Why is the VIIRS Nighttime Microphysics RGB Important?

The RGB identifies a variety of cloud types throughout the atmosphere at a high spatial resolution of 750-m. The RGB incorporates the 10.8µm – 3.7µm channel difference to discriminate between water and ice clouds. Within the red spectra of the RGB, a 12.0µm - 10.8µm channel difference is employed to indicate cloud thickness. The multispectral RGB composite can also be utilized to identify other cloud types that are observed in the middle and upper parts of the atmosphere.

VIIRS Nighttime Microphysics RGB Recipe

<table>
<thead>
<tr>
<th>Color</th>
<th>Band (µm)</th>
<th>Min – Max</th>
<th>Physically Relates to...</th>
<th>Small contribution to pixel indicates...</th>
<th>Large Contribution to pixel indicates...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>(M16) 12.0 - (M15) 10.8</td>
<td>-6.7 – 2.6 ° C</td>
<td>Optical depth, temperature, clouds</td>
<td>Thin clouds</td>
<td>Thick Clouds</td>
</tr>
<tr>
<td>Green</td>
<td>(M15) 10.8 - (M12) 3.7</td>
<td>-3.1 – 5.2 ° C</td>
<td>Particle size and phase</td>
<td>Ice particles</td>
<td>Water clouds with small particles</td>
</tr>
<tr>
<td>Blue</td>
<td>(M15) 10.8</td>
<td>-29.6 – 19.5 ° C</td>
<td>Surface temperatures</td>
<td>Cold surface</td>
<td>Warm Surface</td>
</tr>
</tbody>
</table>

Impact on Operations

**Primary Application**

Fog & Low Clouds: With warm surface temperatures, low clouds and fog appear aqua (stronger blue contribution), while in areas with cooler surface temperatures they appear more yellow/gray (less contribution in the blue component). Note, fog tends to be less bright or near gray coloring compared to low clouds.

Efficient Cloud Analysis: The multi-channel approach of the RGB allows for discrimination of cloud types across the imagery.

Additional Applications: Determining cloud phase and relative cloud height, moisture boundaries, dust and temperature inversions and the identification of fire hotspots.

Limitations

**Nighttime Only:** The 3.7 µm is affected by solar reflectance during the daytime which impacts the 10.8 - 3.7 µm brightness temperature difference.

**Variable land surface colors:** In cloud free regions, surfaces will vary in color and depend on air temperature, surface type and moisture characteristics.

**Anomalous noise in the Infrared:** In very cold clouds (i.e., < -30°C), speckled yellow pixels may appear.

**Timeliness:** VIIRS overpasses over CONUS are observed at least once per night, per satellite, typically between ~05Z to 12Z. VIIRS coverage is more frequent in northern latitudes, like Alaska, with 2-4 passes per night for each satellite.

**Thin Fog:** thin fog is semi-transparent which allows surface emissions to impact pixel color, resulting in a less blue color compared to low clouds.

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http://cira.colostate.edu/
Fog events over Alaska (images on left) and over the northeast U.S. (images on right) are captured by JPSS VIIRS and GOES ABI Nighttime Microphysics RGBs. White box insets highlight the fog and low clouds from both satellites. The GOES RGB imagery exhibits a coarser spatial resolution (2-km) compared to VIIRS (750-m), where the GOES pixel size increases significantly over the high latitudes (e.g., see Alaska example). Note, with warm surface temperatures, low clouds and fog appear aqua, while in areas with cooler surface temperatures they appear more yellow/gray.

Fire Detection: The RGB can observe fires at night as the green spectra of the RGB employs a brightness temperature difference that includes the 3.7µm. The RGB and the 3.7µm detect fire hotspots from the Smokehouse Creek Fire (see below). White pixels in the 3.7µm, and corresponding dark pink pixels in the RGB depict the fires in the imagery.

Resources
Satellite Liaison Blog
Viewing VIIRS Imagery over CONUS
CIRA SLIDER - JPSS Sectors
Northern Hemisphere, Southern Hemisphere, and CONUS.
GOES Nighttime Microphysics RGB
Quick Guide & Quick Brief
GINA
Near-Real-Time Data Online

Hyperlinks not available when viewing material in AIR Tool