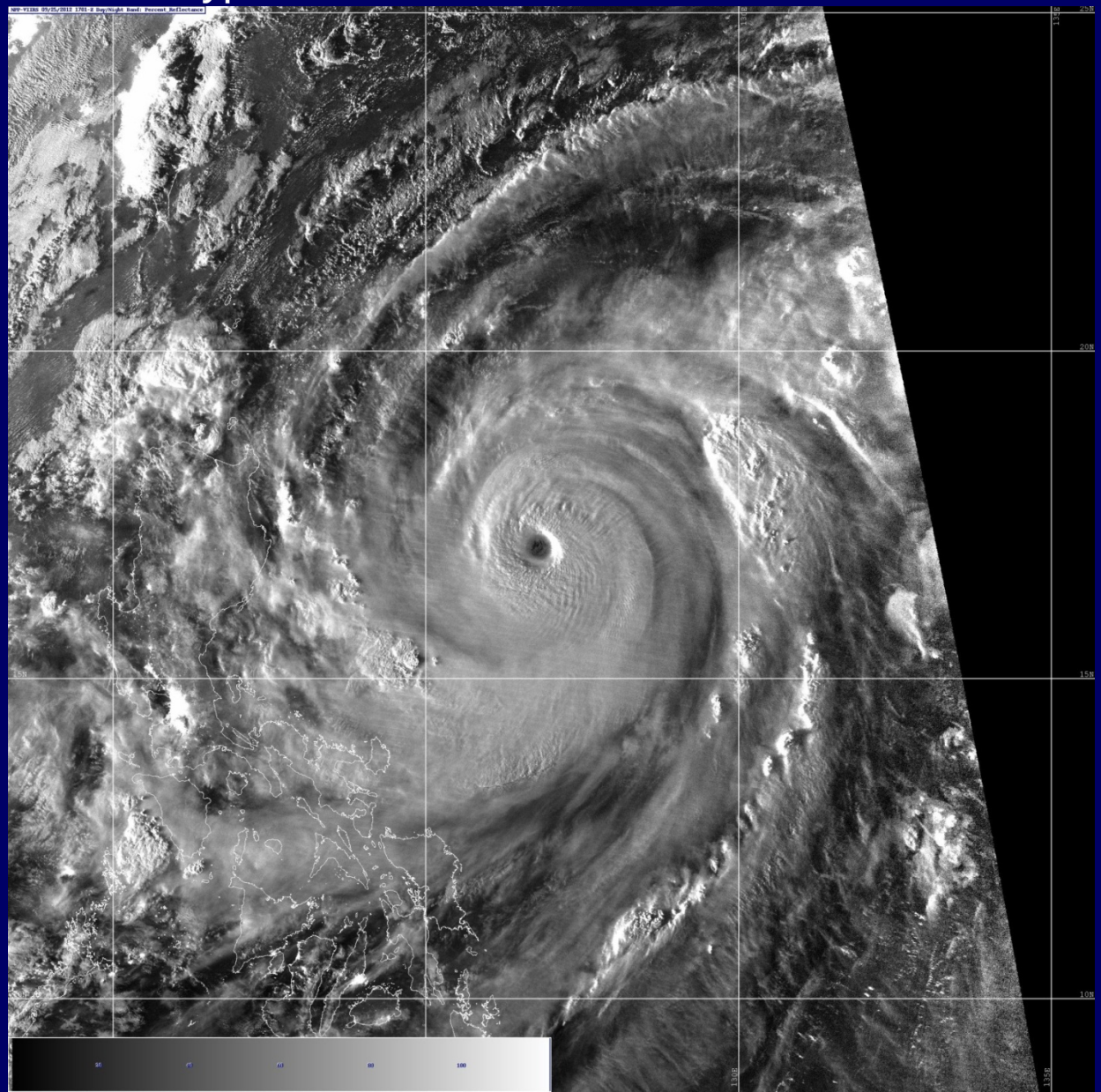
- ✓ 24/7 Monitoring – Seamless blend across day/night terminator
- ✓ Isolates dust with less ambiguity (quick viewer focus)
- ✓ Enhanced discrimination from land background and clouds
- ✓ Greater structural and textural detail (output at sensor resolution)



will be applied to VIIRS

Lunar Reflectance Impact

Typhoon Jelawat: 9/25/2012 ~1700Z



Summary of NexSat

- Wealth of sensor data in near real time
  - 6 GEO, 30+ LEO
  - VIIRS data arriving in 3 major portals to NRL-MRY
- Global coverage
- Google Earth format option
- On-line training and COMET collaboration
- Active outreach support
  - field campaigns
  - disaster monitoring
  - public awareness