JPSS Validation System

Robert Holz, Andy Heidinger Fred Nagle, Greg Quinn, Min Oo, and Ralph Kuehn

May 14th 2014
Outline

• An overview the processing and validation tools
• Products and data access (Atmospheric PEATE)
• Developing a near realtime monitoring system for cloud products
Ingested Products at UW SSEC

Ingested Products

- VIIRS RDR, SDR, and EDR (Clouds and Aerosols)
- MODIS Terra and Aqua L1a, L1b, MYD04 (aerosol), MYD06 (Cloud)
- AVHRR L1B
- ATMS RDR and SDR
- CALIPSO V3 L1b, L2 products (aerosol), and IIR
- CloudSat L1 and L2 products
- CrIS SDR and EDR
- Metop-A (IASI) and Metop-B (IASI)
Collocation and Evaluation

CALIPSO — VIIRS FOV
## Collocation and Evaluation

### PEATE multi-satellite sensors collocation

<table>
<thead>
<tr>
<th>Master</th>
<th>AVHRR</th>
<th>CALIOP</th>
<th>CLOUDSAT</th>
<th>GOES</th>
<th>MODIS</th>
<th>POLDER</th>
<th>SEVIRI</th>
<th>VIIRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIRS</td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
<td></td>
<td>⚫</td>
<td>⚫</td>
</tr>
<tr>
<td>AMSR-E</td>
<td>⚫</td>
<td></td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
</tr>
<tr>
<td>CLOUDSAT</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td>⚫</td>
</tr>
<tr>
<td>CrIS</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
</tr>
<tr>
<td>COMS</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td></td>
<td>⚫</td>
</tr>
<tr>
<td>GOES</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIRS</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IASI</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td></td>
<td>⚫</td>
<td></td>
</tr>
<tr>
<td>MODIS</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
</tr>
<tr>
<td>SEVIRI</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td>⚫</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIIRS</td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
<td>⚫</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Flo Processing System

- Leverages UW Atmospheric PEATE processing system
- Supports forward stream and archival processing
- Geographical and multi-sensor processing via integrated orbital prediction
- An extensible catalog of scientific algorithms; algorithms specify sensor and ancillary input requirements; Flo chains algorithms together as needed to reach output products
- Provides the capability to processes the collocation and algorithms that require multiple instruments platforms (ie VIIRS and CrIS)
Collocation and Evaluation

Aqua/CALIPSO Intersections with NPP

May 1 - Aug 11 2012 Observations within 20 min
Collocation and Evaluation

Match Files Generation

- CALIPSO_Feature_Classification_Flag_Place_Fraction_5km: [2704x3 double]
- CALIPSO_Feature_Classification_Flag_Place_QA_5km: [2704x1 double]
- CALIPSO_IR_Derived_Cloud_Height_5km: [2704x1 double]
- Column_Optical_Depth_Aerosols_532: [2704x1 double]
- Column_Optical_Depth_Aerosols_Uncertainty_532: [2704x1 double]
- CALIPSO_Pressure: [33x2704 double]
- Master_Vertical_Index: [2704x1 double]
- Master_Horizontal_Index: [2704x1 double]
- Slave_Index: [2704x3 double]
- Parallax_Table: [677x32 double]
- CALIOP_GDAS_Pressure: [2704x33 double]
- CALIOP_GDAS_Altitude: [33x1 double]

- IFF_L1b_BrightnessTemperatureBandCenters: [11x1 double]
- IFF_L1b_BrightnessTemperatureBands: [2704x11 double]
- IFF_L1b_EmissiveBandCenters: [11x1 double]
- IFF_L1b_EmissiveBands: [2704x11 double]
- IFF_L1b_LandSeaMask: [2704x1 double]
- IFF_L1b_Latitude: [2704x1 double]
- IFF_L1b_Longitude: [2704x1 double]

- IFF_L1b_ReflectiveBandCenters: [11x1 double]
- IFF_L1b_ReflectiveSolarBands: [2704x11 double]
- IFF_CLX_Cloud_Mask: [2704x1 double]
- IFF_CLX_surface_type: [2704x1 double]
- IFF_CLX_cloud_phase: [2704x1 double]
- IFF_CLX_cld_press_acha: [2704x1 double]
- IFF_CLX_cld_temp_acha: [2704x1 double]
- IFF_CLX_cld_height_acha: [2704x1 double]
- IFF_CLX_cld_height_top_acha: [2704x1 double]
- IFF_CLX_cld_height_base_acha: [2704x1 double]
# Collocation and Evaluation

## Current available multi-satellite sensors

<table>
<thead>
<tr>
<th></th>
<th>Geo-stationary satellites sensors</th>
<th>Polar-orbiting satellites sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEVIRI</strong></td>
<td>✔ ✔</td>
<td>✔ ✔</td>
</tr>
<tr>
<td><strong>COMS</strong></td>
<td>✔ ✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>VIIRS</strong></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td><strong>CALIOP</strong></td>
<td>✔ ✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>MODIS (Aqua)</strong></td>
<td>✔ ✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

- ✔ Aerosol Products
- ✔ Cloud Products
Cloud Height Validation

NDE Applied to VIIRS

**Normalized Frequency**

- All Clouds
- Night Ice
- Day Ice
- Night Water
- Day Water

### IDPS IP

#### VIIRS(IP) – CALIOP Cloud Top Height Difference

- All Clouds
- Night Ice
- Day Ice
- Night Water
- Day Water

<table>
<thead>
<tr>
<th>COT</th>
<th>Accuracy (mean km)</th>
<th>% in spec</th>
<th>Precision (STD) (km)</th>
<th>% in spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.0</td>
<td>12 %</td>
<td>63 %</td>
<td>43 %</td>
<td>49 %</td>
</tr>
<tr>
<td>&gt;1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 3 Months of data
- IDPS has significant low bias
Cloud Cloud Optical Thickness

- Number of sample = 234 mills
- Both Ice and water cloud
- Color bar shows number density in log scale (example: 3 = 1,000)
Aerosol AOD Validation Against MODIS

IDPS EDR Land

2013 Feb–Mar Aqua MODIS vs VIIRS AOT (# of sample = 179127)

Accuracy = −0.051199
Precision = 0.1544
Corrcoef = 0.85031
Uncertainty = 0.16266

Number Density in log scale (eg. 3 = 1,000)

IDPS EDR Ocean

Dec 2012 to Mar 2013 Aqua MODIS vs VIIRS AOT
Number of sample = 234543

Accuracy = −0.0074981
Precision = 0.043267
Corrcoef = 0.93537
Uncertainty = 0.043912

Number Density in log scale (eg. 3 = 1,000)
JPSS Cloud Validation Interface
JPSS Cloud Validation Interface
JPSS Cloud Validation Interface
JPSS Cloud Validation Interface
Near Real Time Processing

- 97% of VIIRS RDR files are created at 118 minutes after observation.
- PEATE could ingest VIIRS RDR files within 5 minutes after creation on the IDPS.
- Process RDR - IP or EDR within 10 min after being ingested.

VIIRS RDR 130 minutes (min)

VIIRS RDR Latency Between IDPS and PEATE

- 97% of VIIRS RDR files are created at 118 minutes after observation.
- PEATE could ingest VIIRS RDR files within 5 minutes after creation on the IDPS.
- Process RDR - IP or EDR within 10 min after being ingested.

VIIRS RDR 130 minutes (min)
Take away messages

- UW SSEC is actively supporting the JPSS cloud and aerosol validation
- Leveraging our processing and collocation expertise has allowed long term inter-comparisons of the JPSS products to active (CALIOP) and passive (MODIS) observations
- We are currently developing a near realtime validation interface which will provide monitoring the of the JPSS products
- The system will also have the capability to reprocess selected products (NDE Clouds and ADL Aerosols) for evaluating algorithm changes