Evaluation of IDPS Cloud Mask for Ocean Color EDR

Menghua Wang, Bob Arnone
Ocean Color Team
IDPS OCC EDR Cloud Related Flags

• Inherited from VIIRS-CM-IP, all in quality flag 5 (QF5_VIIRSOCCEDR)
  (1) Cloud confidence indicator (bit 0~1)
    • Confidently cloudy (11)
    • Probably cloudy (10)
    • Probably clear (01)
    • Confidently clear (00)
  (2) Adjacent pixel is not confidently clear (bit 2)
  (3) Thin cirrus cloud detected (bit 3)
  (4) Cloud shadow detected (bit 4)
  (5) Non-cloud obstruction, thick aerosol (bit 5)
• May consider: QF7_VIIRSOCCEDR, inherited from VIIRS Bright Pixel IP: Bright Target Flag (bit 5)
• IDPS VIIRS OCC EDR only masks all pixels as “confidently cloud”, and leaves the options of masking other flags to users. The pixels contaminated by cloud stray-light will likely be flagged as bright targets due to their higher-than-normal TOA reflectance.
NOAA-MSL12/NASA-L2GEN Cloud Mask (CM)

- Based on Rayleigh-corrected reflectance at the NIR band M7 (862 nm)
- Results from NOAA-MSL12 CM agrees with NASA-L2GEN CM (~95%)
- Straylight flag can be used in NASA-L2GEN.
- Straylight flag and cloud flag is mutually exclusive (i.e., straylight flag only applies to non-cloudy pixels)
Example of the VCM and Ocean Color Product

Standard Cloud uses a threshold of the 862 channel.

VCM – Flag
0 – Confidently clear
1- Probably clear
2- Probably cloudy
3 – Confidently cloudy
Cloud Flag Comparisons – NRL vs. IDPS EDR’s (Continued)
Gulf of Mexico – April 20, 2012

<table>
<thead>
<tr>
<th>Cloud Flag</th>
<th>Threshold</th>
<th>IDPS Cloud Flag3 (Cloudy)</th>
<th>IDPS Cloud Flag2 (Prob Cloudy)</th>
<th>IDPS Cloud Flag2&amp;3 (Prob/Cloudy)</th>
<th>IDPS Cloud Flag1 (ProbClear)</th>
<th>IDPS Cloud Flag0 (Clear)</th>
</tr>
</thead>
<tbody>
<tr>
<td>862</td>
<td></td>
<td>56% Flagged (Ocean Only)</td>
<td>25% Flagged (Ocean Only)</td>
<td>12% Flagged (Ocean Only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37%</td>
<td></td>
<td>37% Flagged (Ocean Only)</td>
<td>21% Flagged (Ocean Only)</td>
<td>42% Flagged (Ocean Only)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Initially IDPS (ProbCloudy & Cloudy) and nL2gen Cloud Flags agree very well!

Cloud Flag Comparisons – nL2gen vs. IDPS EDR’s

Gulf of Mexico – April 20, 2012

NRL Chlorophyll w/ Cloud, Glint, AtmFail, HiLt flags IDPS w Cloud Flags (Clear, ProbClear, ProbCloud, Cloud)
Comparison of Threshold Cloud mask

And

VCM Cloudy and Probably Cloudy

Best.
Global Daily Chlorophyll-a 10/31/2012

NOAA-MSL12 (CM only)  IDPS (confidently/probably cloudy)
Quantitative Case Study

10/28/2012 17:49 UTC, east off Florida

10/31/2012 15:10 UTC, North Atlantic
## NOAA-MSL12 CM vs. IDPS CM (Case 1)

### Table 1. MSL12 and IDPS Cloud Mask/Flag Comparisons

<table>
<thead>
<tr>
<th>IDPS flag used as mask</th>
<th>Either One (MSL12 + IDPS)</th>
<th>Both Two (MSL12 &amp; IDPS)</th>
<th>MSL12 only</th>
<th>IDPS only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidently Cloudy</td>
<td>1,927,333</td>
<td>1,466,370 (76.1%)</td>
<td>460,937 (23.9%)</td>
<td>26 (0.0%)</td>
</tr>
<tr>
<td>Cloudy (+Prob. Cloudy)</td>
<td>1,940,421</td>
<td>1,525,310 (78.6%)</td>
<td>401,997 (20.7%)</td>
<td>13,114 (0.7%)</td>
</tr>
<tr>
<td>Cloudy + Cloud Shadow</td>
<td>1,979,923</td>
<td>1,658,155 (83.7%)</td>
<td>269,152 (13.6%)</td>
<td>52,616 (2.7%)</td>
</tr>
<tr>
<td>Above + Adjacent to Cloudy</td>
<td>2,007,781</td>
<td>1,717,075 (85.5%)</td>
<td>210,232 (10.5%)</td>
<td>80,474 (4.0%)</td>
</tr>
</tbody>
</table>

Confidently cloudy + Probably cloudy + Cloud shadow + Adjacent pixel not confidently clear
NOAA-MSL12 CM vs. IDPS CM (Case 2)

Table 2. MSL12 and IDPS Cloud Mask/Flag Comparisons

<table>
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<tr>
<th>IDPS flag used as mask</th>
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<th>IDPS only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidently Cloudy</td>
<td>1,449,910</td>
<td>770,632 (53.1%)</td>
<td>679,051 (46.8%)</td>
<td>227 (0.0%)</td>
</tr>
<tr>
<td>Cloudy (+ Prob. Cloudy)</td>
<td>1,491,475</td>
<td>911,023 (61.1%)</td>
<td>538,660 (36.1%)</td>
<td>41,792 (2.8%)</td>
</tr>
<tr>
<td>Cloudy + Cloud Shadow</td>
<td>1,649,787</td>
<td>1,149,302 (69.7%)</td>
<td>300,381 (18.2%)</td>
<td>200,104 (12.1%)</td>
</tr>
<tr>
<td>Above + Adjacent to Cloudy</td>
<td>1,847,479</td>
<td>1,306,438 (70.7%)</td>
<td>143,245 (7.8%)</td>
<td>397,796 (21.5%)</td>
</tr>
</tbody>
</table>

Confidently cloudy + Probably cloudy + Cloud shadow + Adjacent pixel not confidently clear
Confidently Cloudy

nLw(412)
Cloudy (Confident + Probable)

nLw(412)
Cloudy + Cloud Shadow

nLw(412)
Cloudy + Shadow + Adjacent pixel not confidently clear

nLw(412)
Cloudy + Shadow + Adjacent + Bright Pixel
Cloudy + Shadow + Bright Pixel

nLw(412)
Conclusion

• Overall, the quality of CM seems OK for VIIRS OCC EDR data processing.

• Since all data are retrieved in IDPS, except for “confidently cloudy” pixels, users can choose which flag(s) to apply for their purposes.

• However, it is important to understand the performance of each individual flag and when/how to apply it.

• Significant efforts are required to assess the performance of each individual flag and how to properly use it.
Thank You!