An Update to the NRL NexSat Webpage

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Preparing User Communities for the New Generation of LEO and GEO Environmental Satellites, February 4, 2014
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


Select Nexsat area of interest in the image map below.
# 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

*VIIRS products in orange*
Product Suite via Co-Registered Navigation
Monitoring SAL using VIIRS Dust Product
Supporting NWS in Puerto Rico

Puerto Rico Region

MODIS AOD

VIIRS Dust (pink shades)
VIIRS Dust Product
Monitoring SAL Outbreaks

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
Low Clouds & Fog Detection

Feb 23, 2012

Low Cloud Deck Boundary

Korean Peninsula

City lights

Fishing boats

Airglow provides sufficient illumination to “light up” low clouds

Day/Night Band
Tools for Quantitative Lunar Applications from the VIIRS/DNB

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

\[ R = \pi I^\uparrow / [\cos(\theta_m)E_m] \]

- Enables quantitative applications from measurements of reflected moonlight


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

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

0.01 0.054 0.29 1.6 8.4 45
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, CI RA)
- 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

Facebook

Twitter

YouTube
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 Radiometer (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 has on atmospheric geostationary observations.
VIIRS COMET Training

Introduction to VIIRS Imaging and Applications

Dust Detection

DNB + IR

Suomi NPP VIIRS DNB (Night Vis) & Infrared 0021 UTC 23 Jun 2013

Suomi NPP VIIRS Dust Enhancement 1950 UTC 20 Feb 2013
Extra slides
NRL-MRY VIIRS Data Latency

- **CIMSS Downlink**
  - **CONUS**
    - 15-45 minutes
    - RDRs, SDRs
  - **SE US**
    - 15-45 minutes
    - RDRs, SDRs

- **NRL-SSC Downlink**
  - **AFWA - IDPS**
    - FNMOC
      - Global
        - 1-3 hours
        - RDRs, SDRs, EDRs
      - Svalbard
        - > 6 hours
        - RDRs, SDRs, EDRs
  - **CLASS - IDPS**
    - GRADVITE
      - Global
      - > 6 hours
      - RDRs, SDRs, EDRs

- **NRL-MRY**
  - **NexSat Web**
  - **Sat METOC Web**
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
  o 6 GEO, 30+ LEO
  o 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
  o field campaigns
  o disaster monitoring
  o public awareness