Suomi-NPP VIIRS Imagery: High-resolution Views of Thunderstorms and Tropical Cyclones

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2. Introduction

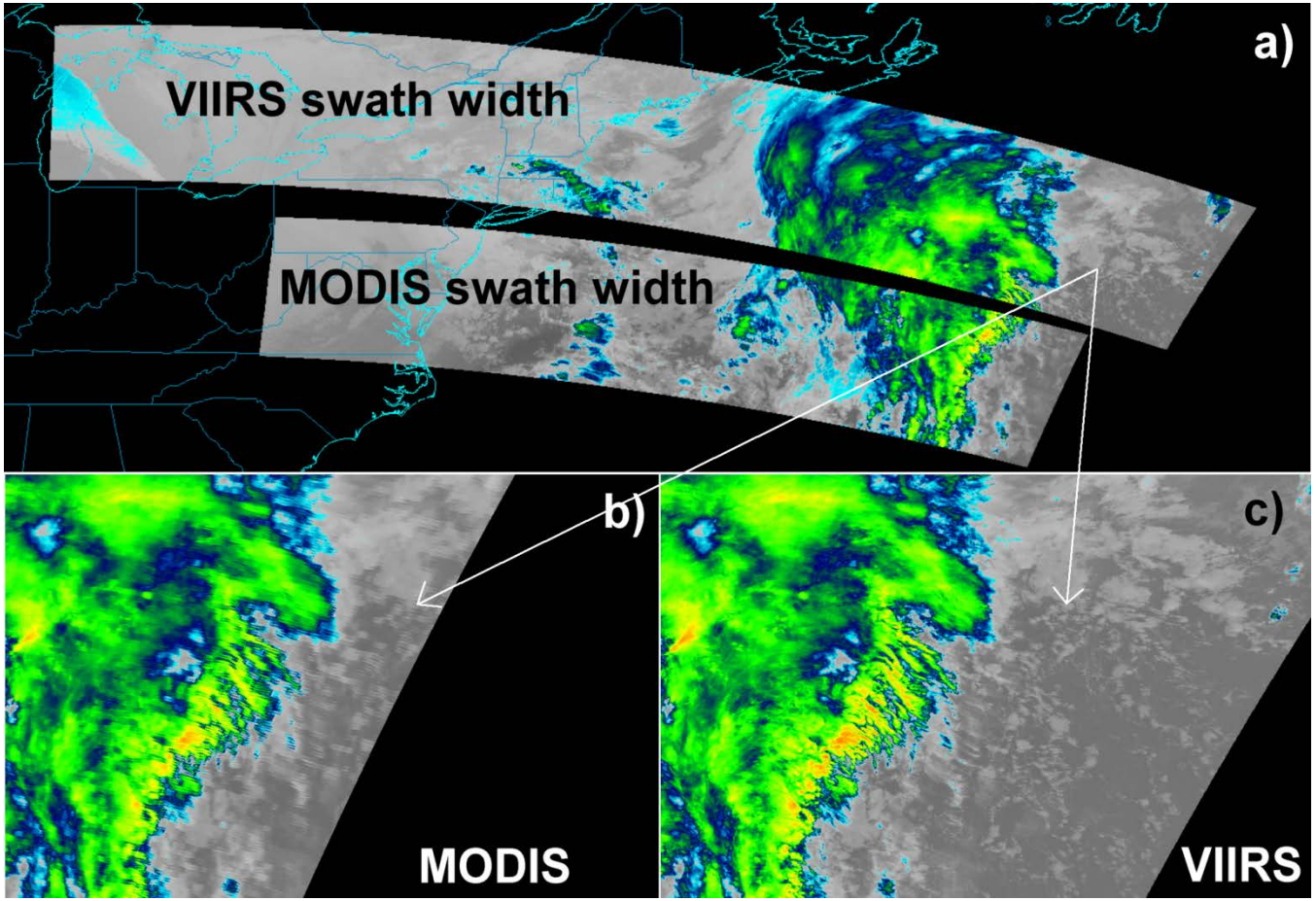
- The VIIRS Imagery and Visualization Team members at CIRA/Colorado State University are involved in verifying the high quality of VIIRS imagery and promoting the many uses of VIIRS imagery products

- VIIRS has 5 high-resolution imagery bands, 16 moderate resolution bands and the Day/Night Band (ranging from 0.41 μm to 12.0 μm)

- Band I-5 (11.45 μm) is the highest-resolution IR-window channel in space (~375 m at nadir) and provides new detail of the structures at the top of thunderstorms and tropical cyclones

- The Day/Night Band (~742 m resolution) produces high quality images of storms at night under moonlit conditions and can also observe lightning

3. VIIRS vs. MODIS

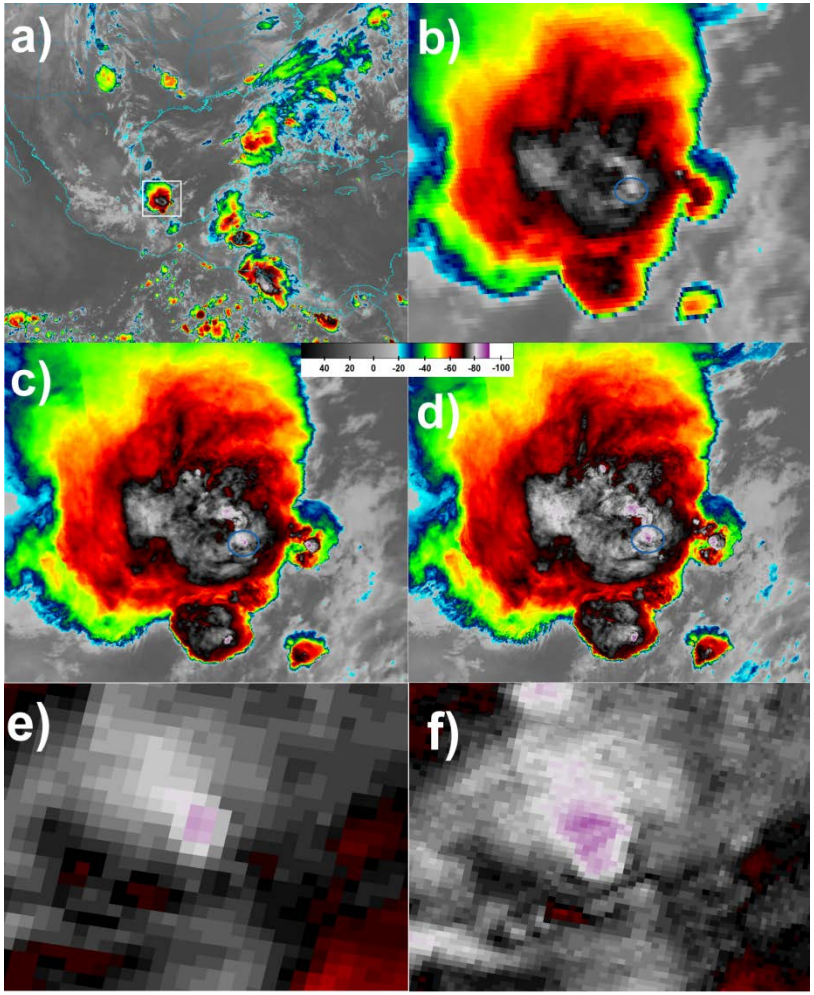


- A) VIIRS has a wider swath width (no data gaps near Equator)
- B) and C) VIIRS maintains resolution out to swath edge, where MODIS resolution degrades

4. VIIRS/MODIS/GOES comparison

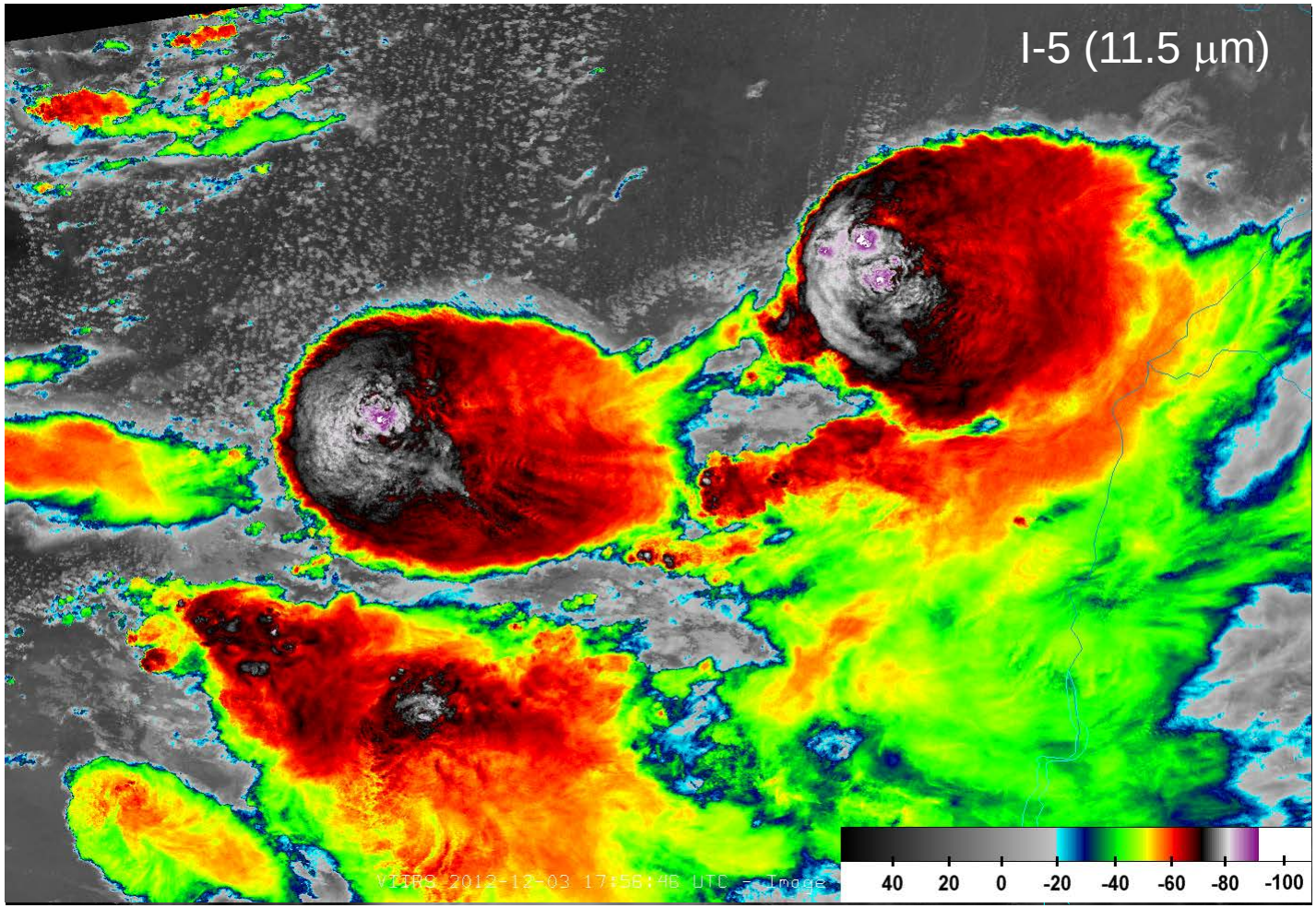
- A) GOES-13 10.7 um image of thunderstorms over the Gulf of Mexico (0815 UTC 6 June 2012)
- B) GOES-13 zoomed in on the box highlighted in A (4 km resolution).
- C) Aqua MODIS Band 31 image (0817 UTC 6 June 2012) zoomed in on box highlighted in A.
- D) VIIRS Band I-5 image (0817 UTC 6 June 2012) zoomed in on box highlighted in A.
- E) MODIS zoomed in on oval highlighted in C and D (~1 km resolution).
- F) VIIRS zoomed in on oval highlighted in C and D (~375 m resolution).

- Highest resolution IR window channel in space (VIIRS I-5) produces greater detail of thunderstorm cloud tops and detects colder overshooting tops



Brightness temperature of coldest pixel in scene:
GOES: -79.7 ºC MODIS: -86.9 ºC VIIRS: -90.6 ºC

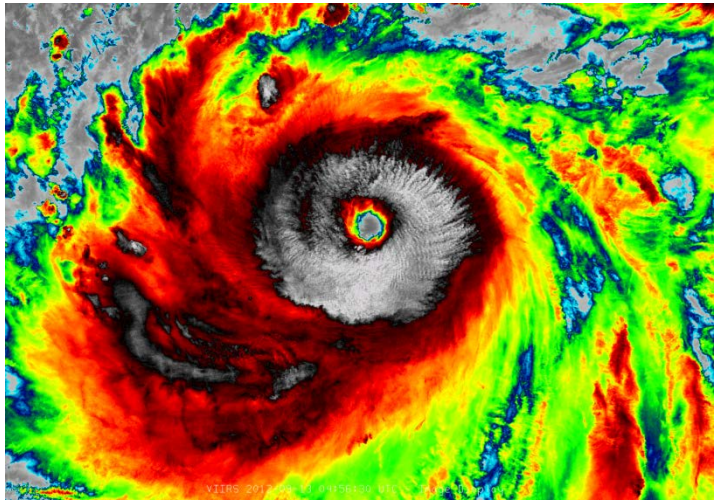
5. Thunderstorms over Argentina



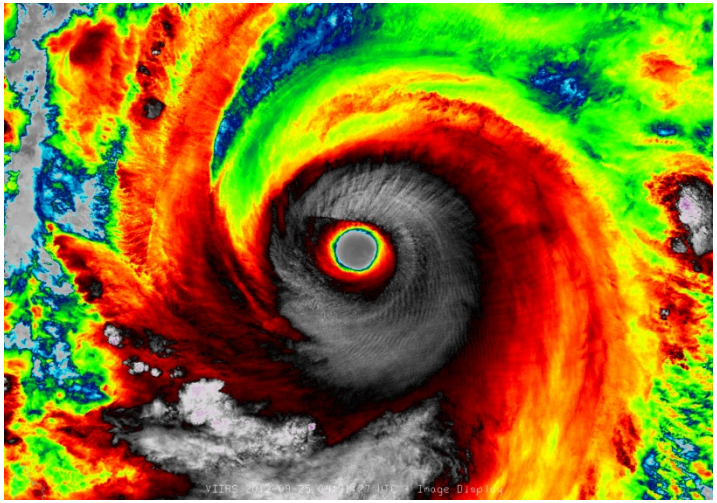
17:56 UTC 3 December 2012

Overshooting tops colder than -90 ^{o}C!

6. Tropical Cyclones

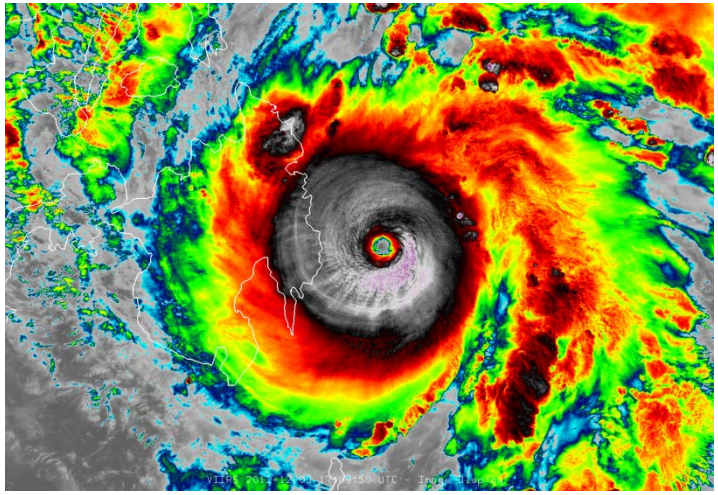


Typhoon Samba 04:56 UTC 13 September 2012

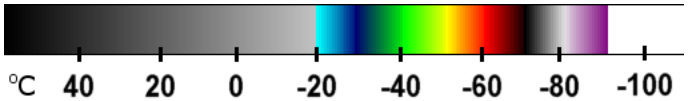


Typhoon Jelawat 04:31 UTC 25 September 2012

- VIIRS Band I-5 images of three tropical cyclones over the western Pacific
- Notice the radial waves, never before seen with this detail in IR imagery
- Notice also the warming of cloud top temperatures at the edge of the eye, which is related to the slope of the eye wall

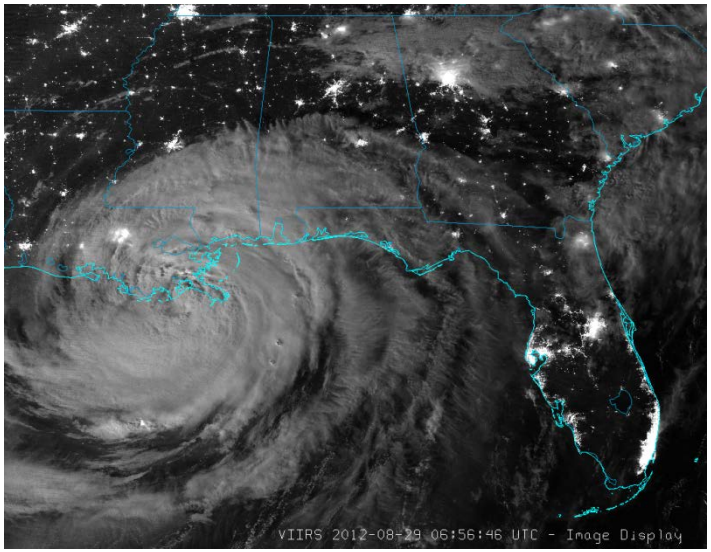


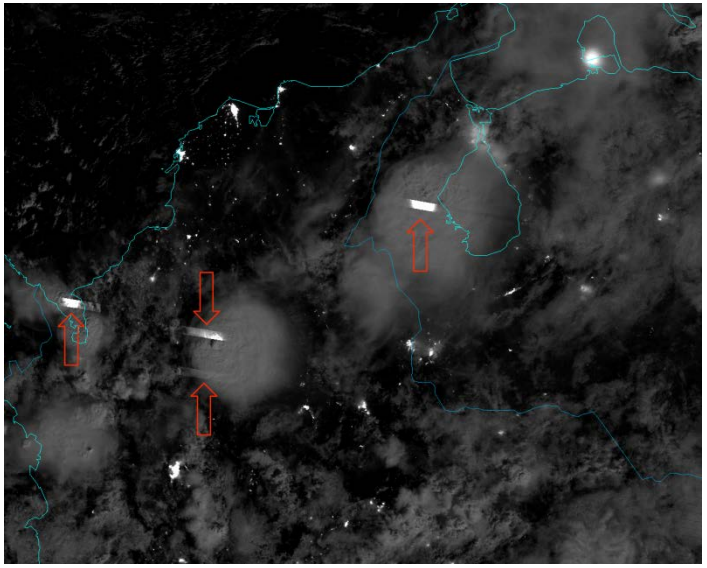
Typhoon Bopha 17:09 UTC 3 December 2012



7. Visible Imagery of Storms at Night

- The Day/Night Band allows forecasters to see visible imagery of storms at night (when the moon is up)
- Sensitive enough to detect shadows cast by the moonlight
- Upper image is of Hurricane Isaac near landfall over Louisiana (06:56 UTC 29 August 2012)
- Lower image is of thunderstorms over Colombia and Venezuela (06:44 UTC 10 May 2012)
- Red arrows at right point to lightning strikes, which the Day/Night Band sees as broad streaks





8. Possible Path to Operations

- The primary source of VIIRS data has a latency of 6-8 hours, limiting the usefulness of these observations in operations
  - The University of Wisconsin Direct Broadcast feed receives VIIRS data over CONUS directly from the satellite and produces the data files in ~90 minutes
  - Solving latency issues is necessary before VIIRS data significantly impacts operations

- CIRA has recently added selected VIIRS imagery to RAMSDIS Online, available for public viewing: http://rammb.cira.colostate.edu/ramsdis/online/npp_viirs.asp

- High-resolution IR observations of thunderstorms and tropical cyclones may lead to improved understanding of storm dynamics, which would ultimately benefit operations

- Nighttime visible imagery from the Day/Night Band aids in the forecasting of tropical cyclones, where latency is less of an issue

9. Future Plans

- The JPSS Imagery and Visualization Team at CIRA will continue to checkout VIIRS data as maturity level is upgraded from Beta to Provisional to Validated/Calibrated

- Continue to promote VIIRS imagery and its applications

- Investigate the benefits of VIIRS imagery that will apply to GOES-R

10. Publication List

- Journal article in press:
  - Hillger et al. (2013), First-Light Imagery From Suomi NPP VIIRS, *BAMS*, in press

- JPSS Imagery and Visualization Team blog (with additional examples)
  - http://rammb.cira.colostate.edu/projects/npp/blog/

- JPSS Imagery and Visualization Team website:
  - http://rammb.cira.colostate.edu/projects/npp/