Current Status of Cloud Properties from VIIRS on JPSS on CERES

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Background

- The Clouds and the Earth's Radiant Energy System (CERES) generates a radiation and cloud climate data record extending from 2000 – present
  - requires a consistent, accurate set of measurements and analyses
- Radiation component is based on measurements from nearly identical broadband radiometers on Terra, Aqua, NPP, and JPSS-1 (N20 after launch)
- Cloud component relies on MODIS on Terra & Aqua, VIIRS on NPP & JPSS
- Assuming Aqua fails in the near future, NPP and JPSS-1 must be consistent so that changes in time series are not due to satellite changes
- Eventually, NPP, JPSS-1, Aqua, and Terra must produce consistent results

Data

- Conditions for matching pixels between VIIRS on N20 & NPP
  - Time = 1 hour
  - Solar zenith & view zenith angles <= 50°
  - Azimuth angles <= 7.5°
  - average in 5 minute grid box
- Data used for N20 & NPP
  - VIIRS September 2018

Preliminary Calibration on N20 VIIRS

<table>
<thead>
<tr>
<th>Reflection</th>
<th>Brightness Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.64 µm</td>
<td>decrease 3.8%</td>
</tr>
<tr>
<td>1.24 µm</td>
<td>increase 8%</td>
</tr>
<tr>
<td>1.61 µm</td>
<td>increase 15%</td>
</tr>
<tr>
<td>1.378 µm</td>
<td>no change</td>
</tr>
</tbody>
</table>

Cloud Property Comparisons between VIIRS on N20 & NPP

- N20 thermal channels (brightness temperatures) are quite consistent with NPP
- N20 solar channels (reflectance): 0.64 µm ~3.8% higher, 1.6 µm ~15% lower, 1.24 µm ~21% lower, 1.24 µm ~8% lower

N20 COD Ice ~ 20% larger

- Cloud Effective Radius
  - 1.6 µm retrieval: N20 Ice ~ 1.5 µm smaller, water ~ 1.3 µm smaller
  - Need to wait for longer & more stable N20 data to derive final calibration

Summary

- N20 solar channels (reflectance):
  - 0.64 µm ~3.8% higher, 1.6 µm ~15% lower, 1.24 µm ~21% lower, 1.24 µm ~8% lower
  - N20 thermal channels (brightness temperatures) are quite consistent with NPP
- With preliminary calibration (by CERES team),
  a) Cloud Fraction, Phase, Effective Height & Effective Radius (3.7 µm retrieval) almost identical (within ~ 0.3%)
  b) Cloud Optical Depth:
    - N20 ~20% larger for ice & 9% larger for water
  a) Cloud Effective Radius
    - 1.6 µm retrieval: N20 Ice ~ 1.5 µm smaller, water ~ 1.3 µm smaller
    - 1.24 µm retrieval: N20 ice ~ 2 µm smaller, water very consistent
- Need to wait for longer & more stable N20 data to derive final calibration
  - so far, only 7 months of N20 VIIRS, May – November 2018

Future Plans

- N20 Solar Channels’ Calibrations
  - account for spectral differences
  - use more months of data to determine trends
- Finalize N20 cloud algorithms
  - begin processing of CERES N20 Edition 1 and NPP Ed2 clouds
  - feed into CERES N20 radiation budget analyses
  - begin validations of N20 VIIRS products
  - release N20 Ed1 SSF product
- Examine other properties: Multilayer clouds & ice and liquid water path
- Develop VIIRS compatible code for MODIS
  - will enable a nearly seamless record from 2000/2002 (Terra/Aqua)