VIIRS for Land EDR(s) (and IPs, ARP)

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NOAA/NESDIS/STAR
and many members of the JPSS Land Algorithm Development, Calibration and Validation Team and
NASA SNPP VIIRS Land Discipline Team
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VIIRS vs. MODIS for land monitoring

• What can VIIRS do better than MODIS?
  – Better coverage and scanning geometry, including higher resolution of “M” bands
    • Improved fire detections (25% higher VIIRS fire counts than MODIS in the three-pixel VIIRS aggregation zone)
    • No gaps at low latitudes, more consistent data for temporal compositing

• What can VIIRS do that MODIS cannot?
  – VIIRS Day/Night Band: VIIRS can directly assess a variety of phenomenon associated with human settlements (e.g., population, socio-economic activity, the built environment, and urbanization).

• What can MODIS do better than VIIRS?
  – MODIS can ‘see’ the Amazon better: TERRA-MODIS was designed to cross the equator at a time when cloud cover is at its daily minimum (10:30AM, descending).

• What can VIIRS do that is currently missing?
  – VIIRS can/should be used to measure the Earth's Biosphere: (i.e., not just daily VI and Surface Type, but also LAI/FPAR, NPP/GPP, Burned Area, Phenology, etc.)
  – Multiple threads of VIIRS product development and generation: IDPS, NOAA JPSS (NDE), Proving Ground, NASA Science Team and Applied Science etc.
MODIS/VIIRS cross calibration over a 50km x 50km site in Australia (left), and true color image of the site (right). The agreement between the two reflectance products is excellent. Data were acquired on 3/6/2012 after a calibration update of the VIIRS.

Provision of spatially gridded VIIRS Surface Reflectance at both moderate (0.5 – 1.0 km) and CMG resolutions.

Land PEATE-adjusted version of VIIRS Surface Reflectance IP

E. Vermote, NASA GSFC
Overall bias close to zero in time series.

Land cover types and AERONET sites

M. Vargas, STAR
Good agreement between VIIRS and MODIS TOC EVI on global scale.

M. Vargas, STAR
VIIRS tends to overestimate TOC NDVI especially over broadleaf forests (cf. time series and maps). Scatter plots indicate that the VIIRS TOC red band is overcorrected for atmospheric effects; VIIRS NIR is higher than MODIS.

M. Vargas, STAR
Correlation between VIIRS and AVHRR (TOA)

VIIRS NDVI is ~30% higher than AVHRR. In order to apply VIIRS NDVI to continue 34-year AVHRR’s NDVI data records & analysis of changes in land cover, drought, climate etc we need to convert NDVI from VIIRS to AVHRR.

F. Kogan, STAR
Green Vegetation on Our Planet

http://www.nnvl.noaa.gov/green.php

April 2012 – April 2013
500 m grid; NDVI weekly composite / gap filled

F. Kogan, STAR
D. Pisut, NOAA Visualization Laboratory

*Top: the VIIRS BPSA albedo
Bottom: the MODIS albedo*
Evaluation of the VIIRS Dark Pixel Surface Albedo EDR (New England 2013183)

VIIRS DPSA White color is fill value. Valid retrievals are nearly all from history, and most of the historical data are fill values.

MODIS Aqua-only Black-Sky Albedo.

VIIRS DPSA QA. Red (missing) = full inversion, green = ‘historical’ data and blue = no-data values.

MODIS Aqua only QA. Red = full inversion, green = magnitude inversion and blue = no-data value.

-- VIIRS DPSA albedo is uses the daily gridded surface reflectance IP as input and only few observations meet the reflectance overall quality for albedo retrieval.
-- Current criteria for DPSA full inversion are limited. A crucial parameter, the WODs (weights of determination), which describes the angular sampling status of the input reflectances, are not even considered.

Zhuosen Wang, Yan Liu, and Crystal Schaaf (UMASS Boston)
A satellite-to-satellite LST comparison tool is built up. It is based on the Simultaneous Nadir Observation (SNO) utility, for the match up selection. Here is an example of the comparisons between the VIIRS LSTs and the MODIS LSTs.
Emissivity over IGBP surface type

The VIIRS LST algorithm is surface type dependent. Emissivity variation study is conducted to understand its impact. Monthly MODIS emissivity data at VIIRS channel 15 (blue) and 16 (red) is plotted showing its variation in Jan, Apr, Jul, and Oct. Also, it is shown the emissivity value shift in 2009.

Y. Yu, STAR
The generation of an VIIRS LST product compatible with MODIS (i.e., a merged product using both split-window and dynamic emissivity retrieval) will result in a much more stable EDR.

MODIS/VIIRS LST at the Kelso Dunes, California, pseudo-invariant site (right) versus radiance-based LST.
Surface Type EDR

- 1st Quarterly Surface Type IP (QST IP) has been produced with VIIRS data and compares well with the MODIS map (see maps on right side).
- No direct impact noticed on Surface Type EDR production so far. However, any SDR issues that affect the Fire and Snow/Ice products will also affect ST EDR, because those products are copied to ST EDR.
- Lack of gridding products from IDPS forces ST EDR team to do offline gridding and compositing of orbital data to monthly gridded data, which is labor intensive, not planned for QST production task, distracts or slows down QST product development and validation efforts.
Active Fires: VIIRS (M-band) vs. MODIS

I. Csiszar, STAR

**M13 Data Aggregation Bug Identified (Feb 2012)**

19 Jan - 13 Feb 2012

**M13 Data Aggregation Revised in Mx5.3 (May 2012)**

11 May - 10 Jun 2012

The overall features of the Aqua MODIS and S-NPP functional dependence on scan angle remained the same a year later and over a longer time period

Feb - Jun 2013
Improved Satellite Mapping of Active Fires Achieved Using VIIRS I-bands

Wildfire in southern Brazil, March/2013

Issues of VIIRS fire detection:
• Anomalous behavior at sensor saturation
• Inconsistent quality flags
• Unknown saturation of native resolution pixels prior to aggregation (single-gain bands)
• South Atlantic Magnetic Anomaly
The Land PEATE: meeting the needs of the NASA Science Team and helping the NOAA IDPS

VIIRS LDOPE QA: [http://landweb.nascom.nasa.gov/NPP_QA/](http://landweb.nascom.nasa.gov/NPP_QA/)

**VIIRS Global Browse**

**Known Issues Page**

**VIIRS Level 3 Products**
Conversion of MODIS code for Daily LAI/FPAR to VIIRS Land Science DDR is complete.

R. Myneni (BU)

Integration and testing of VIIRS Active Fire DDR. New PGE installed to operations.

L. Giglio (UMD)
VIIRS Land Gridding/Granulation - Proposed

DSR GIP

Day 1
DSR GIP
Day 2
DSR GIP
Day ...
DSR GIP
Day 16
DSR GIP

16-day BRDF/Albedo

BRDF Archetypal (updated)

Update once per year (Jan. 1)

Generated every 8-days

Land Albedo GIP

S. Devadiga (GSFC/LDOPE)
Summary and Conclusions

• Overall, the quality of input SDR data is good
  – More work needed to resolve quality flag and sensor performance issues (e.g. Active Fires)

• S-NPP VIIRS land core IDPS product development and evaluation is progressing well
  – Provisional: Surface Reflectance, LST, Active Fires (approved); Vegetation Index (in progress) and Surface Type (January 2014)
  – Beta: albedo

• Teams are continuing the development of improved and additional products
  – Green Vegetation Fraction, I-band Active Fires, LAI/FPAR etc.

• Improvements in auxiliary data and processing scheme

• Publications (JGR and other) and presentations