



First Images and Products from VIIRS on NPP

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VIIRS EDR Imagery Team

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- CIMSS/SSEC (T. Achtor, T. Jasmin, T. Rink)
- Aerospace (T. Kopp, J. Drake, J. Feeley)
- NOAA/NGDC (C. Elvidge)
- AFWA (J. Cetola)
- NIC (P. Clemente-Colon)
- Northrop Grumman (K. Hutchison, R. Mahoney)
- NASA (W. Thomas, P. Meade)
- NOAA/OSPO (A. Irving)
- NASA/SPoRT (G. Jedlovec, M. Smith)



NPP



- **NPOESS Preparatory Project (NPP)** satellite
 - Formerly part of NPOESS program
 - Now the first JPSS satellite
- Joint **NASA/NOAA** mission, but NPP data will be used by many civilian and military customers
- **Visible Infrared Imager Radiometer Suite (VIIRS)**
 - just one of several instruments on NPP

NPP Timeline

- **Launch: 2011-10-28**
- **VIIRS visible/reflective band doors open: 2011-11-21**
- **Day Night Band (DNB) started at the same time.**
- **VIIRS thermal/IR band doors open: 2012-01-18**

VIIRS Imagery EDRs

VIIRS Band	Central Wavelength (μm)	Wavelength Range (μm)	Band Explanation	Spatial Resolution (m) @ nadir
M1	0.412	0.402 - 0.422	Visible	750 m
M2	0.445	0.436 - 0.454		
M3 (blue)	0.488	0.478 - 0.488		
M4 (green)	0.555	0.545 - 0.565		
M5 (red)	0.672	0.662 - 0.682		
M6	0.746	0.739 - 0.754	Near IR	
M7	0.865	0.846 - 0.885		
M8	1.240	1.23 - 1.25	Shortwave IR	
M9	1.378	1.371 - 1.386		
M10	1.61	1.58 - 1.64		
M11	2.25	2.23 - 2.28		
M12	3.7	3.61 - 3.79	Medium-wave IR	
M13	4.05	3.97 - 4.13		
M14	8.55	8.4 - 8.7	Longwave IR	
M15	10.763	10.26 - 11.26		
M16	12.013	11.54 - 12.49		
DNB	0.7	0.5 - 0.9	Visible	750 m across full scan
I1 (red)	0.64	0.6 - 0.68	Visible	375 m
I2	0.865	0.85 - 0.88	Near IR	
I3	1.61	1.58 - 1.64	Shortwave IR	
I4	3.74	3.55 - 3.93	Medium-wave IR	
I5	11.45	10.5 - 12.4	Longwave IR	

Only 6 EDRs for 16 bands
(default bands are highlighted)

1 EDR

All 5 of 5

VIIRS granules

- Granule duration [**~85.752 seconds**] fixed
- Granule dimensions:
 - **I (imagery-resolution) bands** [1541 x 8241] @ **375 m** resolution
 - **M (moderate-resolution) bands** [771 x 4121] @ **750 m** resolution
- Granule swath: **~3000 km @ 824 km** altitude
- Granules: **~70/ orbit** (~100 minutes), or **~1000/day**
- Equator crossing: **~1330 local time**, sun-synchronous
- **Reflectance and radiance** are stored as two-byte (12-bit) unsigned integers. Supplied, slopes and offsets transform the scaled integers to radiance/reflectance or radiance/brightness temperature.
- **Sources of VIIRS data:**
 - GRAVITE
 - CLASS
 - Star Central Data Repository (SCDR) soon

NPP Imagery Team page

<http://rammb.cira.colostate.edu/projects/npp/>



NPOESS Preparatory Project (NPP) VIIRS Imagery and Visualization Team

(Last updated: 2011-11-15)

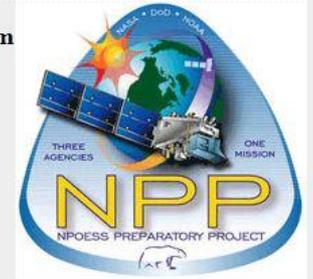
The first of the **Joint Polar Satellite System (JPSS)** spacecraft, the **National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP)** satellite was successfully launched **at 0948 UTC on 28 October 2011**.

See NASA's [NPP launch video](#).

The **first visible/reflective images** are expected on **Launch+24 Days (~21 November 2011)**.
The **first infrared/thermal images** are expected on **Launch+42 Days (~9 December 2011)**.

The NESDIS/STAR Imagery and Visualization and Visualization Team (co-led by Don Hillger @ NOAA and Tom Kopp @ Aerospace Inc.) will be responsible for the checkout of imagery (and data) from the **Visible/Infrared Imager Radiometer Suite (VIIRS)** instrument on NPP.

A RAMSDIS Online display of **simulated/proxy VIIRS data** is available at http://rammb.cira.colostate.edu/ramsdis/online/npp_viirs.asp. The selected images may vary widely in location and size.



[NPP Orbital Passes](#)

[Reverse Chronology of NPP VIIRS Significant Events](#)

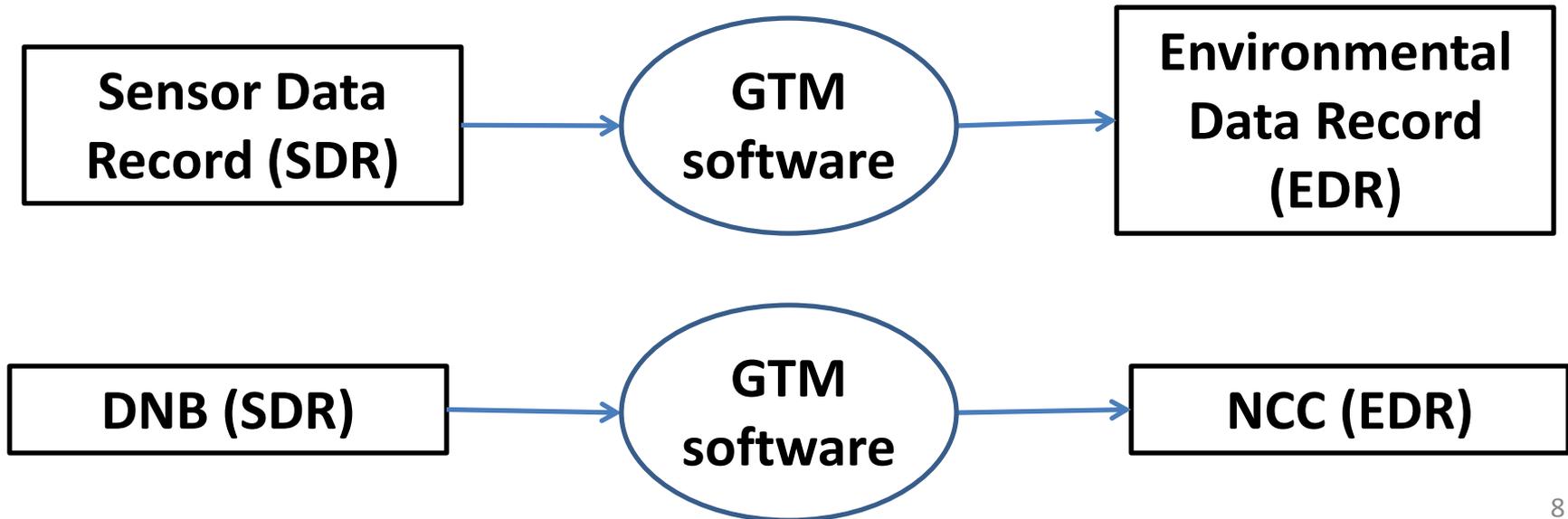
[NPP Reference Information/Websites](#)

NPP Orbital Passes

The NPP predicted track is plotted on GOES-13 full-disk 10.7 μm imagery to assist with matching NPP data with meteorological features of interest. Since the full disk scans occur every 3 hours, only the track within +/- 90 minutes of each scan is plotted.

SDR to EDR

- **Ground Track Mercator (GTM)** remapping software.
- GTM is a **remapping** of the data, but the same radiances/reflectances



SDR Examples

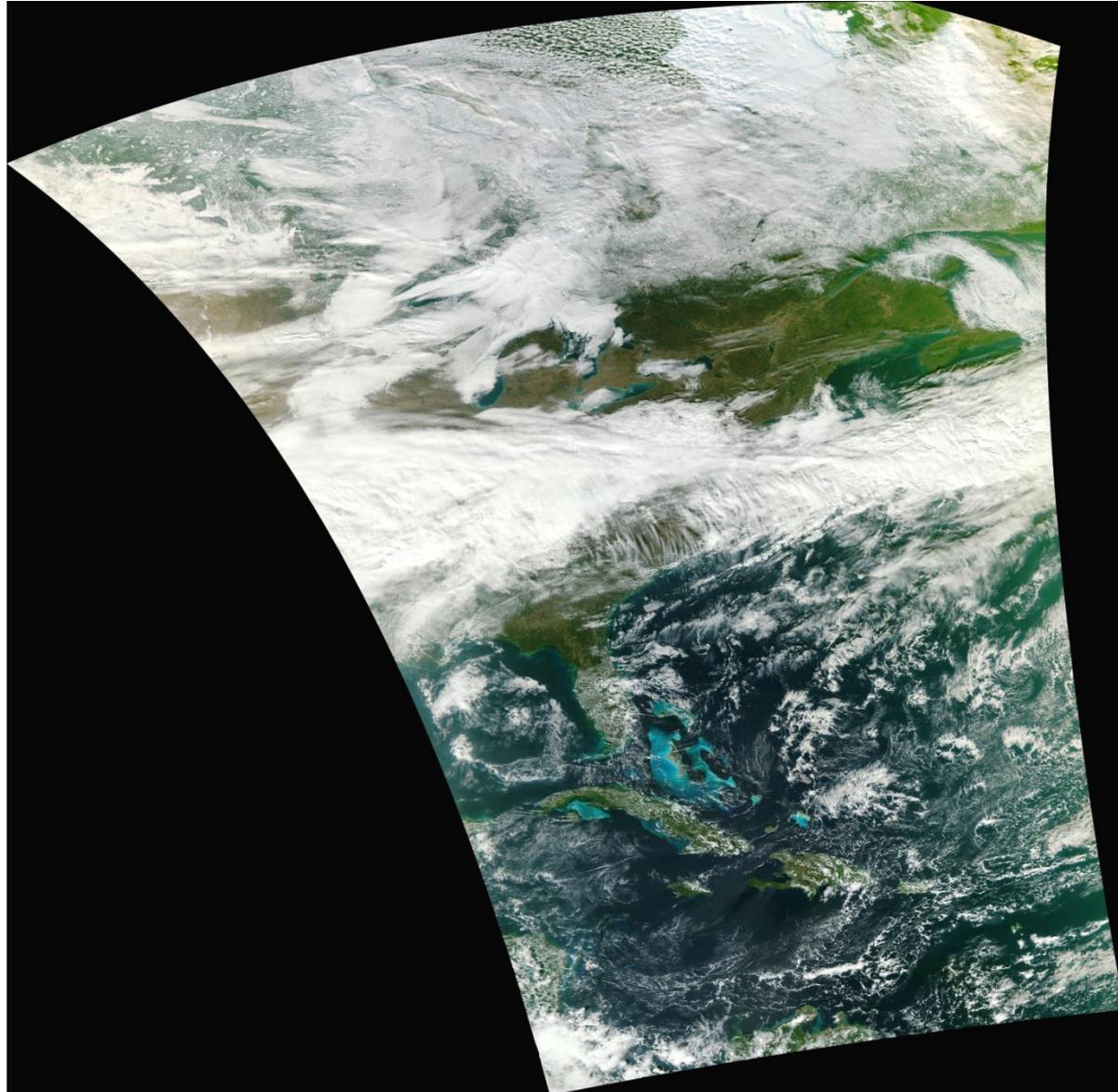
- The following images are **examples** built from VIIRS SDRs by members of the Imagery Cal/Val team
- In particular, Imagery **EDRs** are not produced from all of the VIIRS bands (in particular, the three bands needed for true-color imagery)
- Some of the examples show the **advantages of VIIRS** over MODIS (and over operational NOAA/AVHRR in particular)

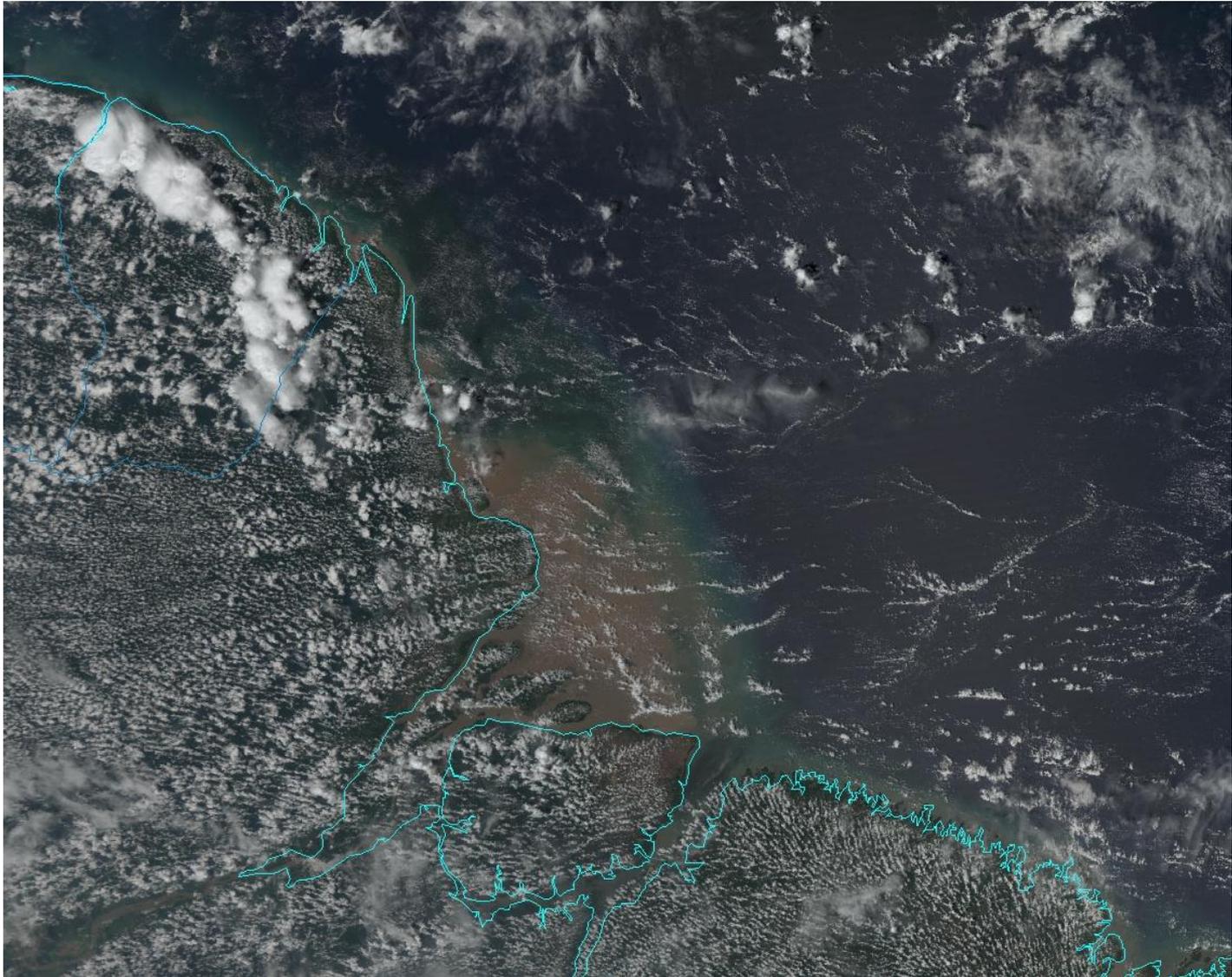
VIIRS display tools

- **McIDAS-V** (VIIRS ready) –
SSEC/CIMSS/Wisconsin
- **McIDAS-X** (VIIRS capabilities under
development) –
SSEC/CIMSS/Wisconsin
- **TeraScan / NexSat** (web display) –
NRL
- Other

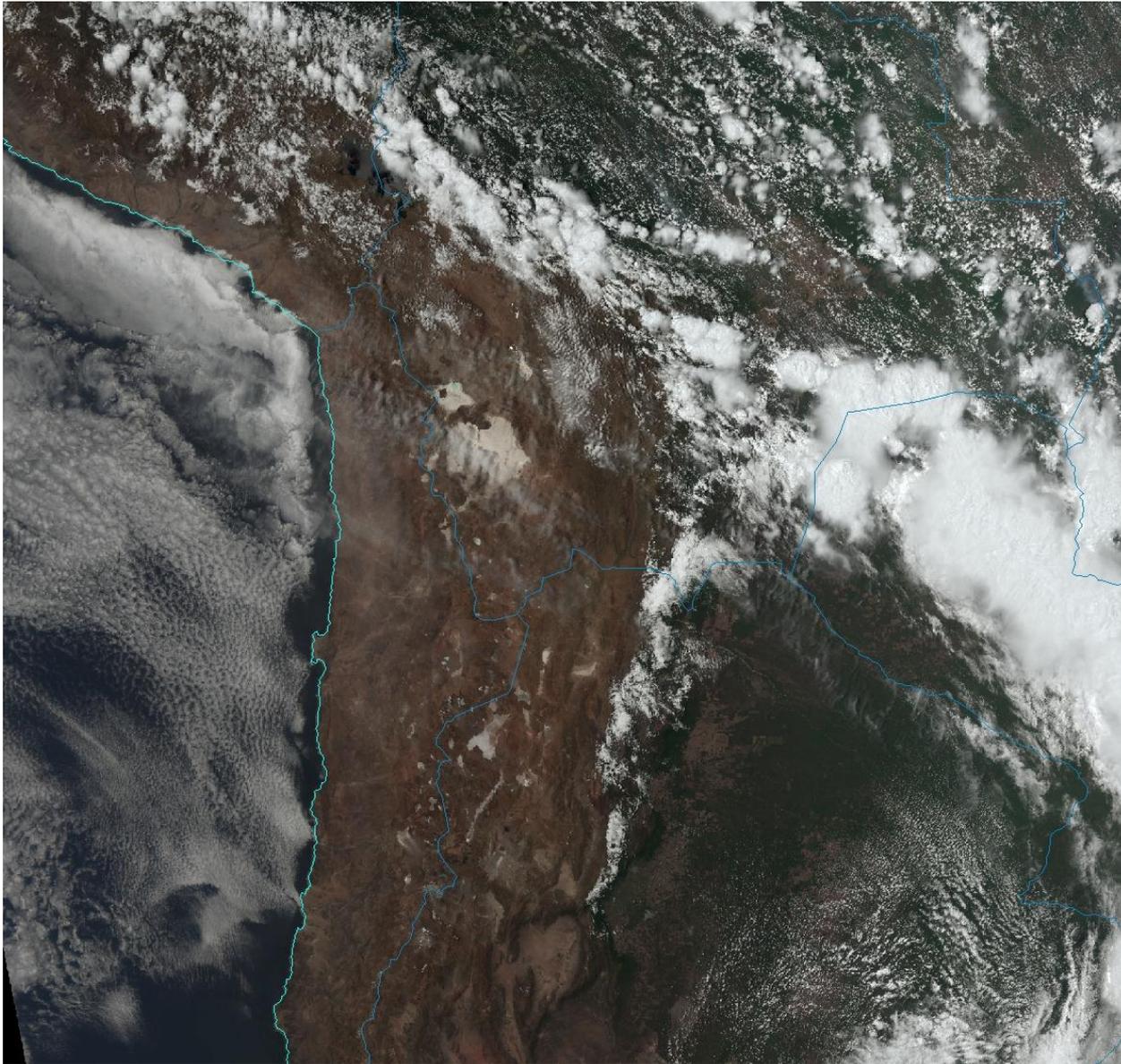


First VIIRS swath – 2011-11-21 (Courtesy of Atmos PEATE)

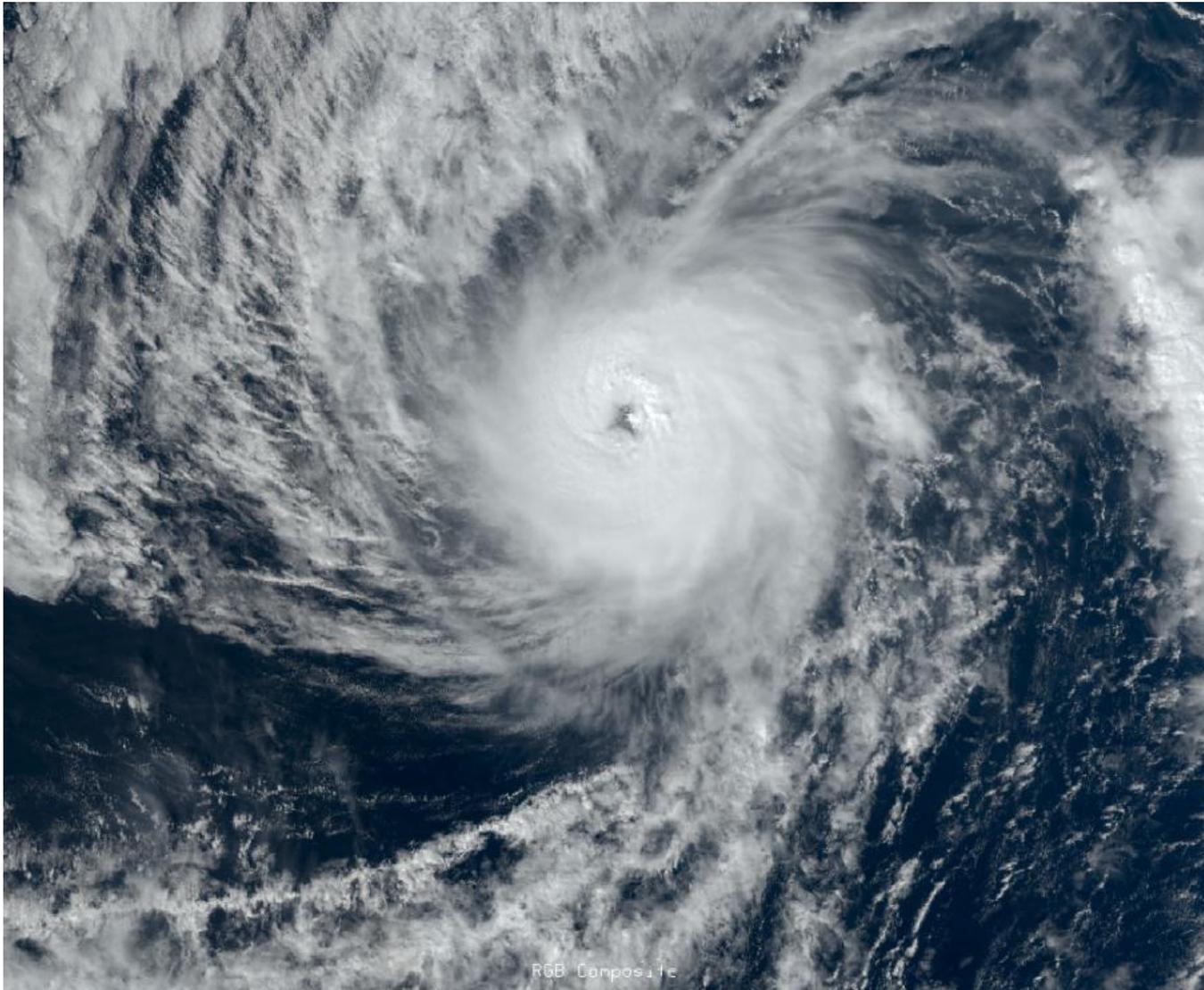




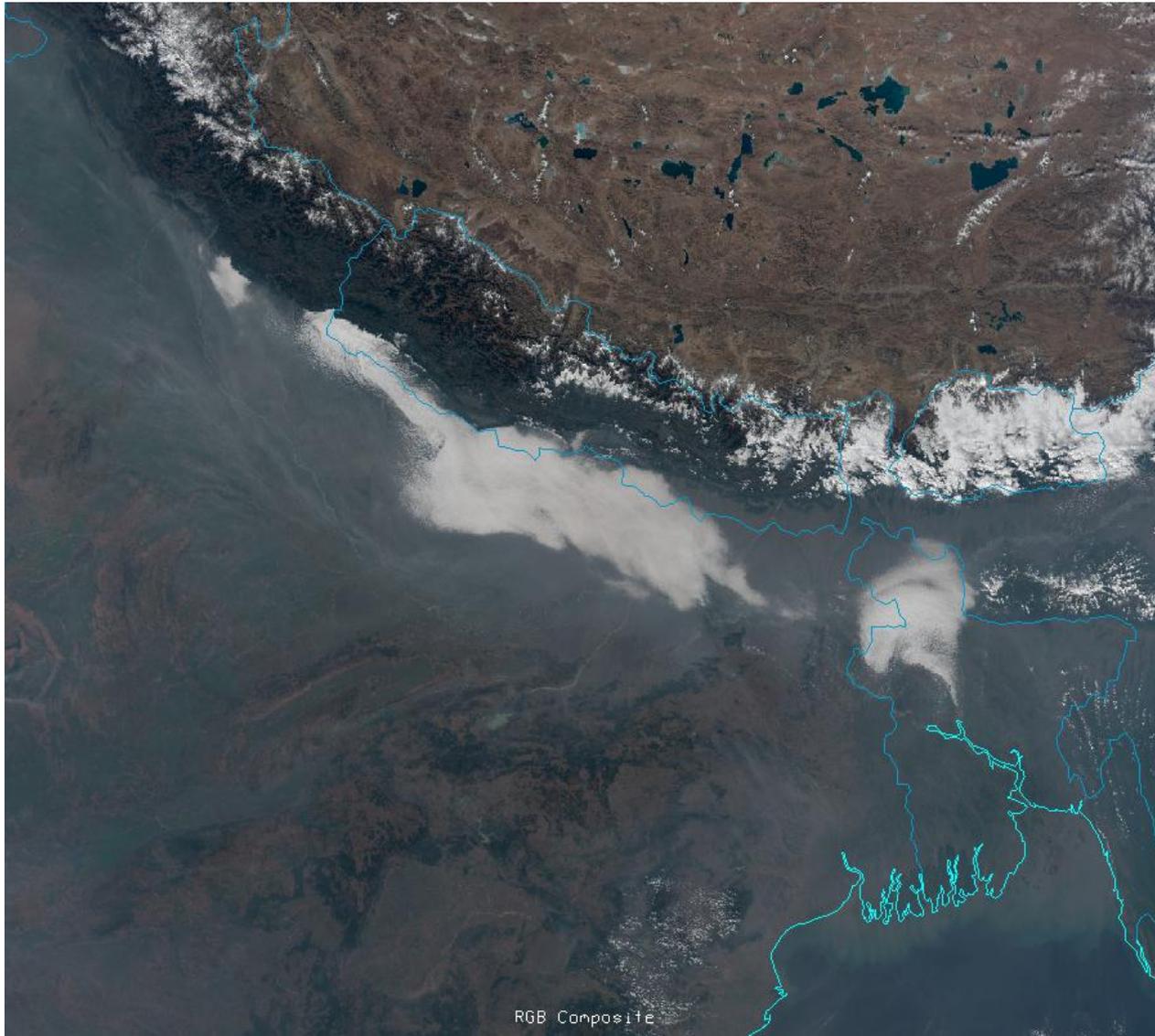
VIIRS M-band (750 m) true-color/RGB images created from the first data from VIIRS is the following image of the Brazilian coast created using McIDAS-V. [Image courtesy of Tom Rink, CIMSS]



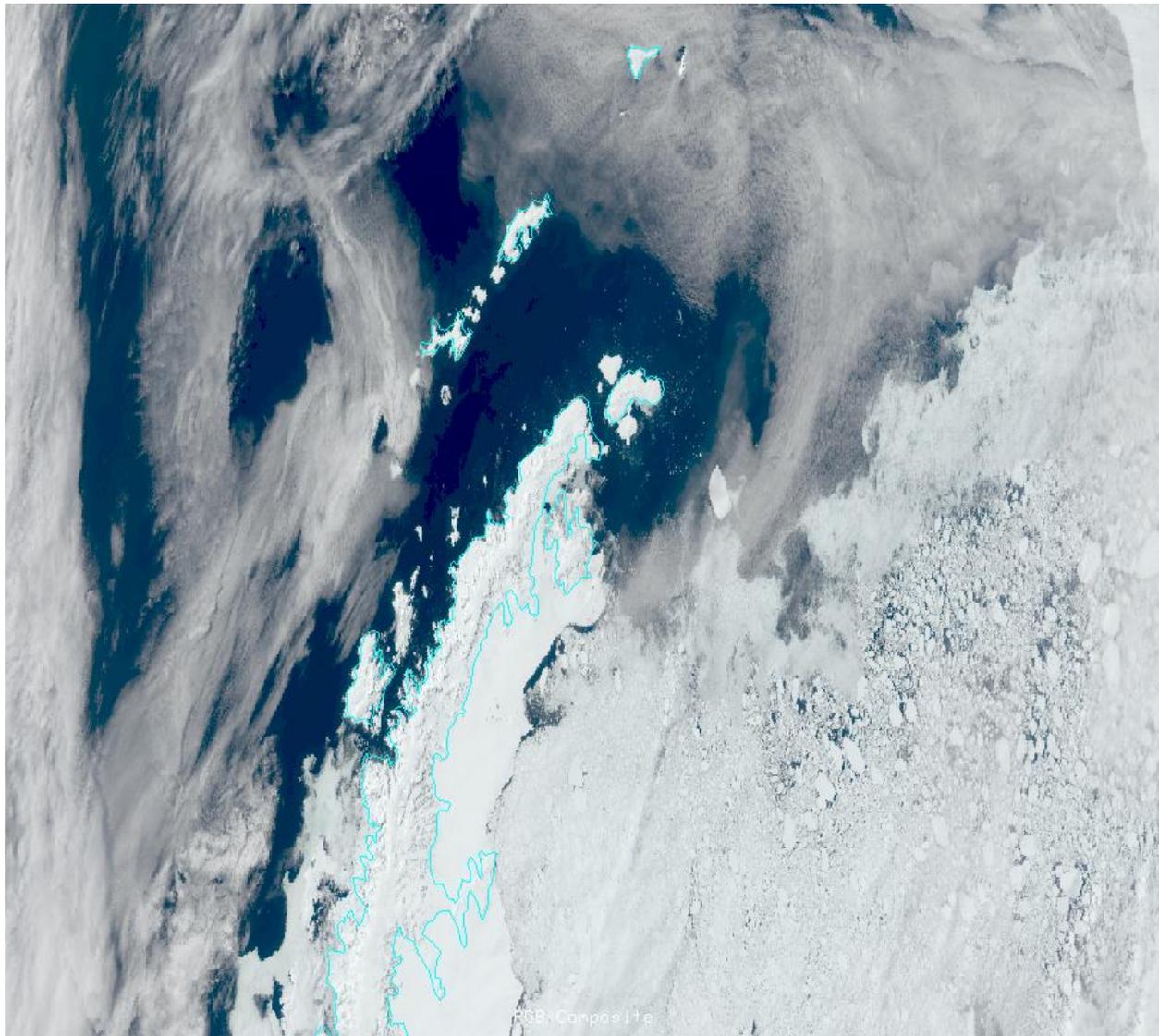
VIIRS M-band (750 m) true-color/RGB image of the western coast of South America. [Image courtesy of Tom Rink, CIMSS]



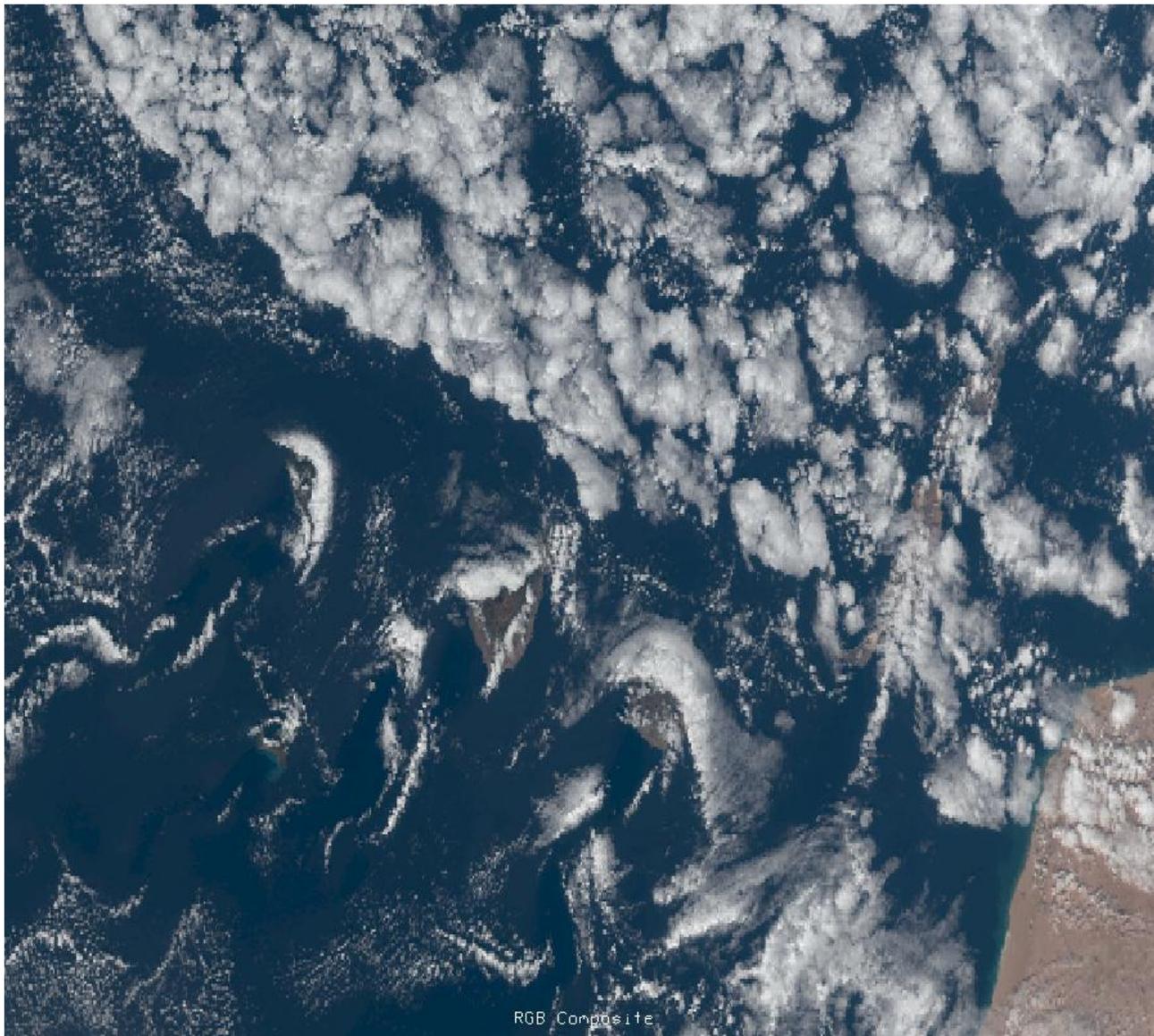
VIIRS M-band (750 m) true-color/RGB image (for 22 November 2011) over Hurricane Kenneth in the east Pacific. [Image courtesy of Dan Lindsey, NOAA/StAR]



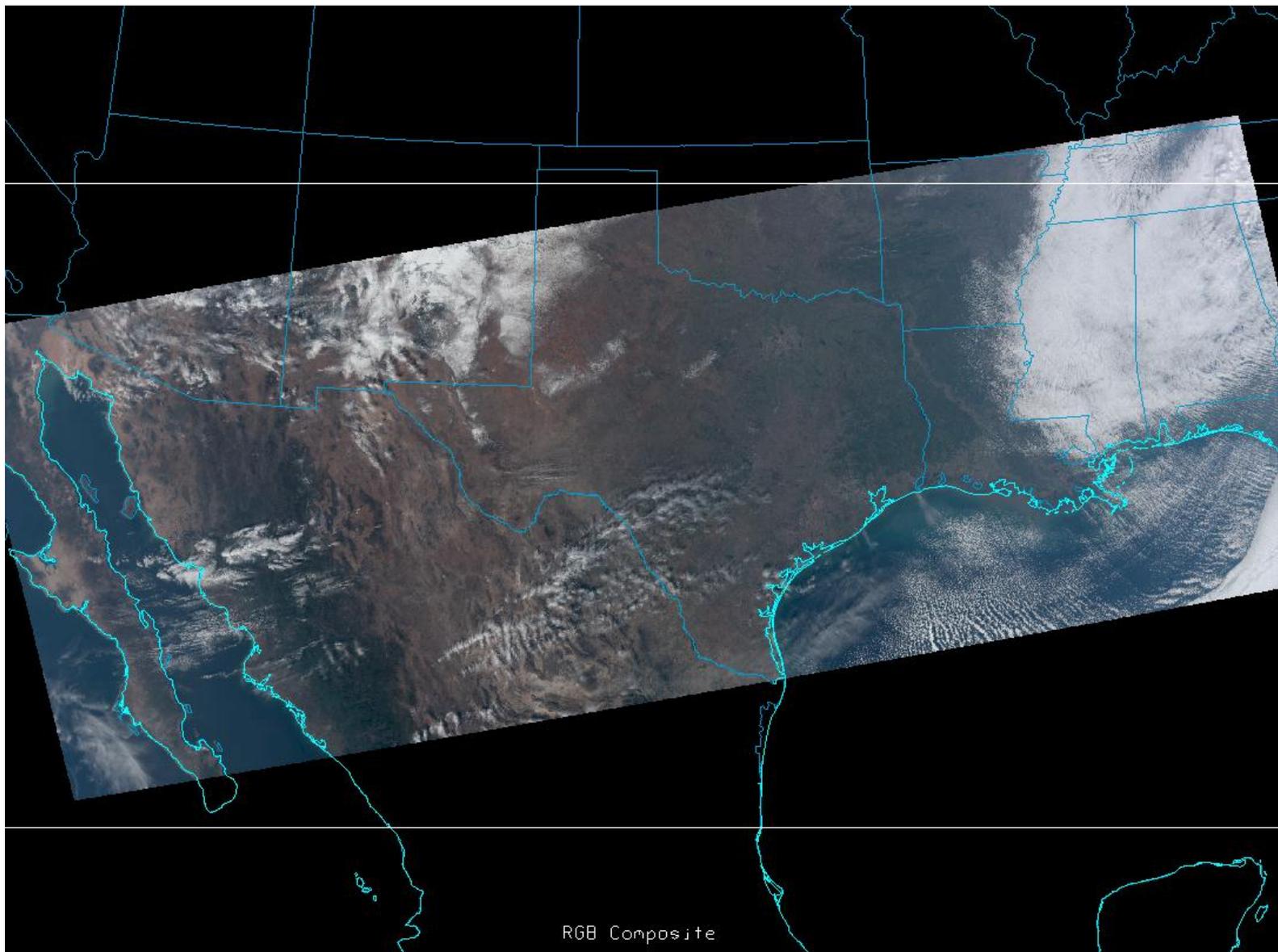
VIIRS M-band (750 m) true-color/RGB image (for 14 December 2011) over northeastern India and Nepal. Note the large amount of pollution over India relative to Tibet, and how the mountains keep it all to the south. [Image courtesy of Dan Lindsey, NOAA/StAR] ¹⁵



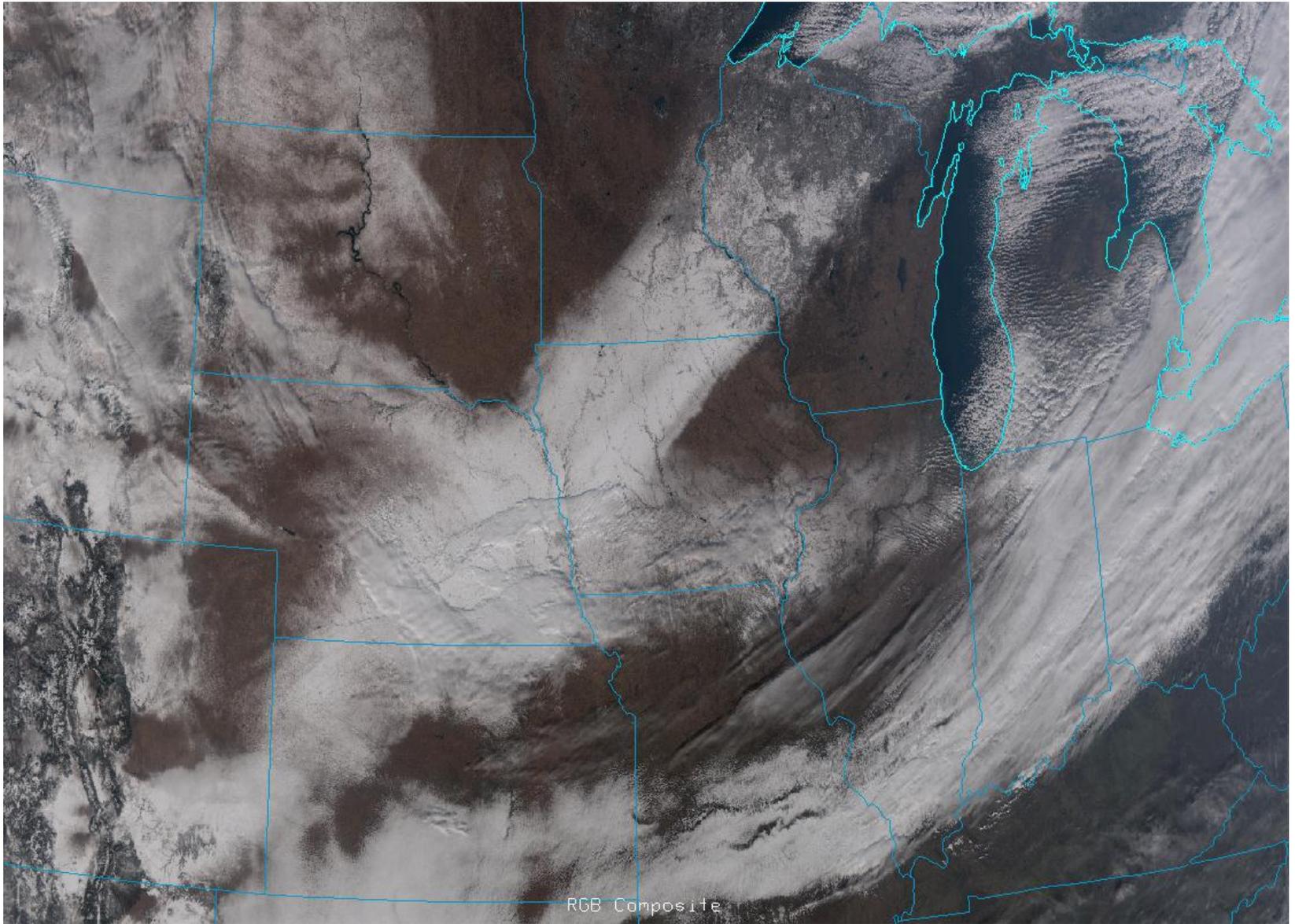
VIIRS M-band (750 m) true-color/RGB image (for 25 November 2011) with a nice contrast of the open ocean vs. ice. The map is the Antarctic Peninsula which extends toward the tip of S. America, and the Weddell Sea on the right in the image. [Image courtesy of Dan Lindsey, NOAA/StAR]



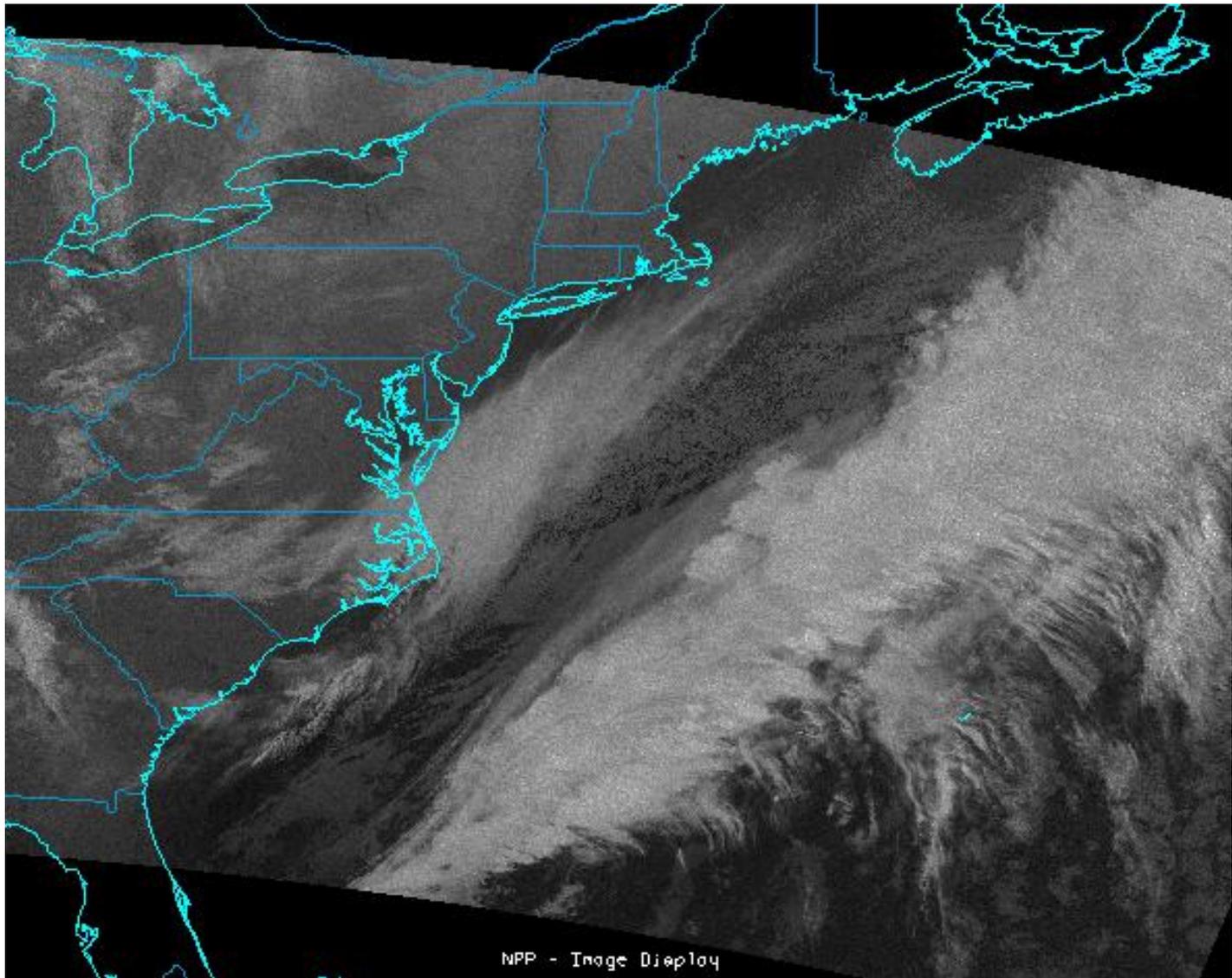
VIIRS M-band (750 m) true-color/RGB image (for 3 December 2011) with cloud vortices over the Canary Islands, just off of NW Africa. [Image courtesy of Dan Lindsey, NOAA/StAR]



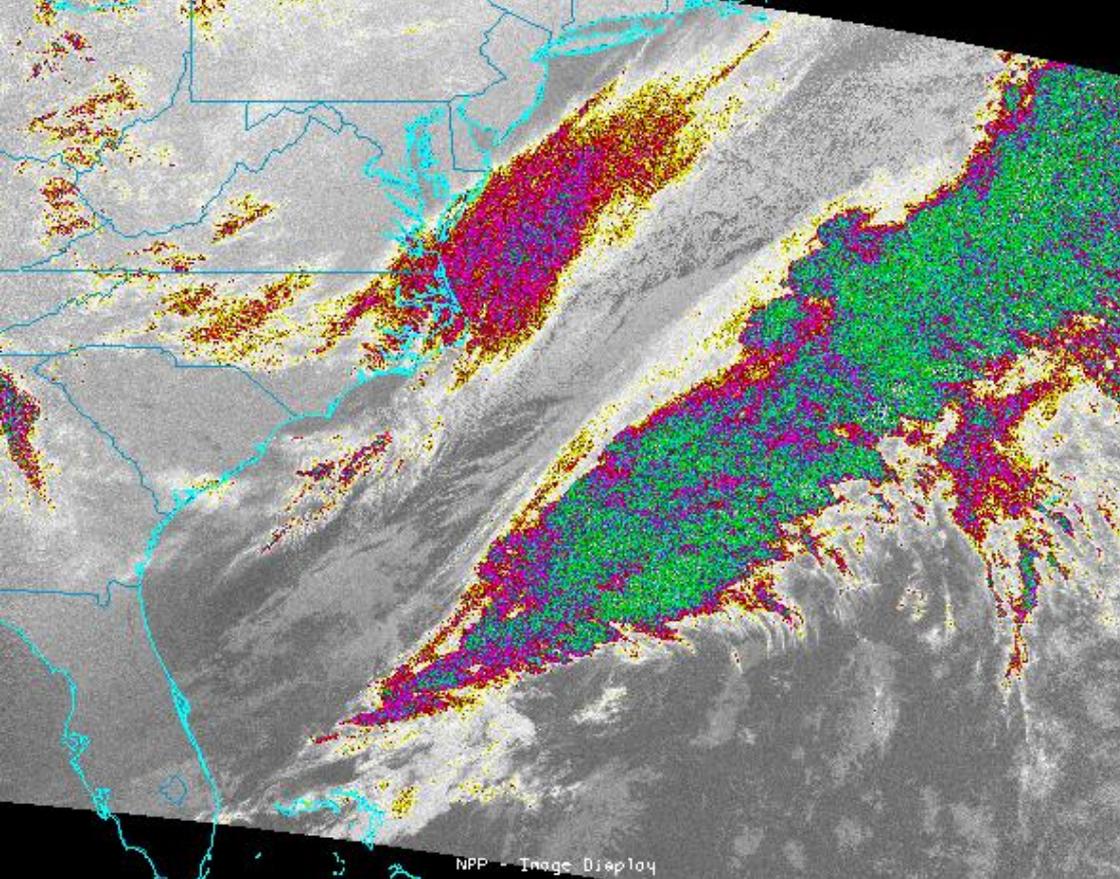
VIIRS M-band (750 m) true-color/RGB image (for 7 December 2011) over the southern U.S. [Image courtesy of Dan Lindsey, NOAA/StAR]



VIIRS M-band (750 m) true-color/RGB image (for 9 December 2011) over the U.S. Upper Midwest. [Image courtesy of Dan Lindsey, NOAA/StAR]



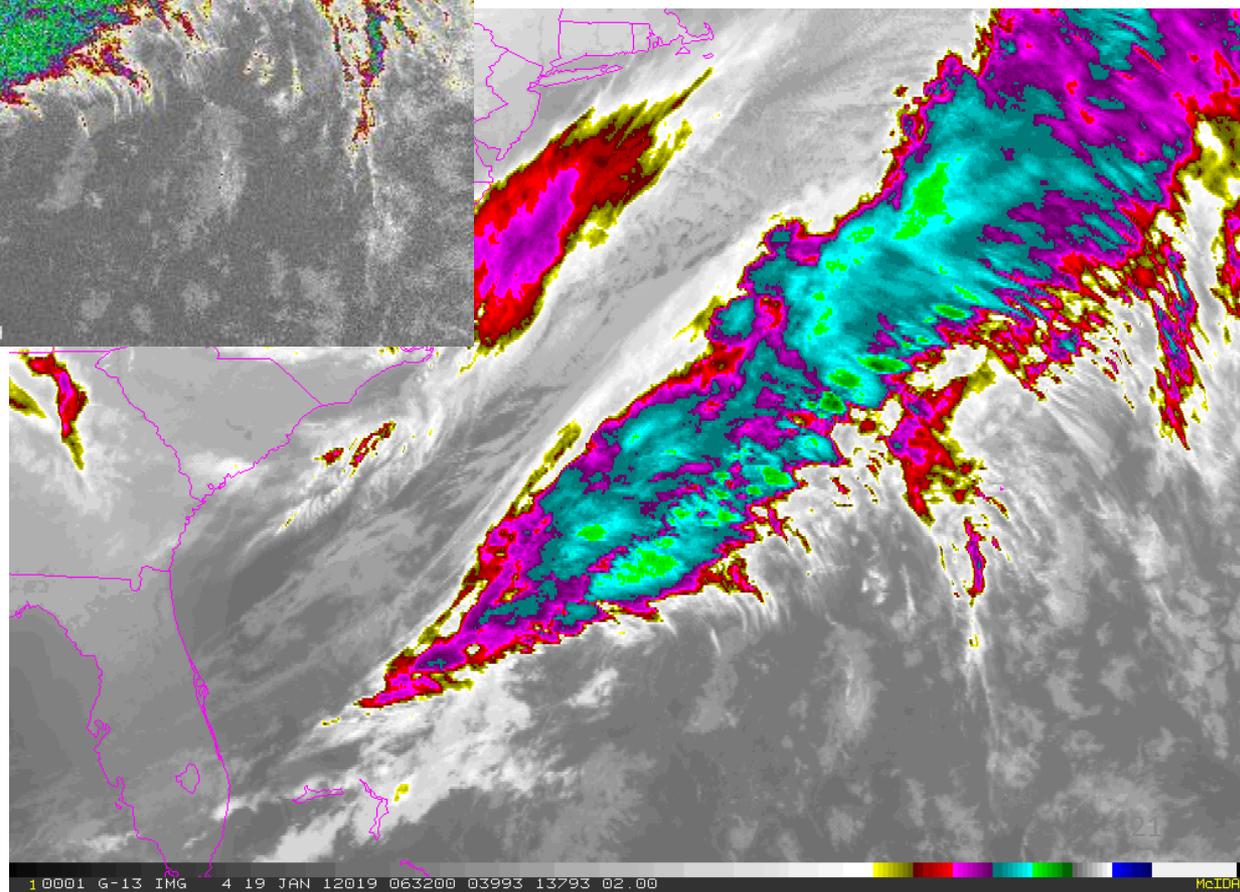
VIIRS I-band-5 (375 m) IR image (consisting of more than one granule for 19 January 2012 @ ~0620 UTC) over the U.S. Note that this IR image is noisy, due to the still-cooling IR detectors at this time. [Image courtesy of Dan Lindsey, NOAA/StAR]

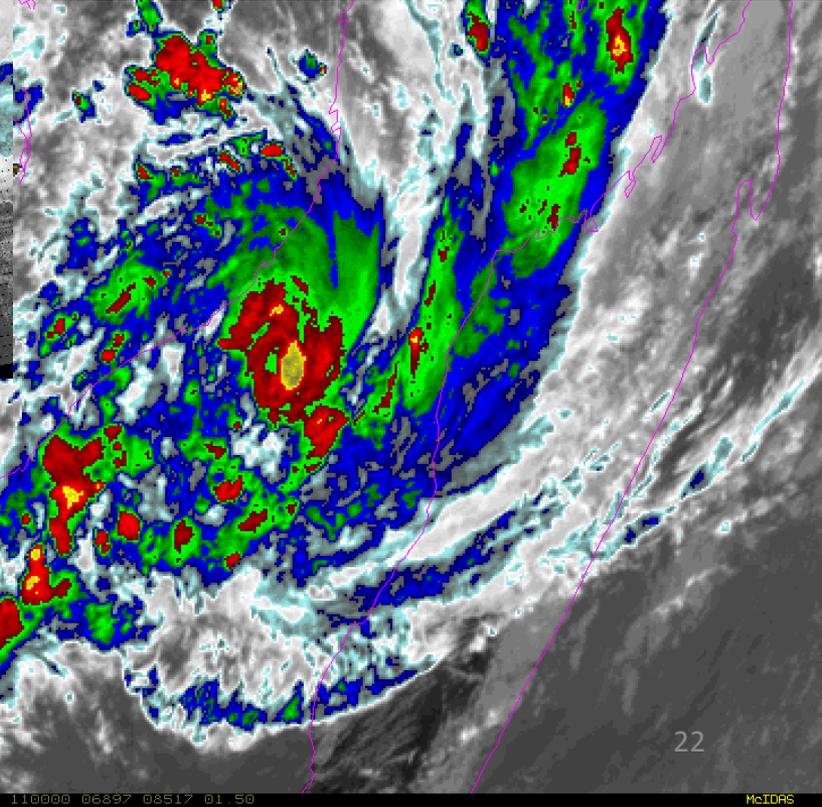
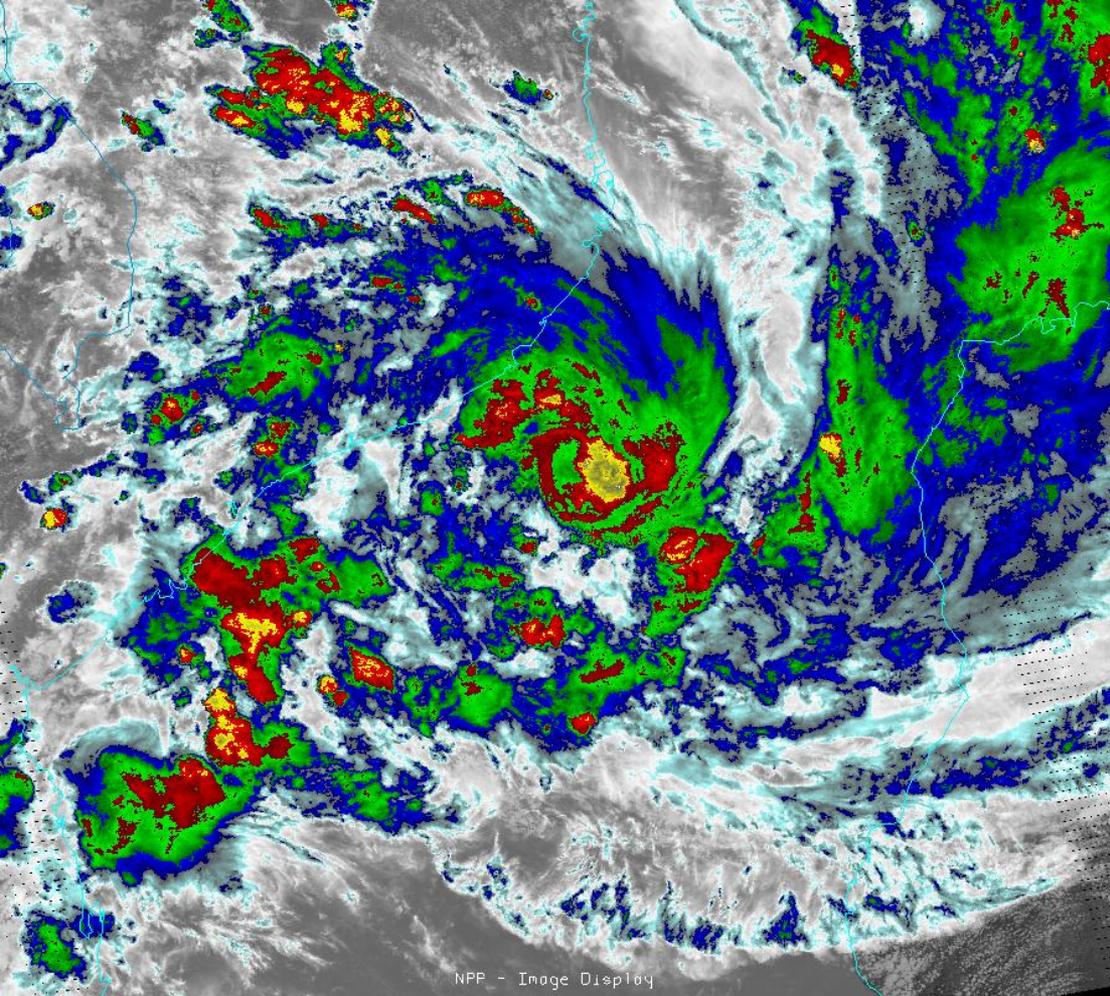


Early NPP VIIRS IR image

**19 January 2012
0620 UTC
Eastern U.S.**

Equivalent GOES-13 image

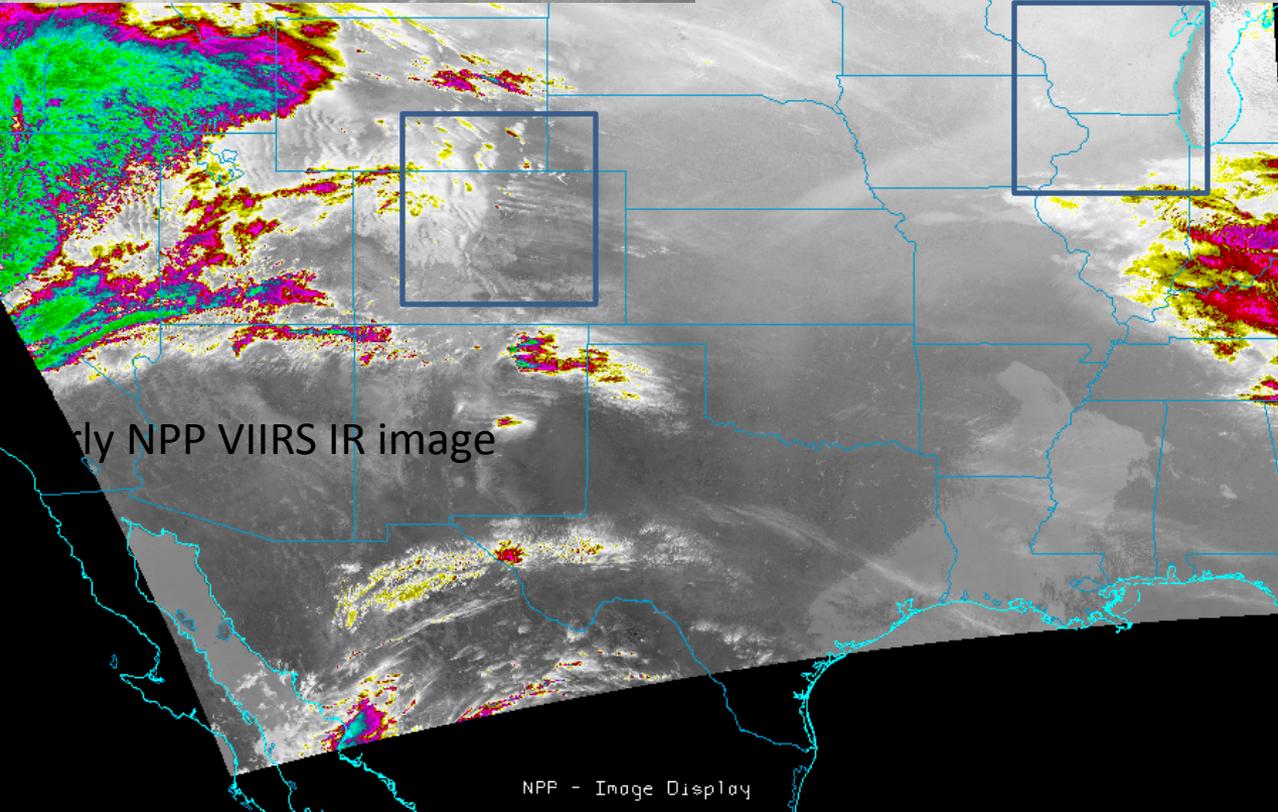
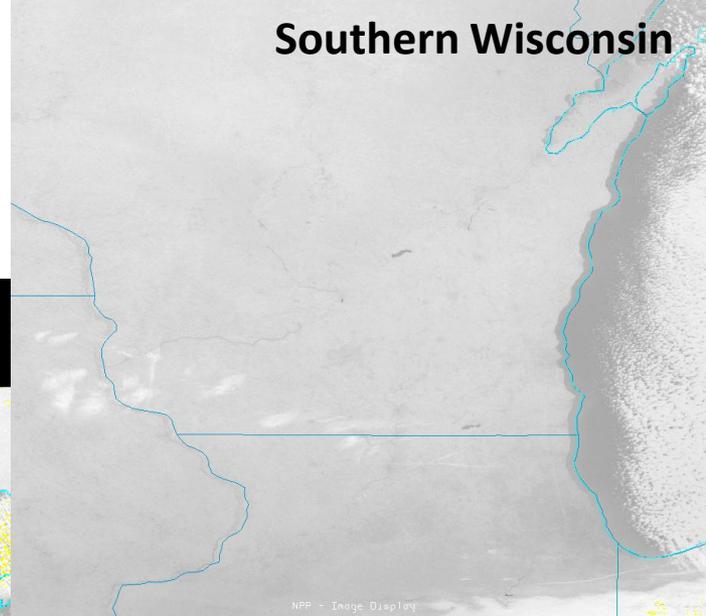
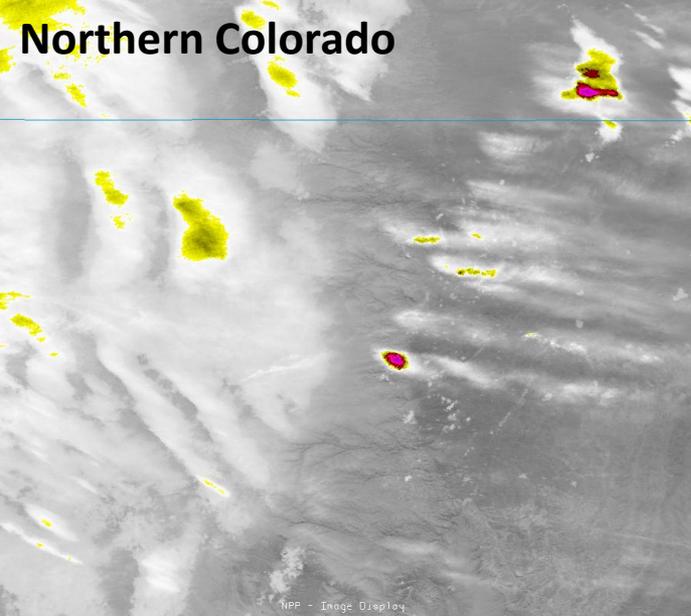




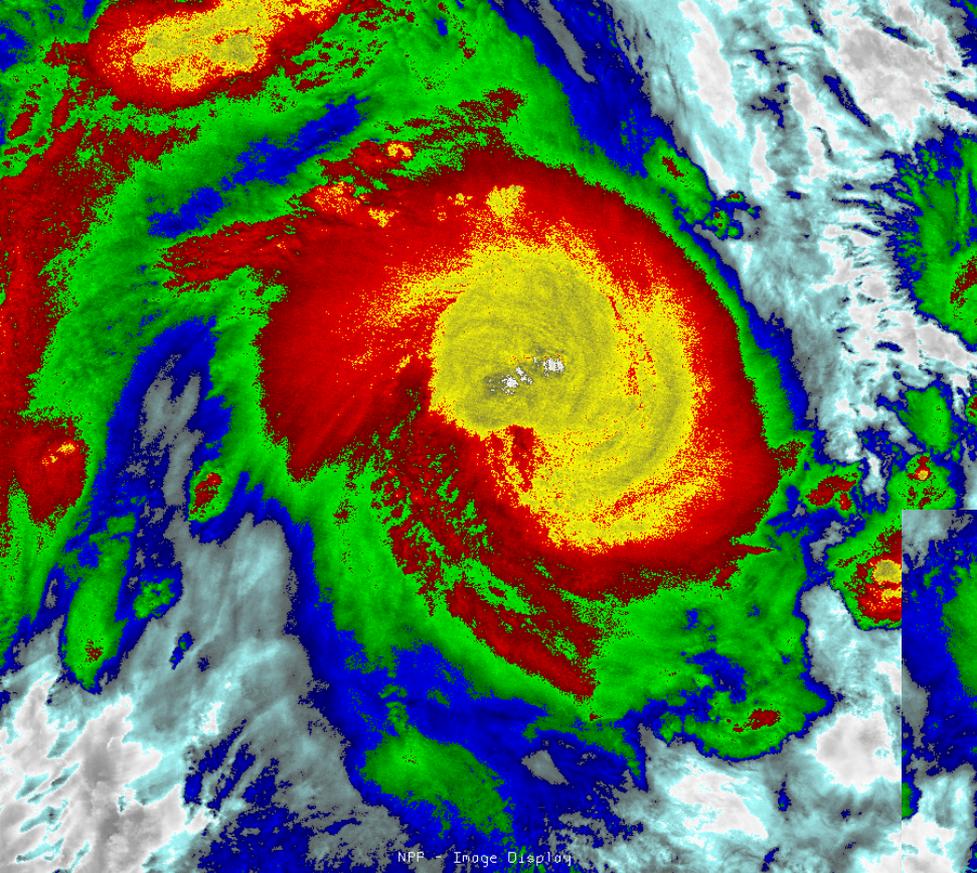
Early NPP VIIRS IR image

19 January 2012
1059 UTC
TC Funso

Equivalent MSG image

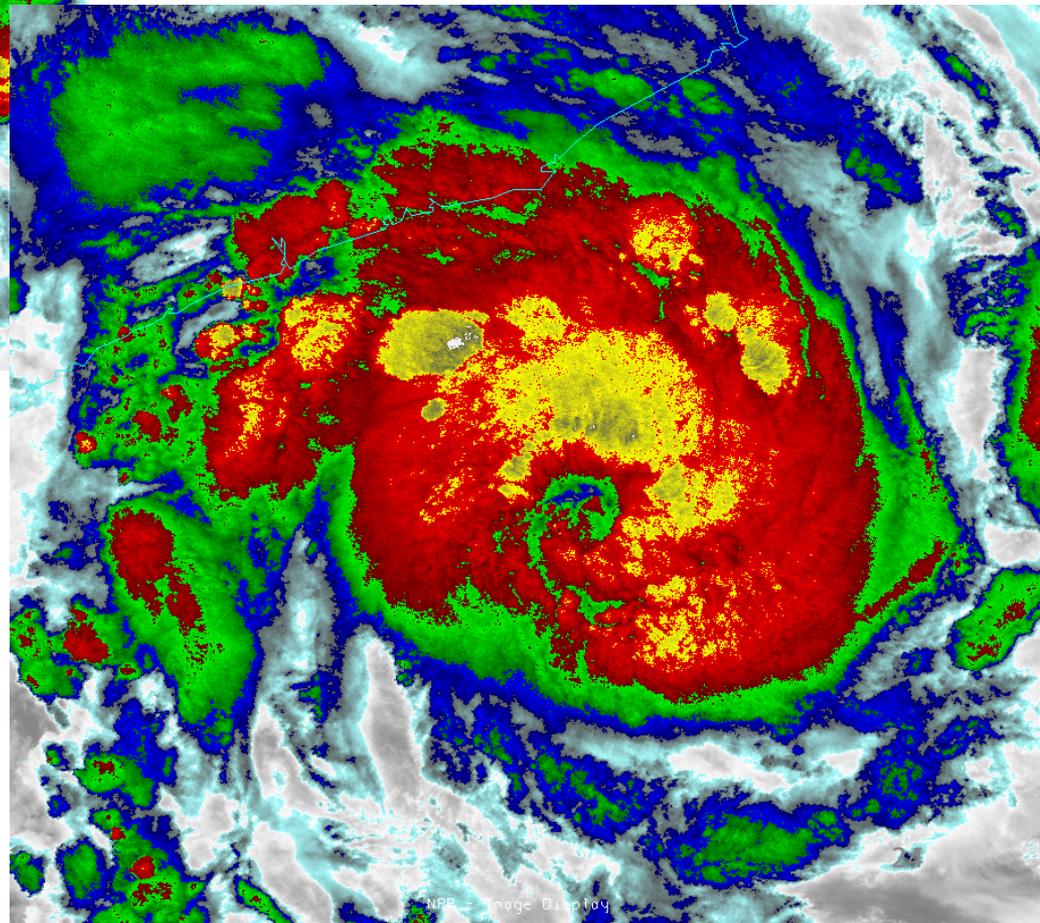


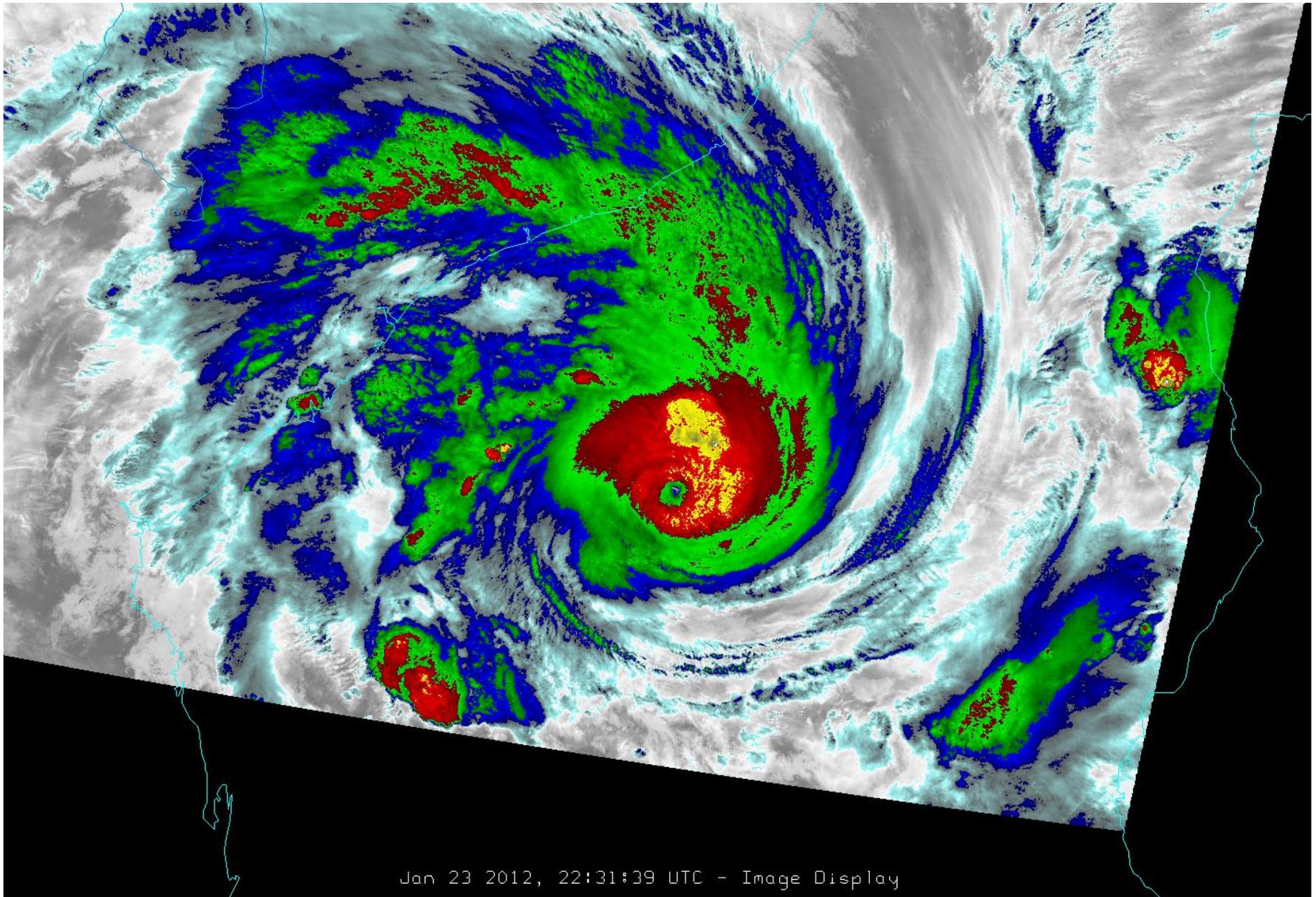
**19 January 2012
1940 UTC
Western U.S.
and detail images**



**19 January 2012
2206 UTC
TC Funso**

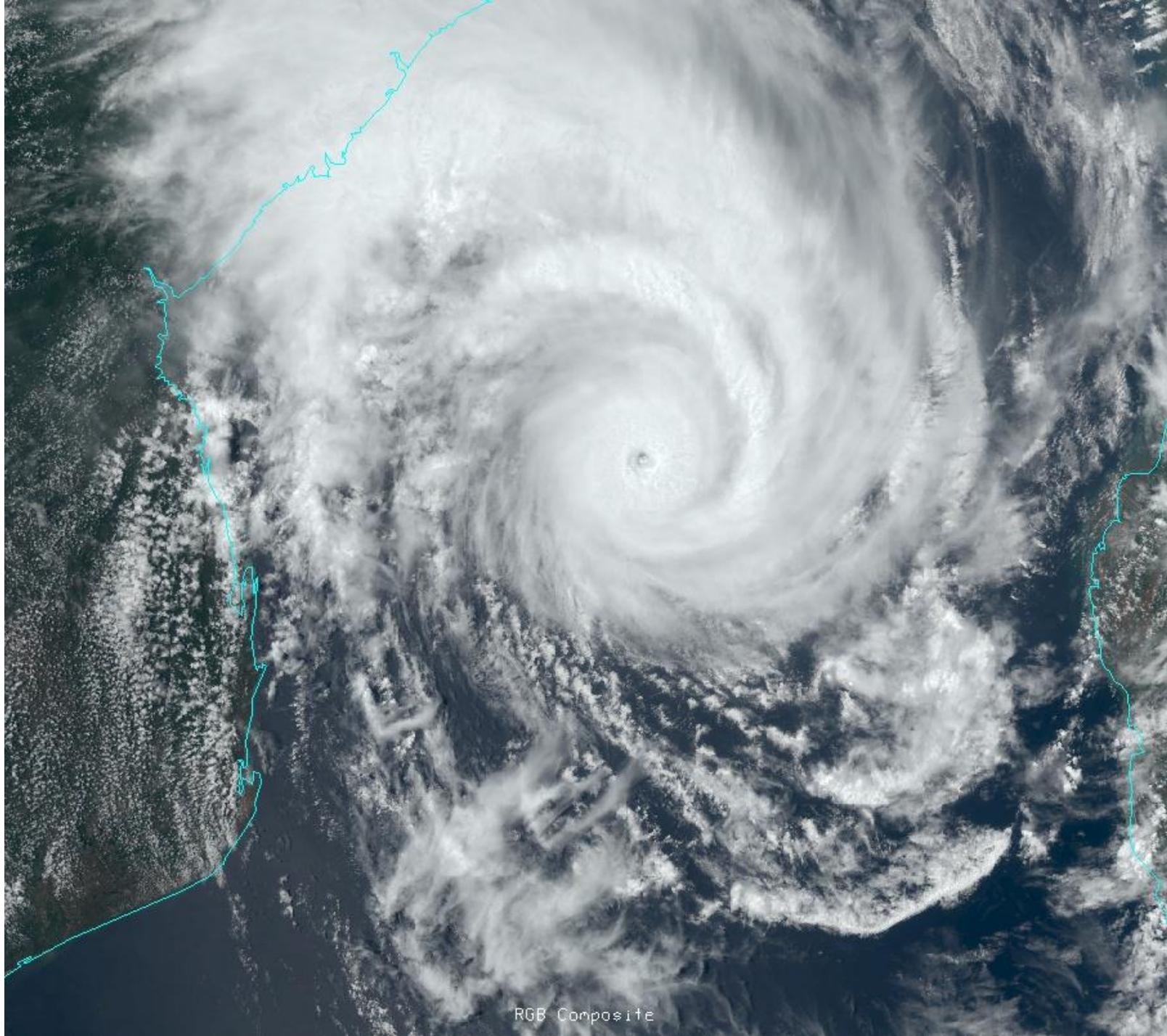
**19 January 2012
2026 UTC
TC Ethel**



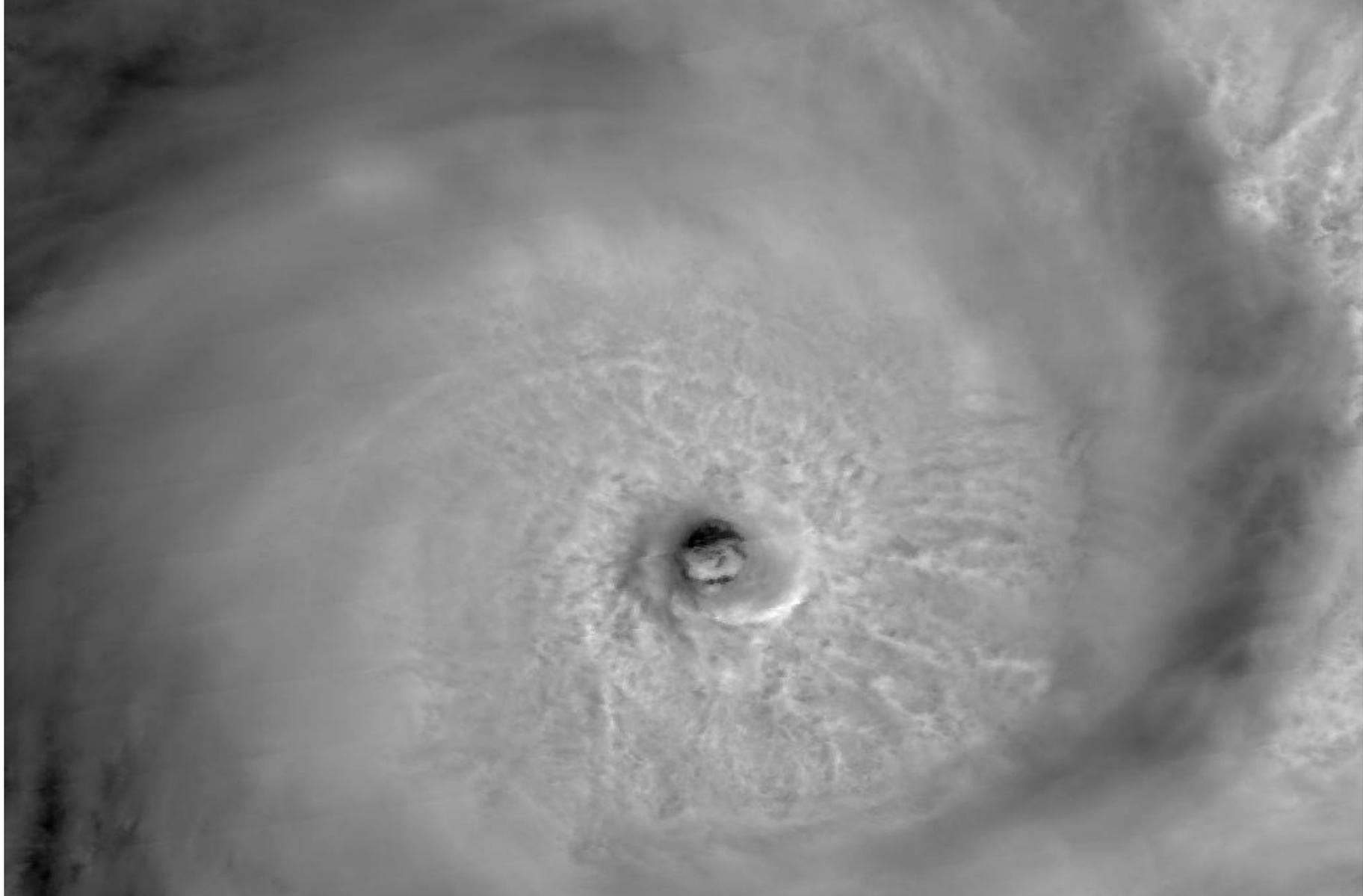


VIIRS I-band-5 (375 m) IR image for 23 January 2012 @ ~2231 UTC over TC Funso. Note that the improved signal-to-noise. [Image courtesy of Curtis Seaman, CIRA]

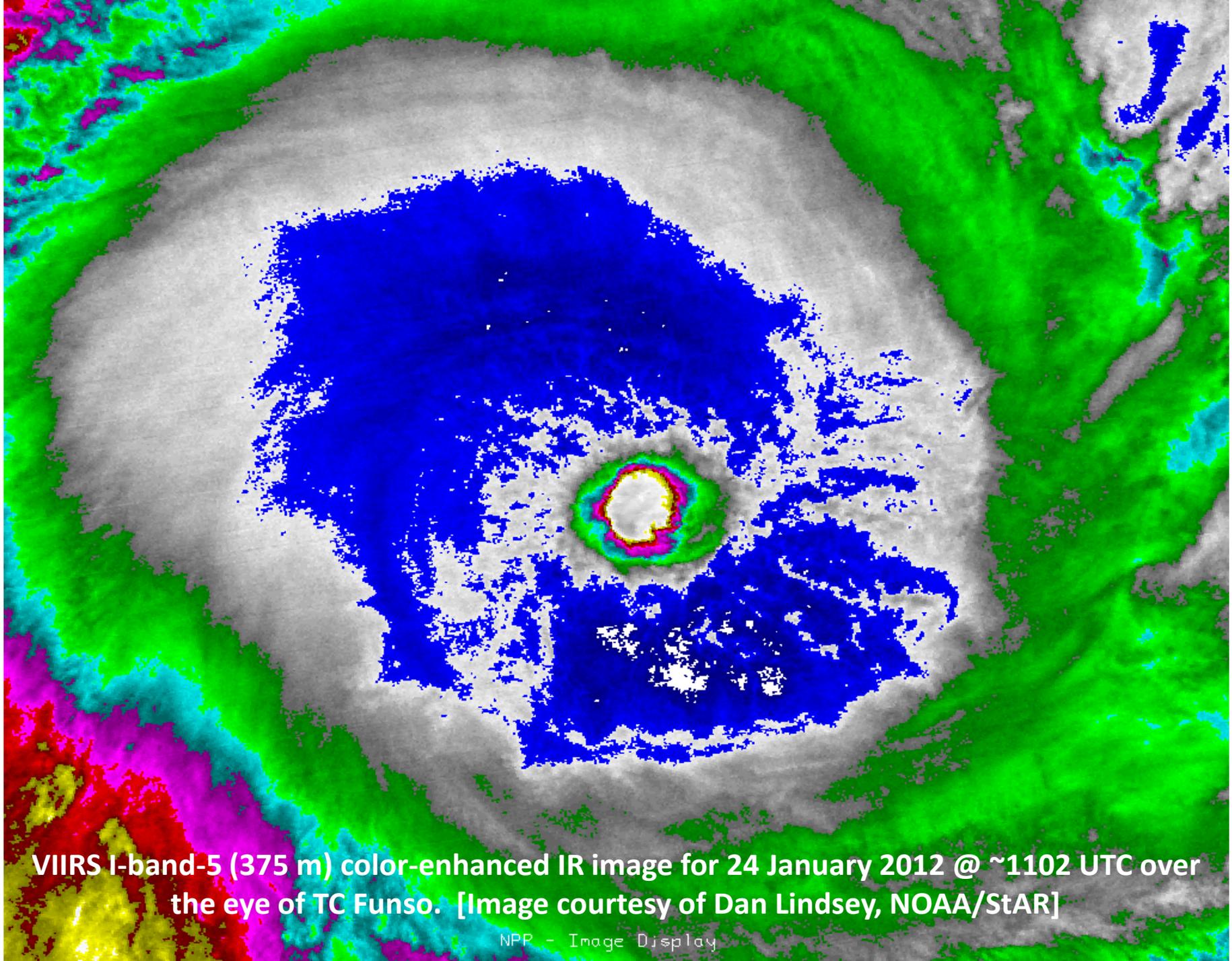
**VIIRS M-
band (750 m)
true-color
image for 24
January 2012
@ ~1102
UTC over TC
Funso.
[Image
courtesy of
Dan Lindsey,
NOAA/StAR]**



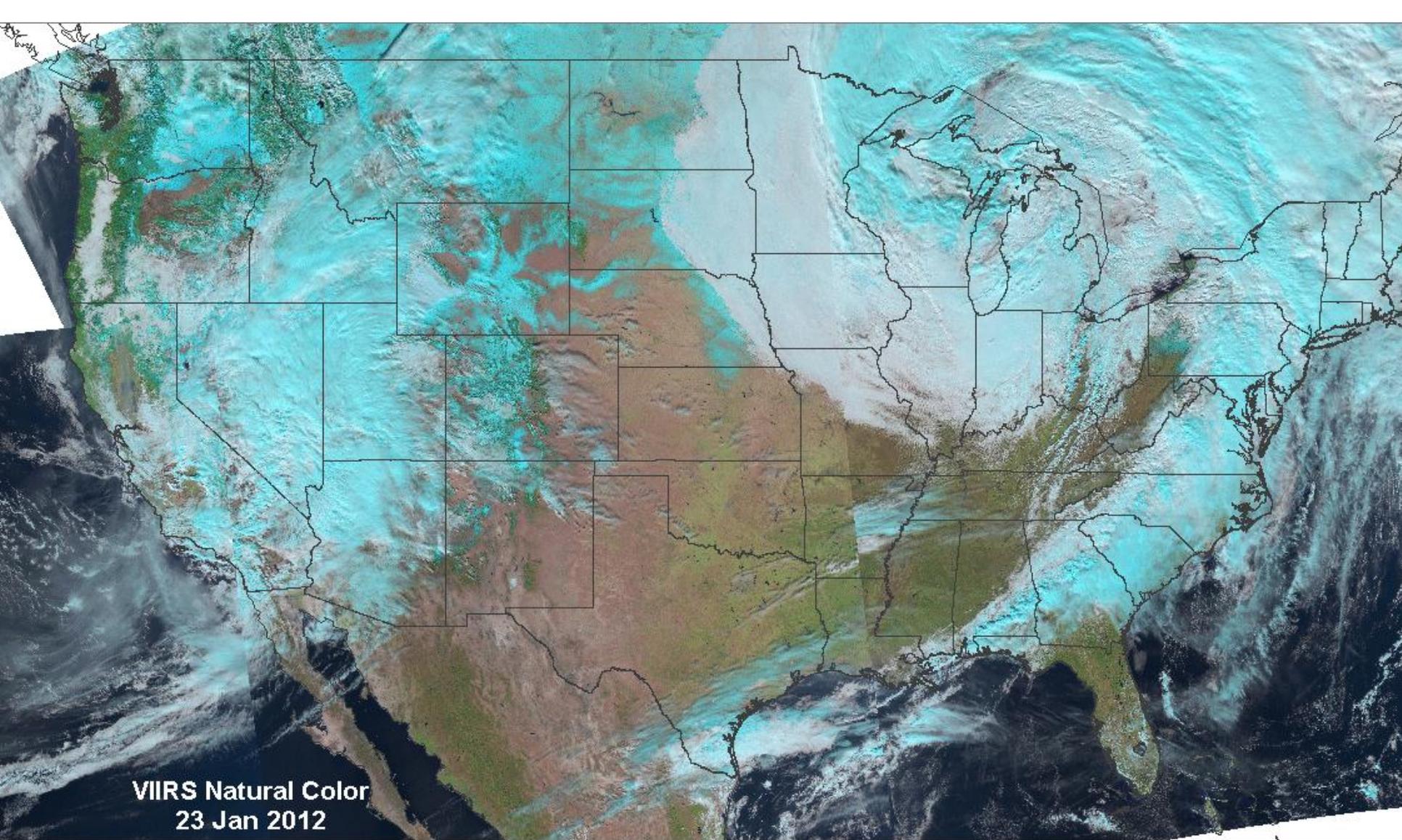
RGB Composite



VIIRS I-band-1 (375 m) IR image for 24 January 2012 @ ~1102 UTC over the eye of TC Funso. Note the sloping eyewall at this resolution. [Image courtesy of Dan Lindsey, NOAA/StAR]



VIIRS I-band-5 (375 m) color-enhanced IR image for 24 January 2012 @ ~1102 UTC over the eye of TC Funso. [Image courtesy of Dan Lindsey, NOAA/StAR]



VIIRS Natural Color
23 Jan 2012

1.6/0.8/0.6 μm (R/G/B) “natural color” image for 23 January 2012. Advantages over true color: (a) less Rayleigh scattering, (b) vegetation shows up as unmistakable green, (c) cloud phase is indicated (cyan clouds are ice, white are liquid), and (d) snow on the ground is easy to distinguish from low clouds (but not from high clouds). [Image courtesy of Stan Kidder, CIRA]

The VIIRS Imagery Team work continues

- **Quantitative** analyses:
 - Noise levels
 - Detector-to-detector striping
 - Inter-satellite comparisons
- **Overall imagery assessment**, for use as image products
- **Multi-spectral products**, as a means of assessing image quality, where signal-to-noise ratio is reduced.



VIIRS Imagery Examples



Steven Miller

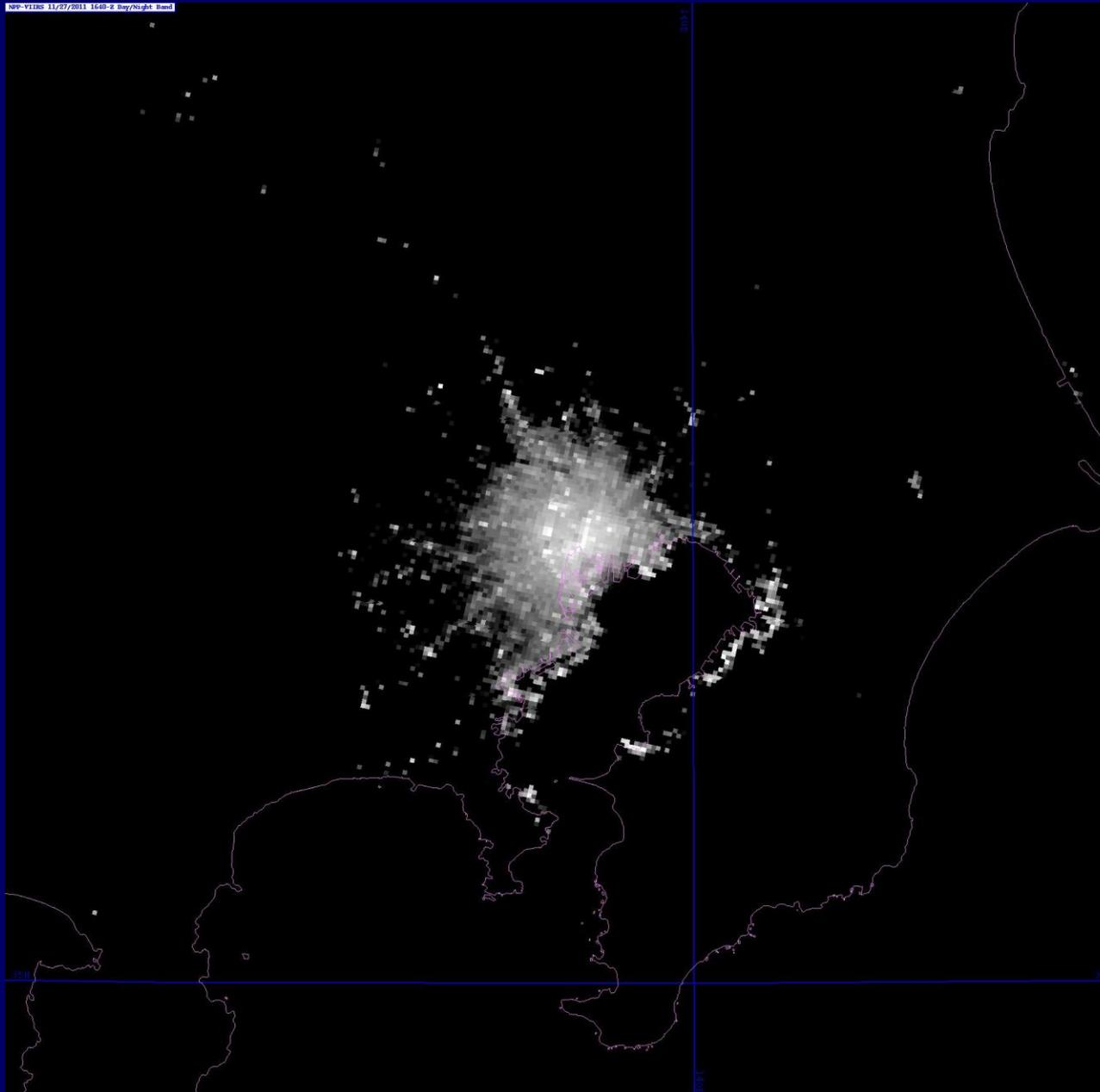
*Cooperative Institute for Research in the Atmosphere (CIRA),
Colorado State University, Ft. Collins, CO*

**Jeremy Solbrig, Mindy Surratt, Kim Richardson, Arunas
Kuciauskas, Jeff Hawkins, Tom Lee and Richard Bankert**

Naval Research Laboratory, Monterey, CA



VIIRS: Zoom-In On Tokyo

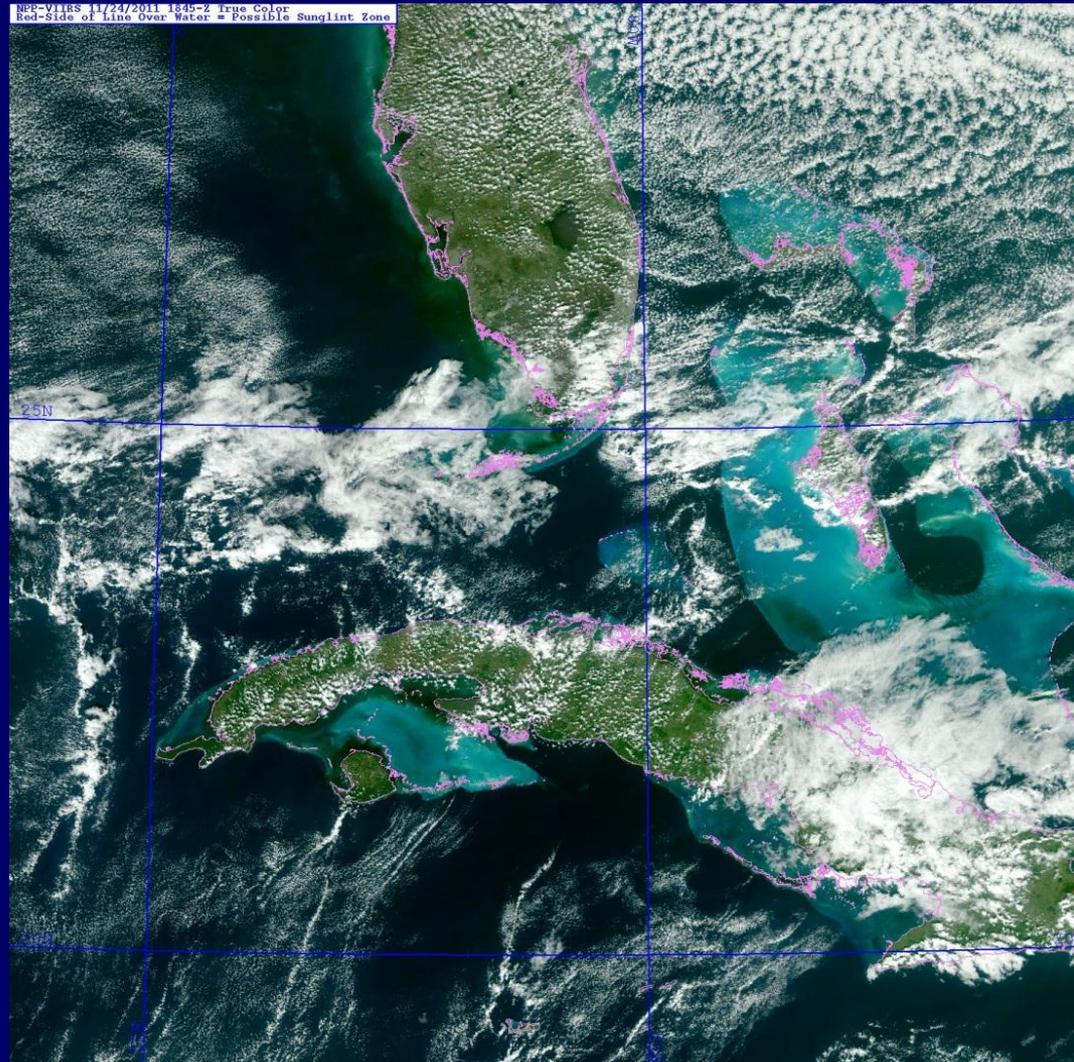




NPP VIIRS True Color Examples



South Florida, Bahamas and Cuba

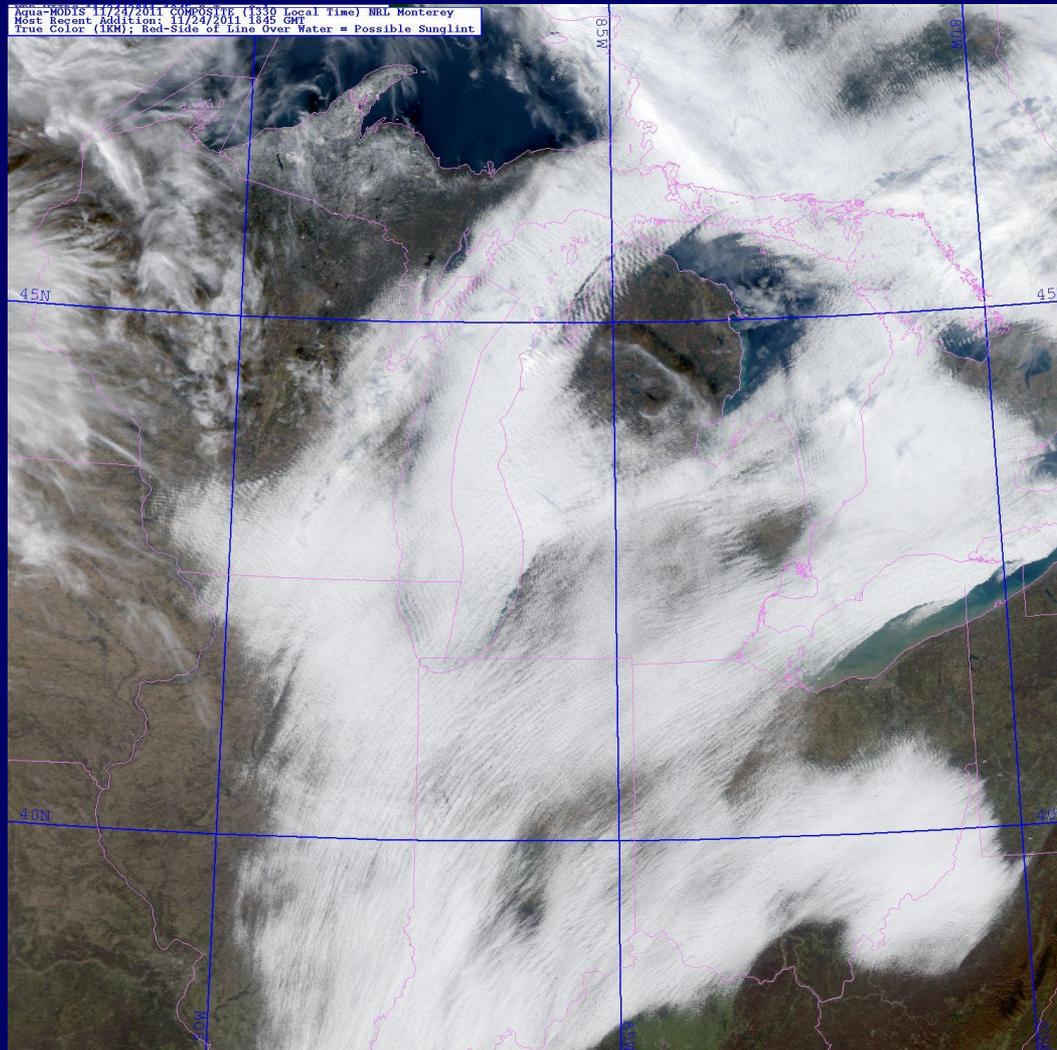




NPP VIIRS True Color Examples



Great Lakes Region

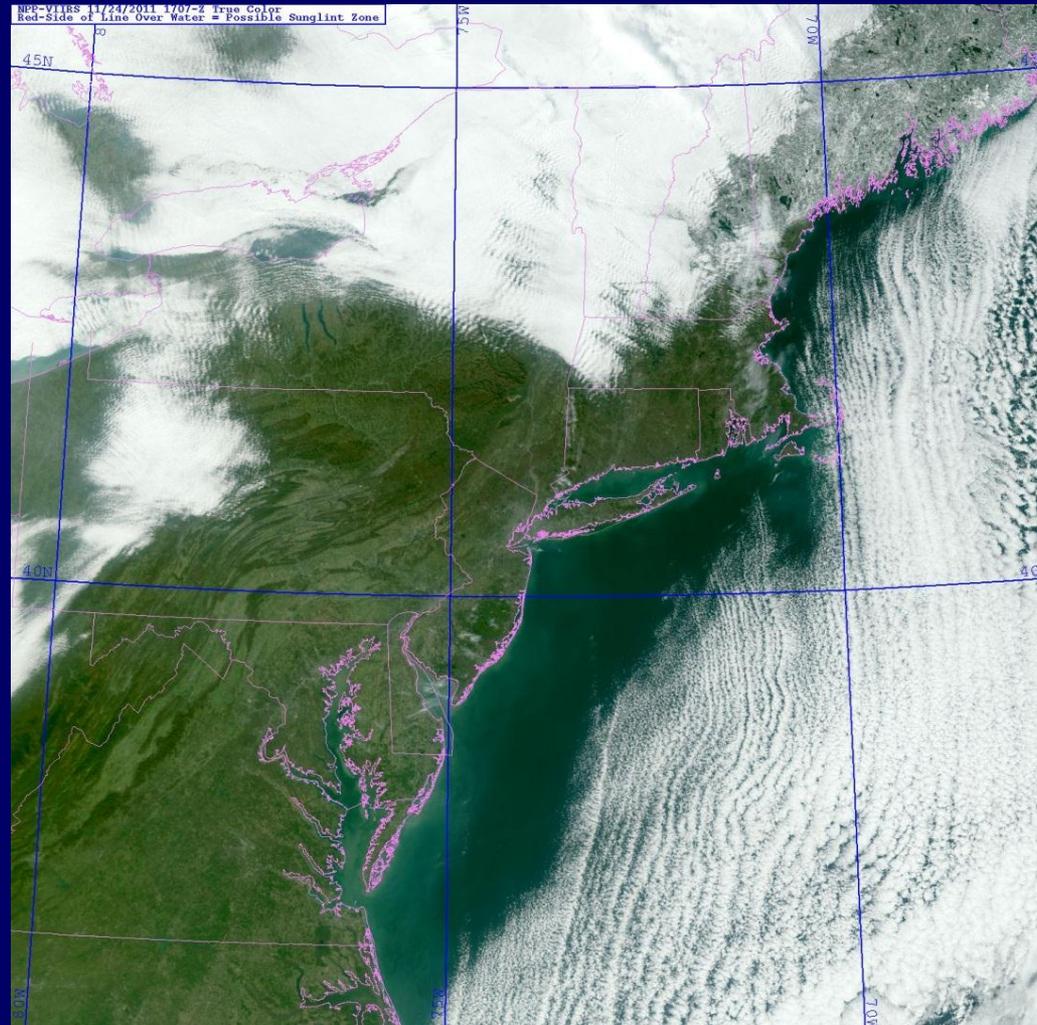




NPP VIIRS True Color Examples



Northeastern USA

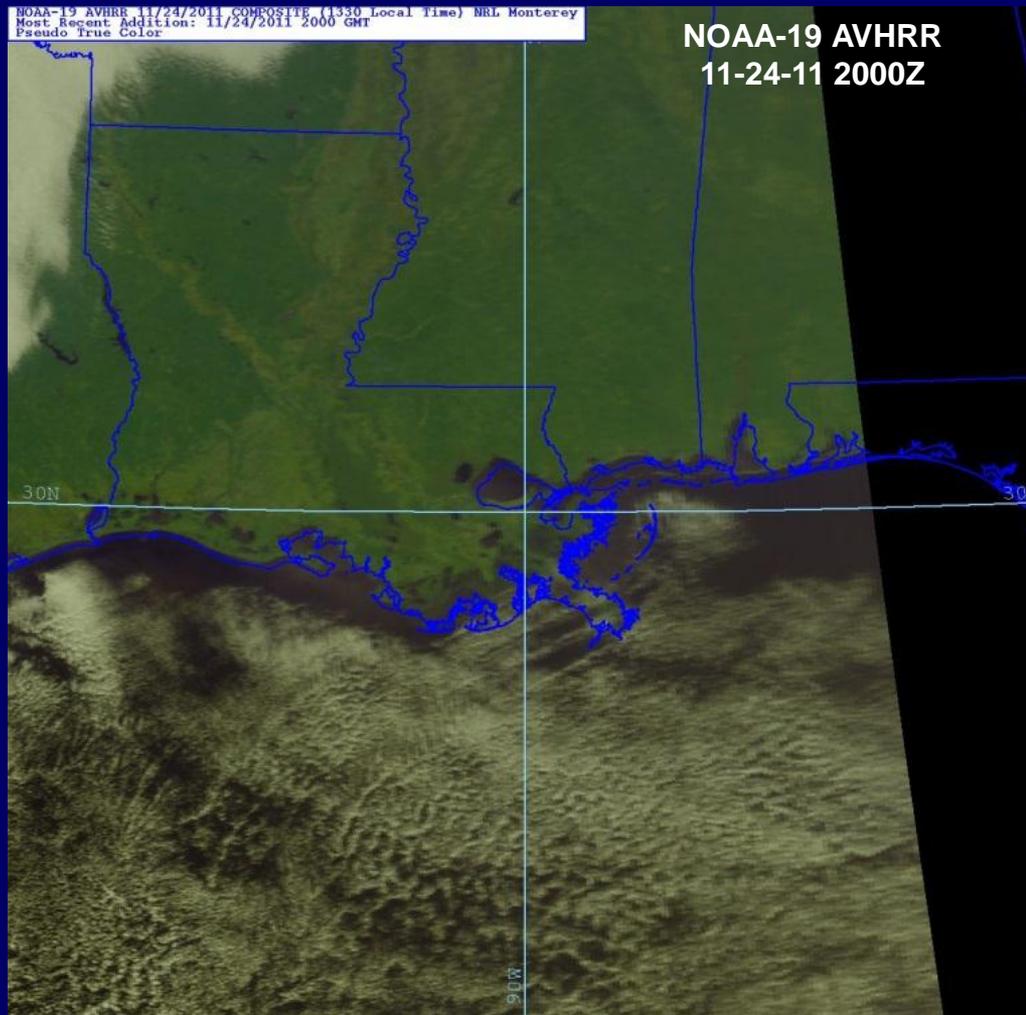




NPP VIIRS True Color Examples



New Orleans and Gulf of Mexico

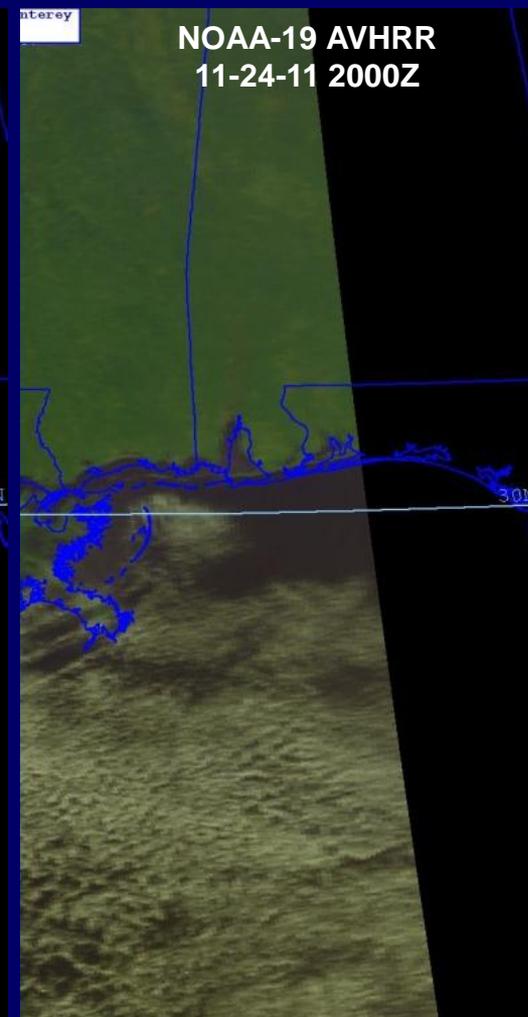
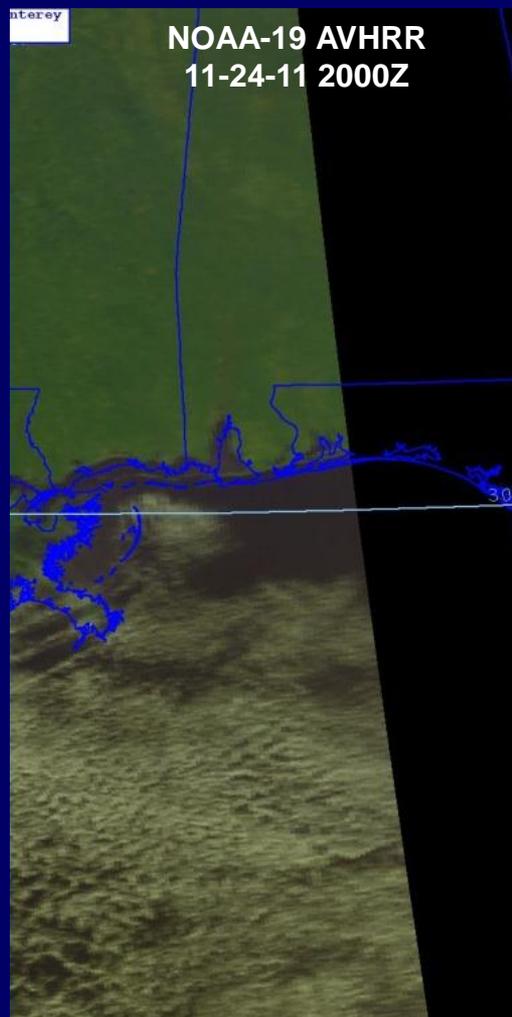




NPP VIIRS True Color Examples



Edge of Scan Intercomparisons

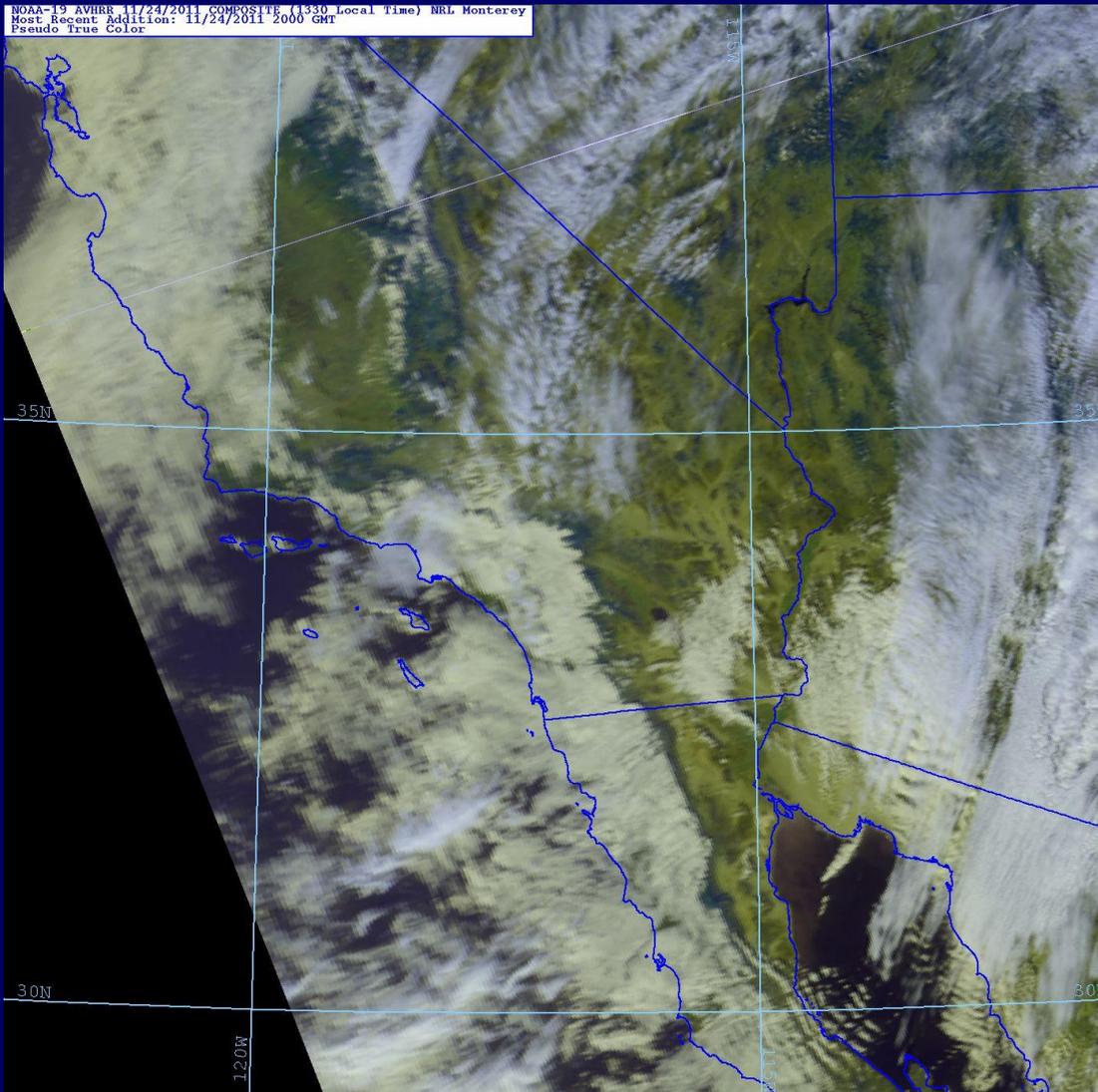




NPP VIIRS True Color Examples



Southwest US and Baja California



Note edge of scan
resolution
degradation with
MODIS imagery

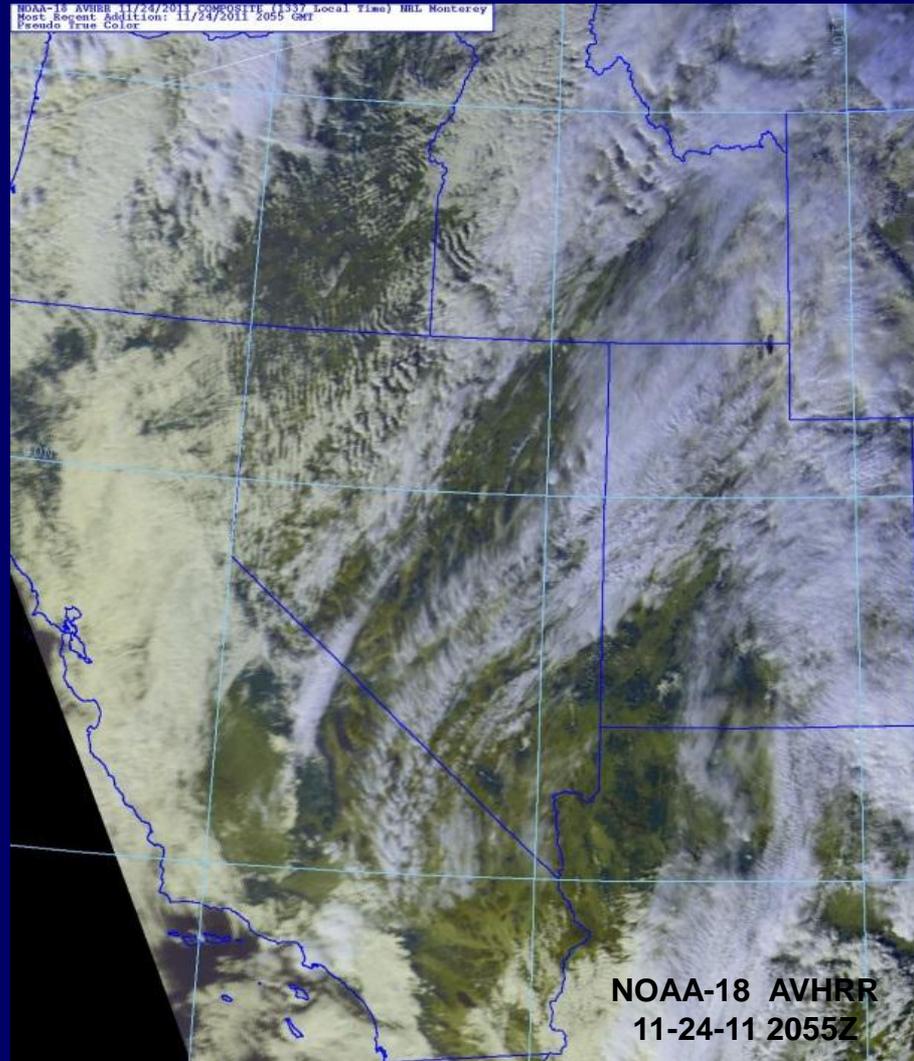


NPP VIIRS True Color Examples



Southwest US and Baja California

Note edge of scan
resolution
degradation with
MODIS imagery

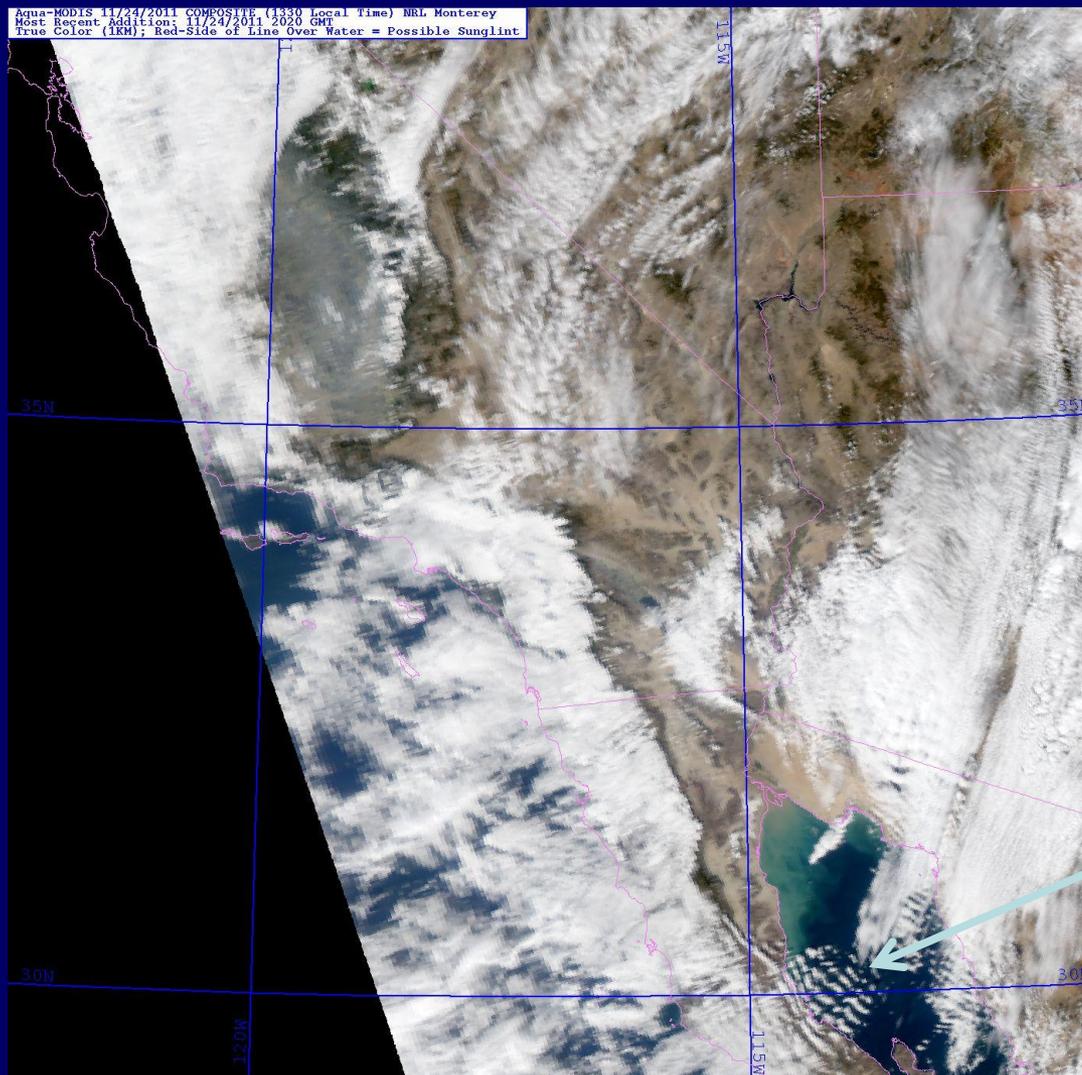




NPP VIIRS True Color Examples



Southwest US and Baja California Zoom-In

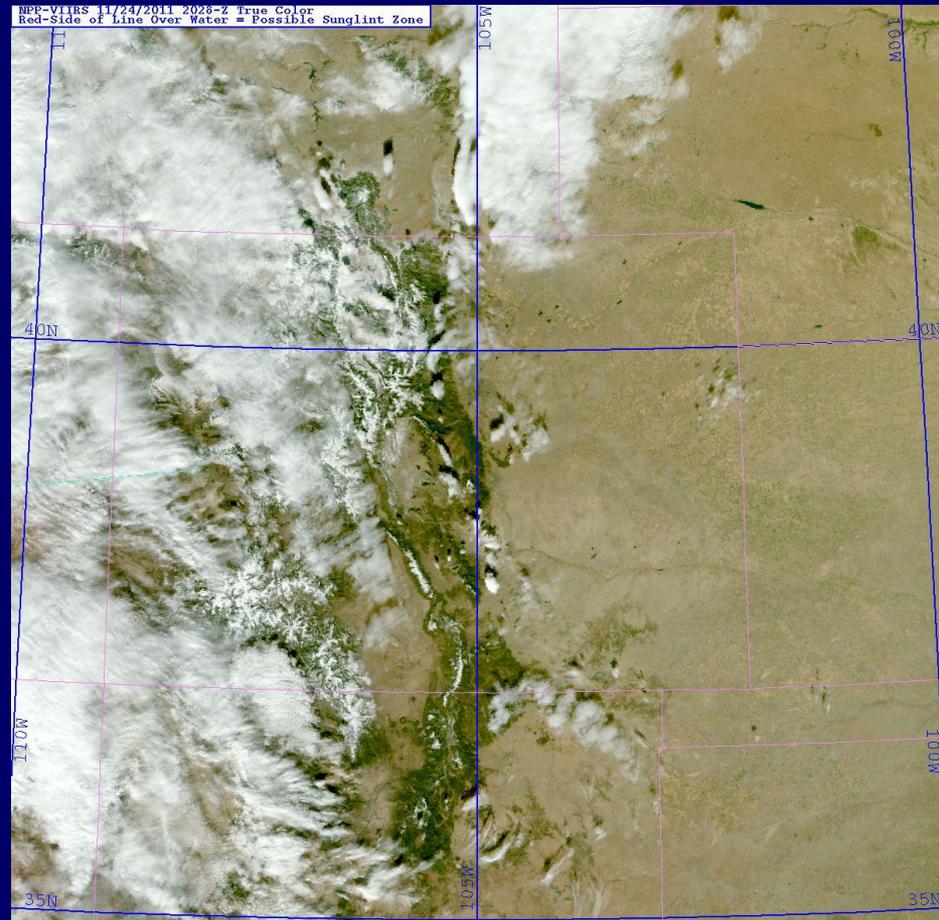
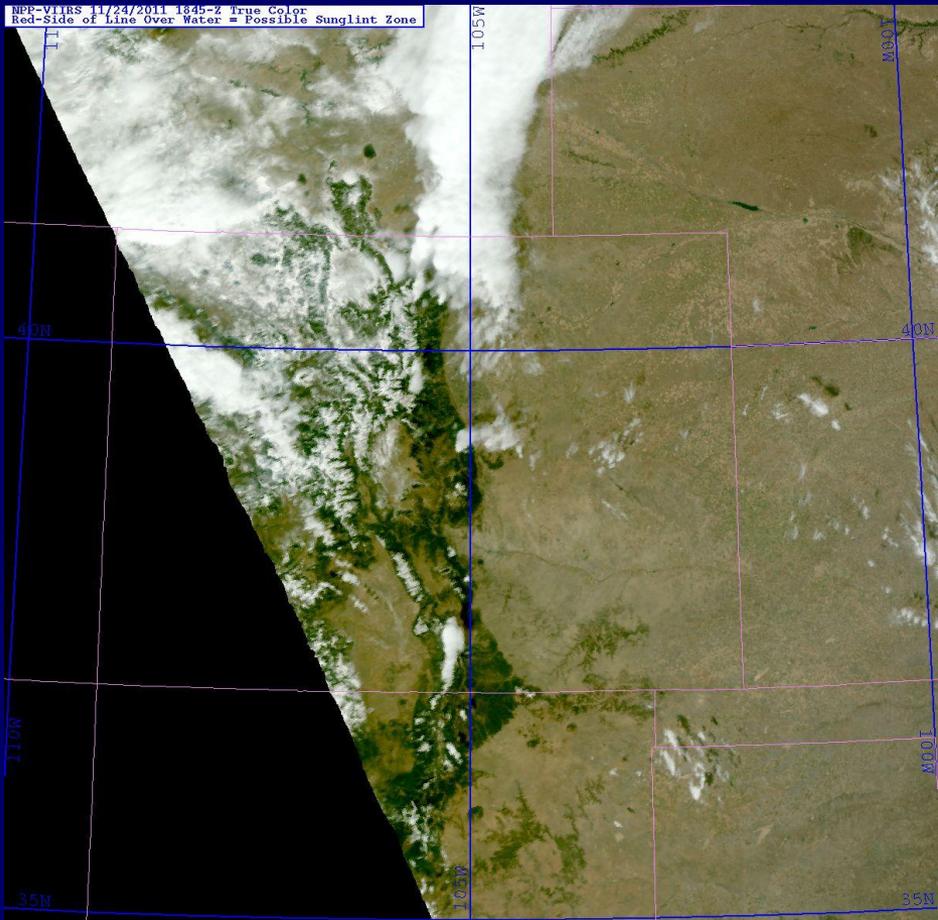


Orographic
Wave Clouds

Colorado

11.24.2011 1845 Z, Near Edge of Scan

11.24.2011 2028 UTC, Near Nadir



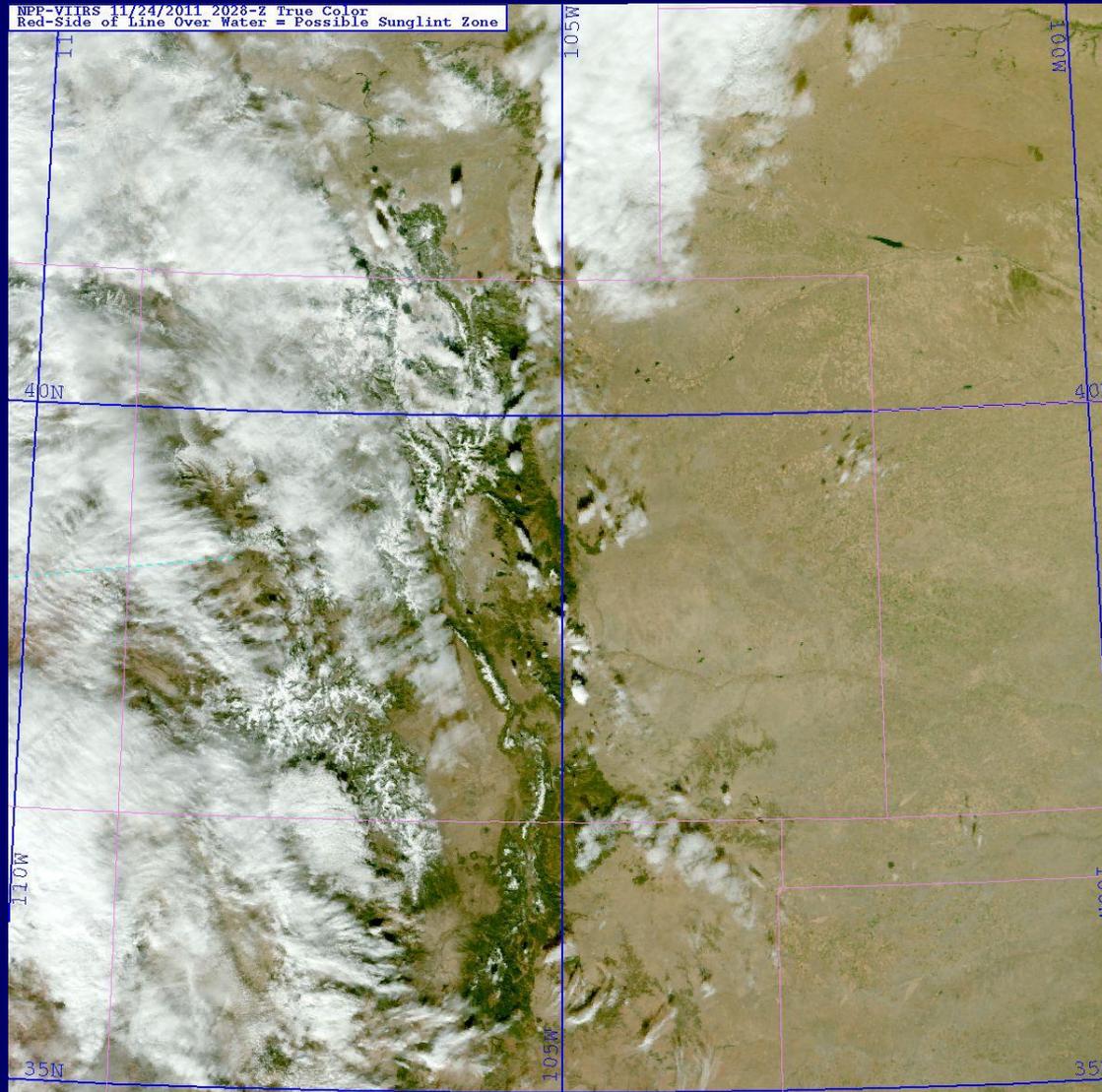
→ VIIRS maintains similar spatial resolution quality at edge of 3000 km swath⁴¹



NPP VIIRS True Color Examples



Colorado





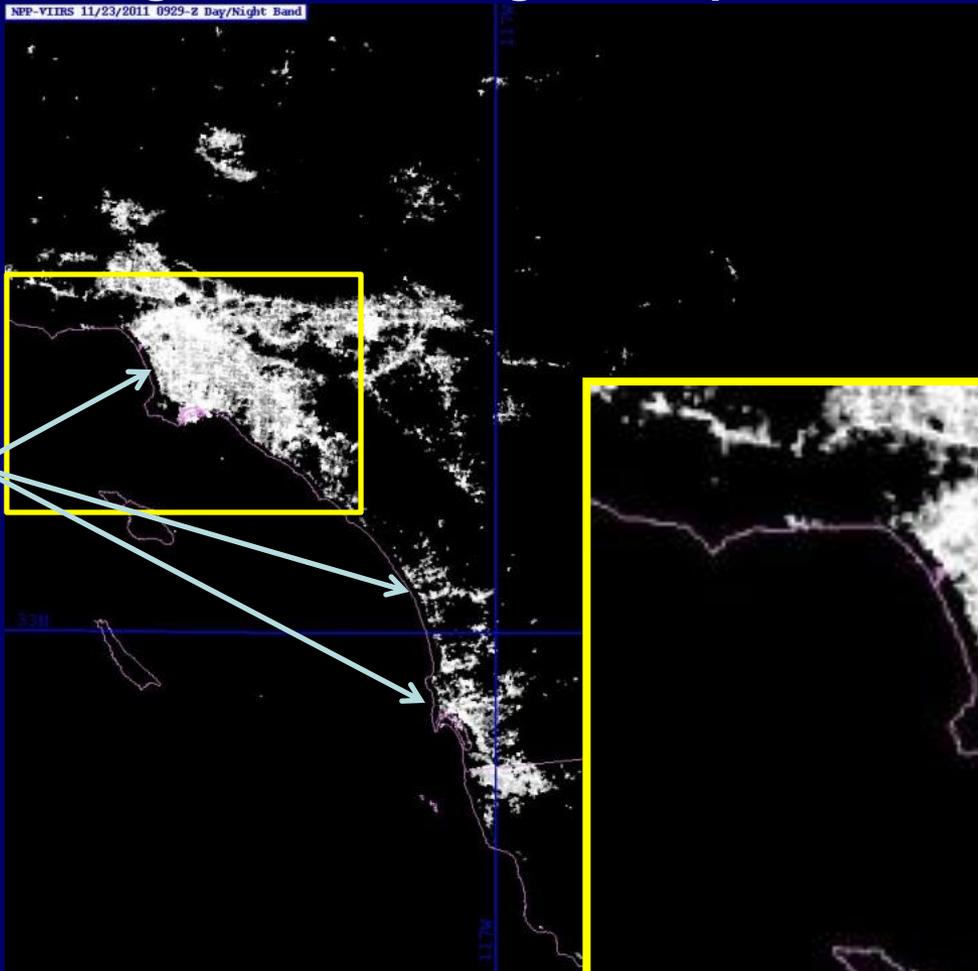
NPP VIIRS DNB Examples



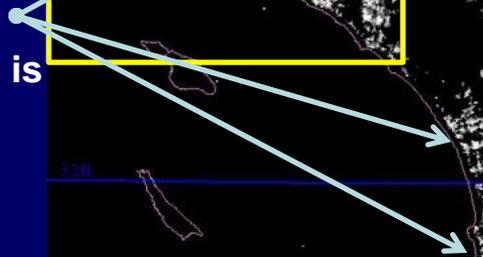
City Lights

Los Angeles & San Diego Metropolitan Areas

NPP-VIIRS 11/23/2011 0929-z Day/Night Band

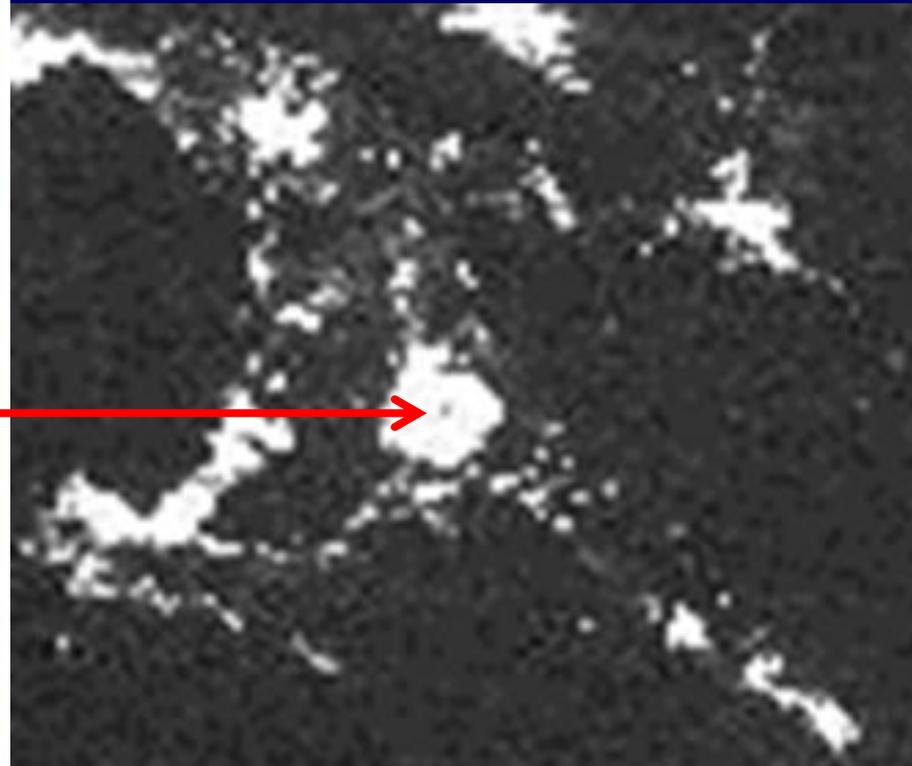
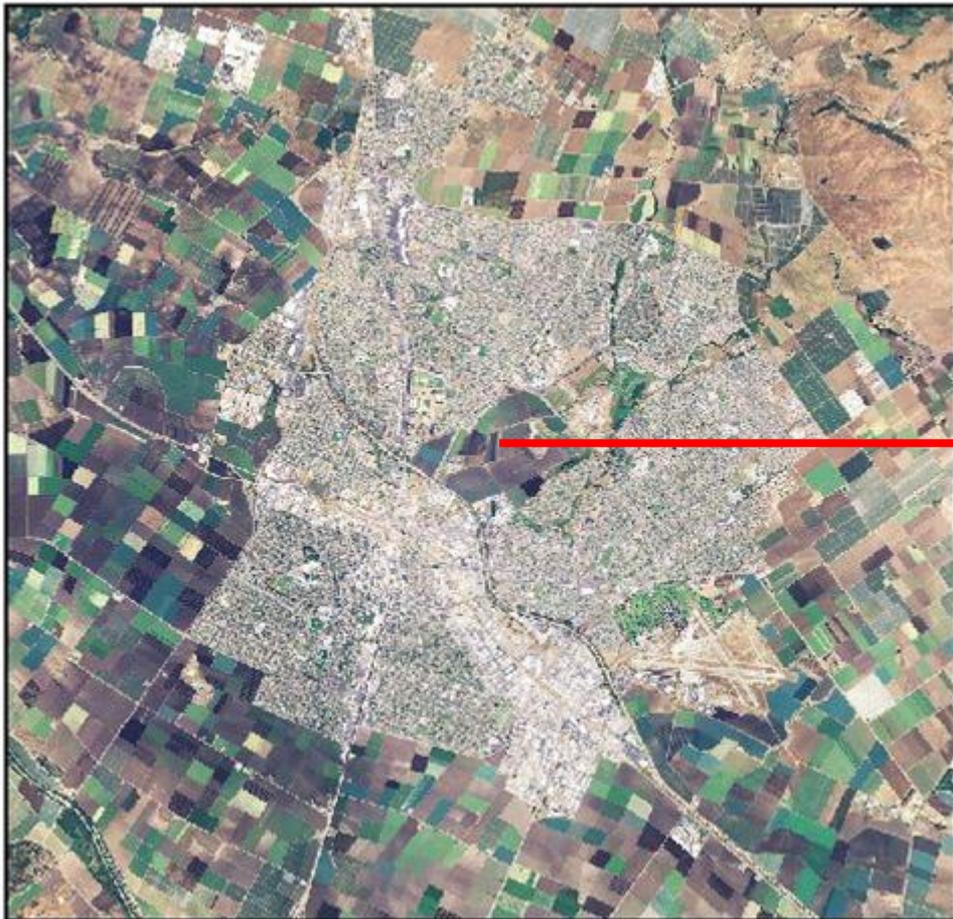


Slight geolocation bias evident in coastal city light imagery. Correction is pending analysis



Agriculture “hole” in Salinas (dark spot in right image)

★ Your town & state name here



VIIRS imagery issues/problems so far:

- **Missing geo-location** values in granules
- **Missing data** in granules
- Other **server (GRAVITE) issues**
 - Missing (or delayed) granules
 - Duplicate granules
- Lack of DNB EDR (NCC) imagery at night under conditions other than a full moon
- Padding stripes (fill values) from the use of GTM and a constant array size in the Imagery EDR

These issues are being confirmed at multiple sites, and addressed as **Discrepancy Reports**, and sent up the chain of command for resolution.

- Coordination with **VIIRS SDR Team**.
- Input for many other **EDR Teams**.
- **Future: JPSS-1 (2016) and JPSS-2 (2022)**