Land EDR Overview

Land product suite
Presenter: Ivan Csiszar (STAR)
Contributors: STAR JPSS Land Team and external team members / partners
Date: August 25, 2015
## Algorithm Cal/Val Team Members

<table>
<thead>
<tr>
<th>PI</th>
<th>Org.</th>
<th>Key Team Members</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivan Csiszar</td>
<td>STAR/UMD</td>
<td>Louis Giglio, Wilfrid Schroeder</td>
<td>NOAA Product Team Lead, Fire</td>
</tr>
<tr>
<td>Miguel Román</td>
<td>NASA/UMD</td>
<td>Chris Justice, Sadashiva Devadiga</td>
<td>NASA Coordination, Validation co-lead, SIPS</td>
</tr>
<tr>
<td>Eric Vermote</td>
<td>NASA/UMD</td>
<td>Belen Franch</td>
<td>Surface Reflectance, VCM, calibration</td>
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<tr>
<td>Marco Vargas</td>
<td>STAR/U HI/AER</td>
<td>Tomoaki Miura, Zhangyan Jiang</td>
<td>Vegetation Index, Green Vegetation Fraction</td>
</tr>
<tr>
<td>Felix Kogan</td>
<td>STAR/IMSG</td>
<td>Wei Guo</td>
<td>Vegetation Health</td>
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<tr>
<td>Yunyue (Bob) Yu</td>
<td>STAR/SDSU</td>
<td>Xiaoyang Zhang</td>
<td>Phenology</td>
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<tr>
<td>Yunyue (Bob) Yu</td>
<td>STAR/UMD</td>
<td>Shunlin Liang, Dongdong Wang</td>
<td>Albedo</td>
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<tr>
<td>Bob Yu</td>
<td>STAR/ UMD</td>
<td>Yuling Liu, Zhen Song, Peng Yu</td>
<td>Land Surface Temperature</td>
</tr>
<tr>
<td>Jerry Zhan</td>
<td>STAR/ UMD</td>
<td>Chengquan Huang, Rui Zhang</td>
<td>Surface Type</td>
</tr>
<tr>
<td>Kevin Gallo</td>
<td>STAR/ USGS</td>
<td></td>
<td>Validation, data continuity</td>
</tr>
<tr>
<td>Walter Wolf</td>
<td>STAR/ IMSG</td>
<td>Marina Tsidulko, Qiang Zhao</td>
<td>STAR AIT Land</td>
</tr>
<tr>
<td>Leslie Belsma</td>
<td>Aerospace</td>
<td></td>
<td>JPSS Algorithm Manager</td>
</tr>
<tr>
<td>Mike Ek</td>
<td>NCEP/IMSG</td>
<td>Yihua Wu, Weizhong Zheng, Helin Wei</td>
<td>NCEP Land Team, data assimilation</td>
</tr>
</tbody>
</table>

**IDPS:** Interface Data Processing Segment; **NDE:** NOAA-Unique; **PGRR:** Proving Ground / Risk Reduction
Overall goal is to keep the NASA Science Product and the NOAA Operational product in sync

Current the VIIRS SR product is directly heritage from collection 5 MODIS and that it has been validated to stage 1

- Land PEATE adjusted version
- ongoing code change for IDPS implementation

MODIS algorithm refinements from Collection 6 will be integrated into the VIIRS algorithm

- candidates for further improvements in the NOAA JPSS operational product

NOAA algorithm integration supported by STAR AIT

Algorithm is generic and tied to documented validated radiative transfer code so the accuracy is traceable enabling error budget.

The use of BRDF correction enables easy cross-comparison of different sensors (MODIS, VIIRS, AVHRR, LDCM, Landsat, Sentinel 2, Sentinel 3...)
Evaluation of Algorithm Performance

VIIRS C11 reprocessing

450000 pixels were analyzed for each band.

Red = Accuracy (mean bias)  
Green = Precision (repeatability)  
Blue = Uncertainty (quadratic sum of A and P)

On average well below magenta theoretical error bar
Cross comparison with MODIS over BELMANIP2

The VIIRS SR is now monitored at more than 400 sites (red losanges) through cross-comparison with MODIS.

BELMANIP2: Benchmark Land Multisite Analysis and Intercomparison of Products
http://calvalportal.ceos.org/web/olive/
Algorithm improvements have ensured good consistency with validated MODIS SR product.

For direct validation AERONET is central and a “standard” protocol for its use to be defined (CEOS CVWG initiative).
SNPP VI EDR Maturity: Validated Stage 1

JPSS1 Algorithm Development (J1 Upper)
- Completed the development of TOC NDVI
- CCR-15-2382 approved by AERB in July 2015

Validation activities
- Global comparisons with Aqua MODIS
- Evaluation over AERONET sites
- Time series validation over FLUXNET sites

Instrument/product quality
- High radiometric quality, meeting the L1RDS requirements
- Low atmospheric correction quality along cloud edges
- Overestimation of cloud shadows

VI algorithm issues
- Unrealistic EVI for snow/ice or cloud-contaminated pixels
- EVI compatibility with MODIS

Long Term Monitoring (LTM)
- Ongoing


<table>
<thead>
<tr>
<th>Attribute</th>
<th>L1RDS Threshold (VI units)</th>
<th>Validation Results</th>
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<tbody>
<tr>
<td>TOA NDVI Accuracy</td>
<td>0.05</td>
<td>0.005</td>
</tr>
<tr>
<td>TOA NDVI Precision</td>
<td>0.04</td>
<td>0.017</td>
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<tr>
<td>TOA NDVI Uncertainty</td>
<td>0.06</td>
<td>0.020</td>
</tr>
<tr>
<td>TOC EVI Accuracy</td>
<td>0.05</td>
<td>0.037</td>
</tr>
<tr>
<td>TOC EVI Precision</td>
<td>0.04</td>
<td>0.011</td>
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<tr>
<td>TOC EVI Uncertainty</td>
<td>0.06</td>
<td>0.039</td>
</tr>
<tr>
<td>TOC NDVI Accuracy</td>
<td>0.05</td>
<td>0.007</td>
</tr>
<tr>
<td>TOC NDVI Precision</td>
<td>0.04</td>
<td>0.023</td>
</tr>
<tr>
<td>TOC NDVI Uncertainty</td>
<td>0.06</td>
<td>0.025</td>
</tr>
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</table>
VI-EDR August 10, 2015

5 VIIRS VIVIO Granules
timestamp d20150810_t1844472
timestamp d20150810_t1846126
timestamp d20150810_t1847380
timestamp d20150810_t1849034
timestamp d20150810_t1850288
TOC-NDVI
16-day composite

VIIRS TOC NDVI (16 days) for April 15 - April 30, 2015

Legend:
- Water
- No data
- VI < 0

Color Scale:
- 0.00
- 0.10
- 0.20
- 0.30
- 0.40
- 0.50
- 0.60
- 0.70
- 0.80
- 0.90
- 1.00
The SNPP VIIRS GVF consists of two products:
  • Daily Rolling Weekly 4-km GVF on a global grid
  • Daily Rolling Weekly 1-km GVF regional

SNPP VIIRS GVF products are derived from VIIRS surface reflectance data (Bands I1, I2 and M3)

Surface reflectance data are gridded, composited and used for calculating the Enhanced Vegetation Index (EVI)

GVF is derived from EVI
4km resolution weekly global GVF (August 10-16, 2015)
1km resolution weekly regional GVF (August 7-13, 2015). Coverage Lat 90°N - 7.5°S, Lon 130°E - 30°E
GVF: Recent Accomplishments

- Delivered SNPP VIIRS GVF LINUX DAP to NDE (May 2014)
- Supported the NDE IPT team during the integration, testing and pre-operational phase of the GVF system
- Briefed the VIIRS GVF product at the monthly SPSRB meeting for an operational decision in Sep, 2014
- The GVF product became operational within the Suomi NPP Data Exploitation (NDE) production facility in February 2015
- Started collaboration with NWS/NCEP to demonstrate that using the VIIRS GVF operational product instead of the AVHRR climatology will improve the performance of NOAA’s environmental prediction suite
The “Science”: Surface Fluxes

\[ H = \rho c_p C_h U (T_{sfc} - T_{air}) \]

\[ LE = LE_c + LE_t + LE_d \]

**Sensible heat flux**
- from soil surface/canopy

**Latent heat flux (Evapotranspiration)**
- Canopy Water Evaporation
- Transpiration
- Bare Soil Evaporation

**Soil heat flux**
- to canopy/soil surface

- Surface fluxes balanced by net radiation \((R_n)\), \(=\) sum of incoming and outgoing solar and terrestrial radiation, where GVF is important for energy partition between \(H\), \(LE\) and \(G\), i.e. surface roughness & near-surface turbulence \((H)\), vegetation processes \((LE)\), and heat transport through canopy \((G)\), affecting evolving boundary-layer, clouds/convection, and precipitation.

\[ G = \left( \frac{K_T}{\Delta z} \right) (T_{sfc} - T_{soil}) \]

\[ R_n = H + LE + G \]
Weekly GVF composites updated daily are being generated for use by the NOAA National Weather Service (NWS) National Centers for Environmental Prediction (NCEP). Early sensitivity studies have shown a reduction of errors of temperature, humidity and wind speed forecasts, and an improvement of precipitation scores in Global Forecasting System (GFS) performance, compared to the use of the heritage AVHRR-based climatology.
Surface relative humidity (left) and air temperature (right) GFS model runs for the Western CONUS for June 20 – August 9 2013. Black: observed; red: control run using AVHRR climatology; green: experimental run using VIIRS near-real-time data.
There is a critical need for establishing relationship between VIIRS and heritage AVHRR GVF for the characterization of anomalies.
VIIRS vs. AVHRR GVF

differences need to be understood and characterized to ensure continuity and incremental improvements
Monitoring Drought in California With SNPP VIIRS GVF

- California has been experiencing a severe drought since 2012
- Drought conditions develop gradually and they are often not identifiable immediately
- VIIRS Green Vegetation Fraction (GVF) can easily monitor changes in vegetation density

California mean GVF in August decreased from 32.3% in 2012 to 27.7% in 2015
SNPP VIIRS GVF product
Validation

- GVF product maturity: Provisional
- The SNPP VIIRS GVF pre-operational product was shown to meet the threshold performance attributes identified in the JPSS Level 1 Requirements Supplement
- SNPP VIIRS GVF pre-operational product was validated against Landsat derived GVF, and compared with AVHRR derived GVF
- Time series stability monitoring

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<tr>
<th>Attribute Analyzed</th>
<th>L1RD Threshold</th>
<th>VIIRS GVF</th>
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<tbody>
<tr>
<td>Measurement accuracy</td>
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<tr>
<td>1. Global</td>
<td>12%</td>
<td>7.9%</td>
</tr>
<tr>
<td>2. Regional</td>
<td>12%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Measurement precision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Global</td>
<td>15%</td>
<td>10.9%</td>
</tr>
<tr>
<td>2. Regional</td>
<td>15%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Measurement uncertainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Global</td>
<td>17%</td>
<td>13.4%</td>
</tr>
<tr>
<td>2. Regional</td>
<td>17%</td>
<td>14.2%</td>
</tr>
</tbody>
</table>
Vegetation Health product suite (VCI, TCI & VHI)

- **Current operational: Applications**
  - (a) NOAA-19/AVHRR: 4 km, global (until the sensor deteriorate)
  - (b) S-NPP/VIIRS: 4 km, global

- **Future operational: Development**
  - (a) S-NPP/VIIRS: 1 km, global (2016-2017)
  - (b) JPSS-1 & S-NPP/VIIRS: 0.5 km, global (after 2017)

- **Cal/Val**
  - (a) S-NPP/VIIRS: 4 & 1 km, global – algorithm improvement
  - (b) JPSS-1 & S-NPP/VIIRS validation
  - (c) New indices

- **Development of new products**
  - **Short term**: Vegetation health, Drought features, Moisture condition/stress, Thermal condition/stress, Malaria, Fire risk, Soil saturation, Growing season, Ecosystem productivity;
  - **Long term**: Land cover change, Environmental condition change; Climate warming, Climate forcing, Ocean forcing
Vegetation health (VHI)
VH Applications
http://www.orbit.nesdis.noaa.gov/smcd/emb/vci

APPLICATIONS

(A) Moisture & Thermal stress
(B) Drought area
(C) Intensity of vegetation stress
(D) Fire risk
(E) Drought duration
(F) Drought detection/prediction
APPLICATIONS

Crop/Pasture Production
Malaria:
  Number of affected people
  Affected area
  Intensity
• Surface albedo (SA) EDR consists of land surface albedo (LSA), sea ice surface albedo and ocean surface albedo.
• A direct estimation method (BPSA) is developed to retrieve LSA from VIIRS clear-sky TOA reflectance data.
• The beta release was effective on 6/25/13 and the provisional release of LSA was effective on 4/17/14.
• The maturity of Validated Stage 1 was achieved on 11/28/14.
• Validation results suggest the VIIRS direct estimation approach can generate albedo retrievals with accuracy similar (or superior) to existing products.
• Surface albedo EDR is a full resolution granule instantaneous product. LSA is only generated for clear-sky pixels.
• We propose to develop a new high-level daily gridded LSA product with data gaps filled.
Inter-comparison with MODIS albedo

Contiguous US maps of 16-day mean LSA from VIIRS and MODIS, during DOY 145-160, 2012

Comparing 16-day mean VIIRS albedo from BRDF LUT with MODIS blue-sky albedo. Data are limited to those with at least 8 clear-day observations during the composite period of 16 days.
LST Product Status

- **Provisional Review – May 2014**
- **Validated V1 review – December, 2014**

**Validation summaries** of the LST EDR are shown in Table (right); validated 1 maturity approval in Dec. 2014. Marginally meet the requirement with limited “in-situ” data

**Validation details** of the VIIRS LST comparisons against the SURFRAD station data are shown in the plots (bottom-left) and in the tables (bottom-middle, bottom-right).

<table>
<thead>
<tr>
<th>Attribute Analyzed</th>
<th>L1RD Threshold</th>
<th>Validation Result</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-situ Validation</td>
<td>1.4K (2.5K)</td>
<td>-0.37 (2.35)</td>
<td>Results are based on the VIIRS data over SURFRAD sites for over 2.5 years. The error budget estimation is limited by ground data quality control, cloud filtering procedure and upstream data error.</td>
</tr>
<tr>
<td>R-based Validation</td>
<td>1.4K (2.5K)</td>
<td>0.47 (1.12)</td>
<td>A forward radiative transfer model is used, over 9 regions in globe, representing all 17-IGBP types over the seasons. The error budget estimation is limited by profile quality, cloud screening procedure and sampling procedure.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Season</th>
<th>Samples</th>
<th>Overall</th>
<th>Day</th>
<th>Night</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Bias</td>
<td>STD</td>
<td>Bias</td>
<td>STD</td>
</tr>
<tr>
<td>Spring</td>
<td>1297</td>
<td>-0.54</td>
<td>2.78</td>
<td>-0.69</td>
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<tr>
<td>Summer</td>
<td>1403</td>
<td>-0.1</td>
<td>2.43</td>
<td>-0.87</td>
</tr>
<tr>
<td>Fall</td>
<td>1160</td>
<td>-0.28</td>
<td>1.9</td>
<td>-0.32</td>
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<tr>
<td>Winter</td>
<td>976</td>
<td>-0.65</td>
<td>2.01</td>
<td>-0.83</td>
</tr>
</tbody>
</table>

**IGBP type** | **Samples** | **Overall** | **Day** | **Night** |
<table>
<thead>
<tr>
<th></th>
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<td>Bias</td>
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<tr>
<td>4</td>
<td>18</td>
<td>-1.41</td>
<td>3.01</td>
<td>-1.82</td>
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<td>6</td>
<td>96</td>
<td>-0.98</td>
<td>1.41</td>
<td>-0.5</td>
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<td>7</td>
<td>955</td>
<td>-0.2</td>
<td>1.59</td>
<td>0.24</td>
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<td>8</td>
<td>286</td>
<td>0.19</td>
<td>2.56</td>
<td>-1.7</td>
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<td>10</td>
<td>1048</td>
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<td>1.81</td>
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<td>12</td>
<td>1238</td>
<td>-0.35</td>
<td>2.68</td>
<td>-0.63</td>
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<td>14</td>
<td>857</td>
<td>-0.28</td>
<td>2.54</td>
<td>-1.28</td>
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<td>15*</td>
<td>189</td>
<td>-1.72</td>
<td>4.31</td>
<td>-1.72</td>
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<tr>
<td>16</td>
<td>149</td>
<td>-0.23</td>
<td>1.55</td>
<td>0.87</td>
</tr>
</tbody>
</table>

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Monitoring -- LST images

SEVIRI LST: 2015-03-25  12:30

GOESE daytime LST (ver 2): 20150101

AHI LST2 Date: 20150210 UTC: 1200

VIIRS Global Land Surface Temperature (Daytime)
2015-06-23 UTC

Global Monthly mean diurnal LST range from VIIRS: 201507
Monitoring -- Animation of Time Series

VIIRS Global LST (daytime): 20150701

SEVIRI LST: 2015-07-01 01:30
Distribution of monthly mean LST difference (NAM–VIIRS) between NAM hourly forecast (f00 cycle) and VIIRS LST in March 2012. Left: daytime; right: nighttime.
NOAA Operational Fire product status

• **Current 750m operational product** in IDPS*
  – delivers a list of fire pixels
  – reached **Validated 1 maturity status** with an effectivity date (i.e. IDPS implementation) of **August 13, 2014**.
  – declared NOAA Operational product in September 2014
  – long-term monitoring and maintenance continues

• **Upcoming 750 NOAA operational product** in NDE**
  – the product is developed at UMD and is tailored subset of the NASA science product for real-time NOAA operations
  – global mask of thematic classes including water, cloud, non-fire clear land and fire at three confidence levels
  – fire radiative power for each fire-affected pixel
  – new algorithm elements to improve detection performance

• NOAA operational products are **archived** at NOAA CLASS***

*IDPS: Interface Data Processing Segment; **NDE: Suomi NPP Data Exploitation (NOAA operational ground data production systems)
***Comprehensive Large Array-Data Stewardship System; www.class.noaa.gov
Examples of early IDPS product

Frequent occurrence of spurious scanlines during the first ~10 months of production (Beta)

Examples of the operational real-time IDPS product as archived in NOAA CLASS. Not reprocessed; not to be used for science analysis. Product history demonstration only.
IDPS Suomi NPP Active Fire Product history:
data anomalies and product maturity (2/1)

2012

IDPS Suomi NPP Active Fire Product history:
data anomalies and product maturity (2/1)

N_{\text{max}} \rightarrow \text{Pre-Beta} \rightarrow \text{Beta} \rightarrow \text{Provisional}

2013

N_{\text{max}} \rightarrow \text{Provisional}

N_{\text{max}}: \text{maximum number of detections within a scanline}
IDPS Suomi NPP Active Fire Product history: data anomalies and product maturity (2/2)

2014

N_{max} \quad \text{Provisional} \quad \text{August 13, 2014} \quad \text{IDPS Mx8.5} \quad \text{Validated stage 1}

N_{max} = \text{maximum number of detections within a scanline}

No anomalies detected so far in 2015

2015

N_{max} \quad \text{Validated stage 1} \quad \text{---}

Removed by Mx8.5 SDR fix
VIIRS fire mask generated at NOAA/NESDIS/STAR from IDPS input data. The NOAA Level-2 product is consistent with the corresponding NASA science product.
2012 Global gridded surface type classification map (GST) created using C5.0 decision tree. (shown on top)

2013 and 2014 GST are in production using the Support Vector Machines classification algorithm. (Preliminary results shown on right)

2012 GST has been validated. Reached validated 1 maturity
Daily global surface type, active fire, snow/ice and vegetation fraction maps are composited from the ST-EDR data for the long term monitoring.
CEOS-WGCV Land Product Validation (LPV) Framework

- **JPSS Land cal/val team has adopted the CEOS/WGCV LPV framework & validation stages.**

- **Key JPSS contributions:**
  1. Tower-based reference data (CRN, BSRN-SURFRAD)
  2. Airborne-UAV reference data (MALIBU: Román et al.)
  3. Land Product Characterization System (LPCS: K. Gallo)

- **Participating CEOS member agencies:** NOAA-STAR, NOAA-NCDC, USGS-EROS, NASA-GSFC, ESA-ESRIN.

CEOS/WGCV/LPV subgroup has developed a framework for land product intercomparison and validation based on: (1) a citable protocol, (2) fiducial reference data, and (3) automated subsetting. These components are integrated into an online platform where quantitative tests are run, and standardized intercomparison and validation results are reported.
## Land Product Validation plan comparison

<table>
<thead>
<tr>
<th>Product</th>
<th>Variable</th>
<th>Metric</th>
<th>Correlative data</th>
<th>Reference data</th>
<th>Field Campaigns</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>Surface Reflectance</td>
<td>APU</td>
<td>SNPP, MODIS, Landsat</td>
<td>AERONET, BELMANIP2</td>
<td></td>
<td>6SV radiative transfer code</td>
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<td>APU computation</td>
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<td>VI</td>
<td>TOA NDVI</td>
<td>APU</td>
<td>SNPP, MODIS, Landsat, AVHRR, Sentinel, GCOM SGLI</td>
<td>AERONET, BSRN, PEN, FLUXNET, NEON, SpecNet</td>
<td>ABoVE, NASA’s Tree-Grass project</td>
<td>Monitor VIIRS Data Display</td>
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<td>VIIRS VI Time Series</td>
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<td>VI Cross-Comparison</td>
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<td>Global APU Computation</td>
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<td>VIIRS Matchup Display and Analysis</td>
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<td>VI Phenological Metrics</td>
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<td>Vizualization, monitoring and validation</td>
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<td></td>
<td>TOC NDVI</td>
<td>APU</td>
<td>SNPP, MODIS (+GLASS), Landsat, AVHRR</td>
<td>BSRN, ARM, SURFRAD, GC-Net, FLUXNET</td>
<td>MALIBU (?)</td>
<td>Matchup, QC, statistical analysis, reporting</td>
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<td>LSA</td>
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<td>SURFRAD, BSRN</td>
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<td>Matchup, QC, statistical analysis, reporting</td>
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<td>Probability of detection</td>
<td>SNPP, Aqua MODIS, TET, BIROS</td>
<td>Higher resolution (&lt;30m) imagery</td>
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<td>Sensor collocation / intercomparison</td>
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<td>AF</td>
<td>FRP</td>
<td>APU</td>
<td>SNPP, Aqua MODIS, TET, BIROS</td>
<td>Higher resolution imagery, ground</td>
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<td>ST</td>
<td>Surface type</td>
<td>Confusion matrix</td>
<td>MODIS, SNPP</td>
<td>High resolution imagery</td>
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<td>Subset interpretation interface</td>
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- Ensure consistency of timeline with product precedence, including SDR, cloud mask etc.
- Linkage to CEOS validation protocols, resources and terminology
- Leverage validation tools and resources between JPSS and GOES-R
- Include use of LPVS where applicable
Land Product Characterization System

A web-based system designed to use moderate to high-resolution satellite data for characterization, and assist with validation, of GOES-R ABI and JPSS VIIRS land products.
NOAA Operational Land Product Status

• Evaluation and update of the heritage IDPS algorithms is practically complete
  • Products achieved validated stage 1 as defined by the NOAA JPSS program
  • Only remaining IDPS code change package is aerosol / SR (to implement validated algorithm in operations)
  • Long-term monitoring in place / transitioning to systematic production
• NOAA ESPC (NDE) operational implementation
  • Additional / added-value products
    ➢ Green Vegetation Fraction – fully operational
    ➢ Vegetation Health – transition to operations
    ➢ Active Fire – re-allocated to NDE – transition to operations
    ➢ Snow Fraction – in development
    ➢ Phenology (Risk Reduction) – in development
NOAA Land Operational Product Status

- **NOAA Enterprise Algorithm Development**
  - Common algorithms / ground system implementation options to leverage resources and ensure best algorithm solutions
    - Targets NOAA satellite assets i.e. JPSS and GOES-R
      - Often results in the implementation of GOES-R algorithms to process JPSS data
      - “Risk Reduction” algorithm package transitioning into operations
      - Land products not part of this effort, but assessment is ongoing
  - Use of non-NOAA assets for critical NOAA missions
    - Can be considered as the extension of NOAA Enterprise development
  - New directions and framework for the Science Team’s activities
  - Reactive maintenance and long-term monitoring of operational products
  - Algorithm development towards ESPC implementation of enterprise solutions; testbeds, demonstration products, active user involvement
  - Different review / TTO process / documentation
  - Algorithm deliveries to STAR Algorithm Integration Team (AIT)
Land Products: Moving forward

• JPSS-1 preparation
  • Suite of algorithms include significant improvements
    ➢ TOC NDVI, full fire mask and FRP – implemented for Suomi NPP
    ➢ JPSS-1 test datasets are becoming available
  • JPSS-1 validation plans
    ➢ draft plans delivered; review / feedback ongoing
    ➢ final plans due December 31

• NOAA – NASA ST coordination and collaboration
  • Algorithm development
    ➢ keep algorithms in sync (i.e. SR, Active Fire)
    ➢ seeking common algorithm solutions where possible (i.e. LST)
    ➢ different algorithm solutions where necessary
    ➢ NASA-unique features (SDR, output format etc.) to be addressed
  • Validation
    ➢ leveraging approaches and resources

• JPSS-2 and beyond assessment
VIIRS NOAA Land Data Production

Data from Suomi NPP are being used by NOAA to generate, among other things, a suite of Land products for use in a number of applications, ranging from real-time weather operations to forecast model input and environmental monitoring applications.

Most VIIRS land products are currently being generated in NOAA’s Interface Data Processing System (IDPS), which receives raw instrument data and telemetry from ground stations supporting the Suomi NPP mission. The IDPS converts the Level 0 Raw Data Records (RDRs), generated by sensors on Suomi NPP, into calibrated geolocated Level 1 measurements called Sensor Data Records (SDRs), and then into Level 2+ geophysical parameters or Environmental Data Records (EDRs). In addition to SDRs and EDRs, the IDPS produces Intermediate Products (IPs), which are produced as an interim step in the EDR processing. SDRs, EDRs, and most IPs are stored for long-term archiving and distribution at the NOAA Comprehensive Large Array-Data Stewardship System (CLASS). Note that the standard VIIRS IDPS-generated products (EDRs and IPs) are produced in swath-based format. Thus, only information from a single orbit is used, and available per-pixel information from overlapping swaths is not used.

In addition to IDPS, some NOAA Land Products are generated within the Suomi NPP Data Exploitation (NDE) System (products generated by NDE are also referred to as NOAA Unique Products). The NDE Green Vegetation Fraction product is operational and generates a sliding weekly composite, gridded both globally and regionally, on a daily basis. The NDE system will also be running the continuation of the heritage Vegetation Health product suite using VIIRS data as input. The VIIRS Active Fire algorithm that is compliant with the NOAA JPSS Level 1 requirements is being implemented into NDE.

Below is a table of JPSS accuracy requirements (Threshold and Objective accuracy requirements are as listed in version 2.10 of the JPSS Level 1 Requirements Supplement), and estimated performance is based on NOAA and NASA VIIRS Science Team evaluations. Note that additional specifications that are not listed here typically apply to each product, such as revisit time, coverage, long-term stability and mapping, precision, and uncertainty. Further, each product has an associated set of exclusion conditions (e.g., high solar zenith angles) for which the specifications are relaxed.
Land: user involvement and added value products

• Close linkages between code cal/val and risk reduction activities
  • Risk reduction is also a platform for further algorithm changes
• Close collaboration with critical NOAA users
  • NOAA NCEP and other modeling groups – data assimilation
  • National Ice Center, Hazard Mapping System, CPC etc.
• Key Proving Ground Initiatives
  • e.g. Fire and Smoke, Land Data Assimilation
  • Joint Center for Satellite Data Assimilation as testbed
• Direct Broadcast CSPP and IPOP and algorithm updates
• Development of new / level-3 and beyond products
  • GVF in operation
  • Gridded/composited LST, albedo etc.; LAI/fPAR
• Reprocessing
  • ongoing for select VIIRS bands / products (i.e. ocean)
  • planning / implementation for additional SDR and products
COMING UP THIS THURSDAY:

- Land / Cryosphere Breakout Session 7c: Conference Room A 8:30 - COB

- Land-related posters: Thursday during lunch break
Land / Cryosphere Breakout Agenda (am)

Product overviews

- 8:45 Surface reflectance – Belen Franch
- 9:00 Vegetation index EDR and NDE Green Vegetation Fraction – Marco Vargas
- 9:15 Vegetation Health – Felix Kogan
- 9:30 Land surface albedo – Bob Yu
- 9:45 Land surface temperature – Bob Yu
- 10:00 Active fire – Ivan Csizsar

10:15 Break

- 10:30 Surface type – Jerry Zhan
- 10:45 Sea ice characterization and thickness – Jeff Key
- 11:00 Sea ice concentration – Yinghui Liu
- 11:15 Sea ice surface temperature – Mark Tschudi
- 11:30 Binary snow cover – Peter Romanov
- 11:45 Snow fraction - Peter Romanov and Igor Appel
- 12:00 NASA SIPS Land Production and QA – Sadashiva Devadiga / Miguel Román

12:15 Lunch break
Land / Cryosphere Breakout Agenda (pm)

**Product validation and long-term monitoring**
- 1:00 Validation datasets and interagency / international coordination - Miguel Román
- 1:30 JPSS 1 land validation plan overview – Ivan Csiszar
- 1:45 GOES-R land validation activities and coordination with JPSS – Bob Yu
- 2:00 Land product characterization system – Kevin Gallo
- 2:15 Land long-term monitoring system – Lori Brown / Tony Reale

**NOAA Enterprise system**
- 2:30 Land / cryosphere enterprise product assessment – Ivan Csizsar / Jeff Key
- 2:45 Non-NOAA data sources for operational land / cryosphere applications: mission status, data access and plans Marco Vargas / Bob Yu / Jeff Key / Ivan Csizsar

3:00 Break

**NOAA operational applications of JPSS land and cryosphere products**
- 3:15 NCEP – Mike Ek
- 3:30 National Ice Center – Sean Helfrich

**Open discussion and wrap-up**
- 3:45 - 5:00 Overarching topics such as re-processing, gridding, CLASS RIP archives, Direct Broadcast, summary and action items