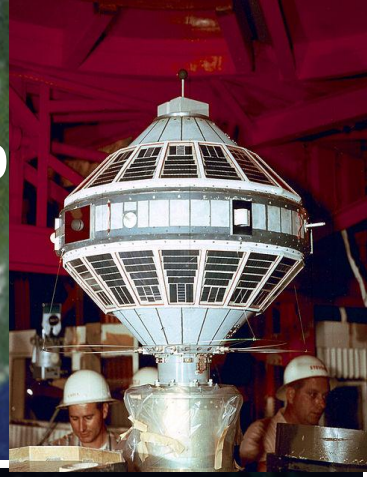
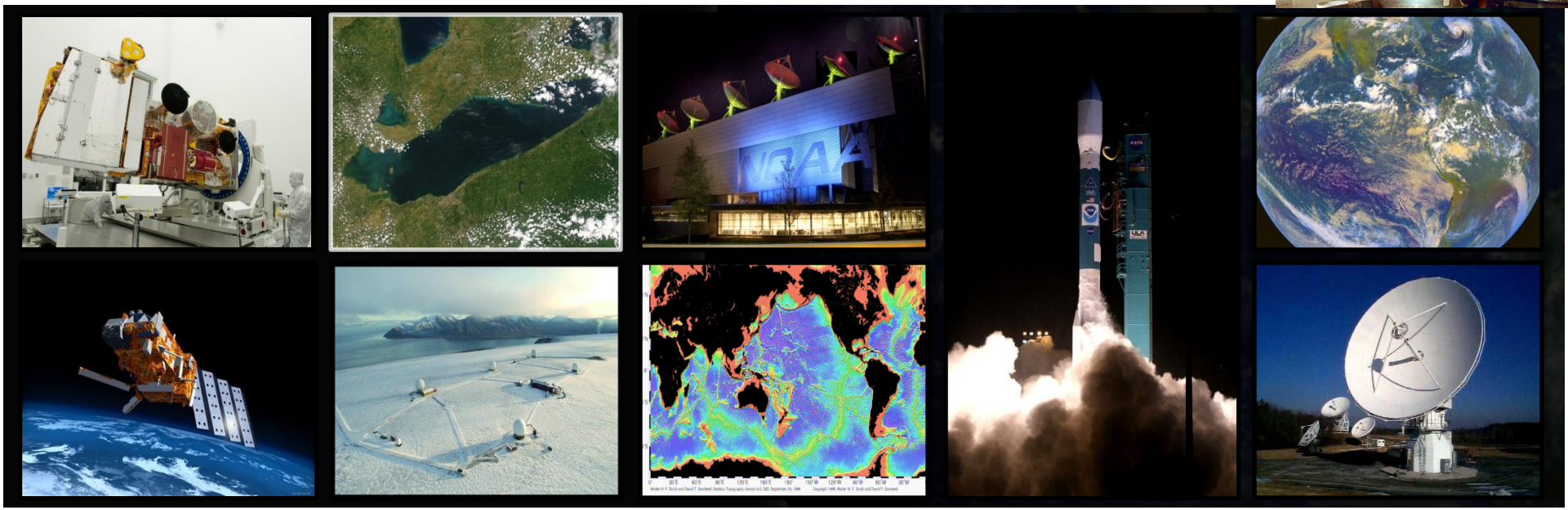
SUOMI National Polar-orbiting Partnership Status and Instrument Performance



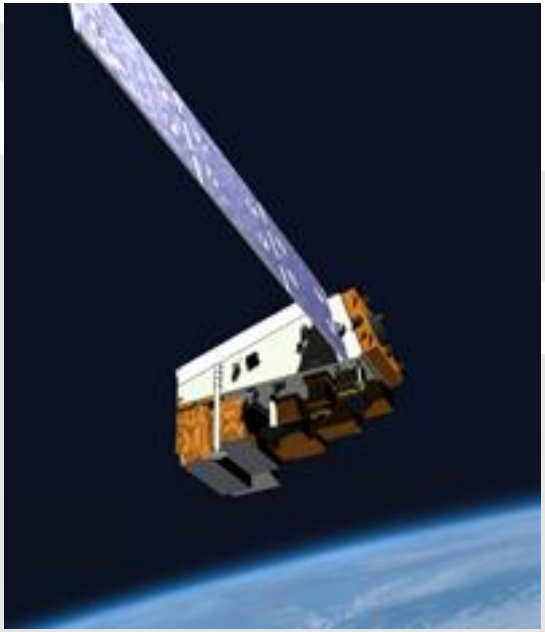


Mitchell D. Goldberg, NOAA JPSS Program Scientist

NPP to JPSS Program

Drivers and Benefits

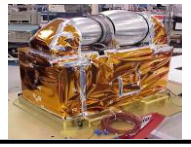
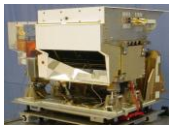
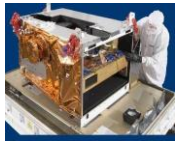
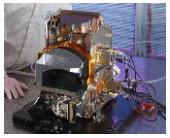
- Maintains continuity of weather/climate observations and critical environmental data from the polar orbit
- NOAA – JPSS provides improved continuity for POES
  - HIRS > CrIS
  - AMSU > ATMS
  - AVHRR > VIIRS
  - SBUV2 > OMPS
- NASA – JPSS provides continuity for EOS
  - AIRS > CrIS
  - AMSU > ATMS
  - MODIS > VIIRS
  - OMI > OMPS
  - CERES > CERES
  - AMSR-E > AMSR2 (JAXA-GCOM-W)



JPSS-1 Satellite

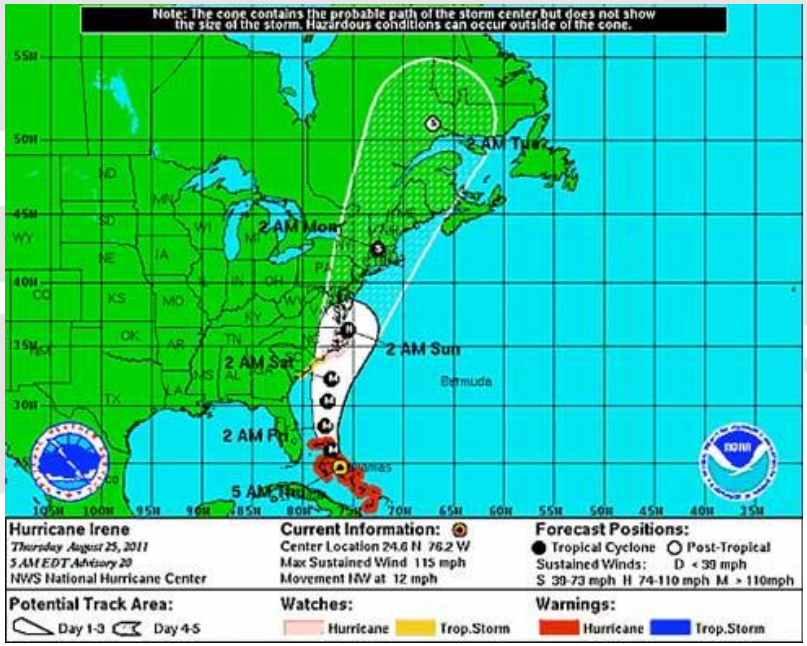
(NPP-clone)

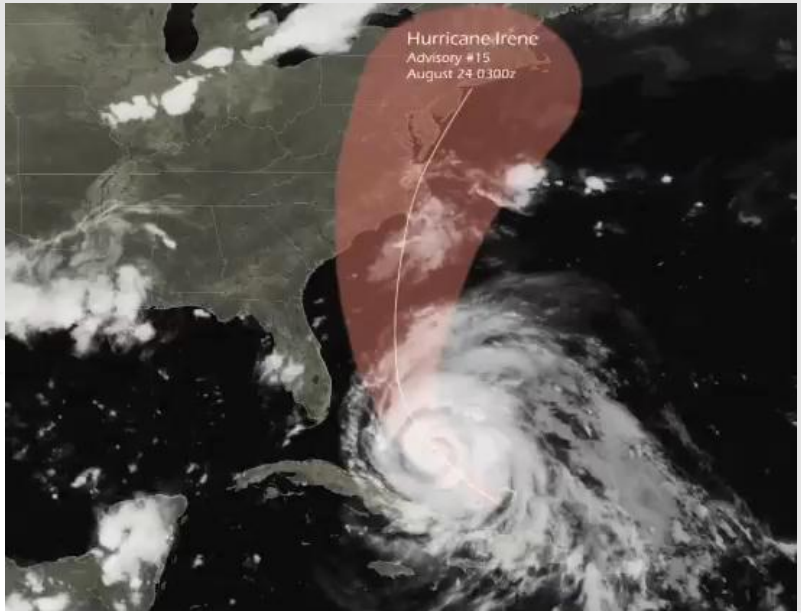
NPP/JPSS Instruments

NPP/JPSS Instrument		Benefits to the NOAA Mission
	ATMS (NGES)	ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 5 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks.
	CrIS (ITT)	
	VIIRS (Raytheon SAS)	VIIRS provide a large set of parameters including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton abundance/chlorophyll needed for environmental assessments which impacts human health and key economic sectors (transportation, fishing, energy, agriculture)
	OMPS (Ball Aerospace and Technology Corp)	Total ozone for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts
	CERES	Provide climate quality measurements of the Earth's outgoing radiation budget.

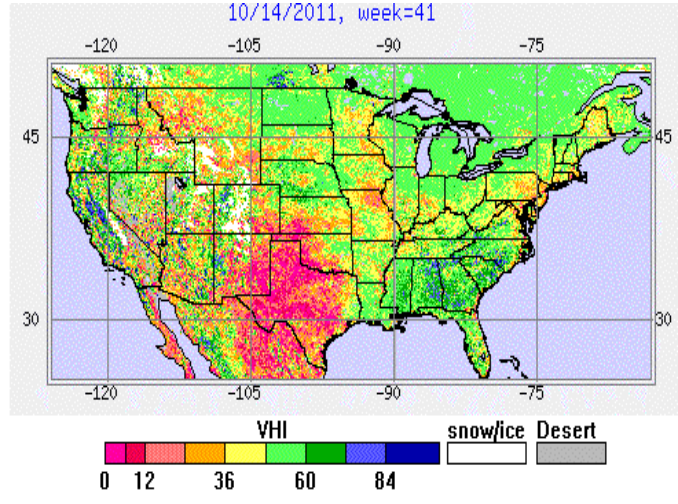
Weather Forecasting : JPSS Critical Mission

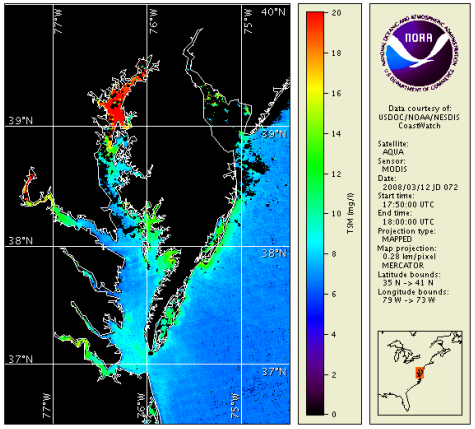
NPP/JPSS Instrument		NOAA Mission Benefits
	ATMS	ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 5 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks.
	CrIS	



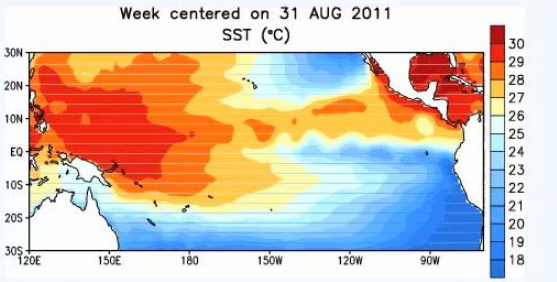


Operational applications for Decision makers

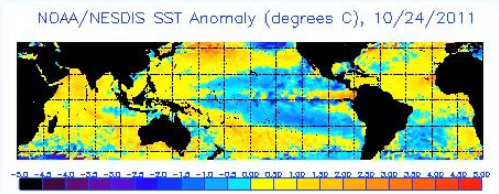


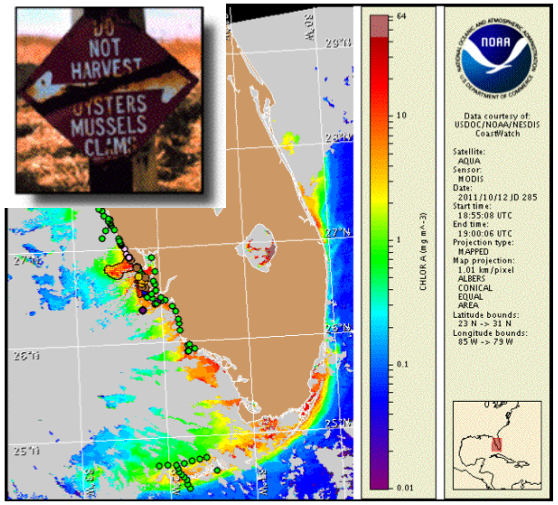


NOAA's El Niño Page

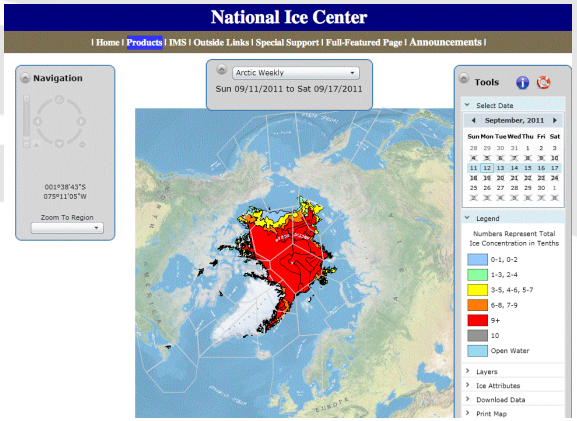


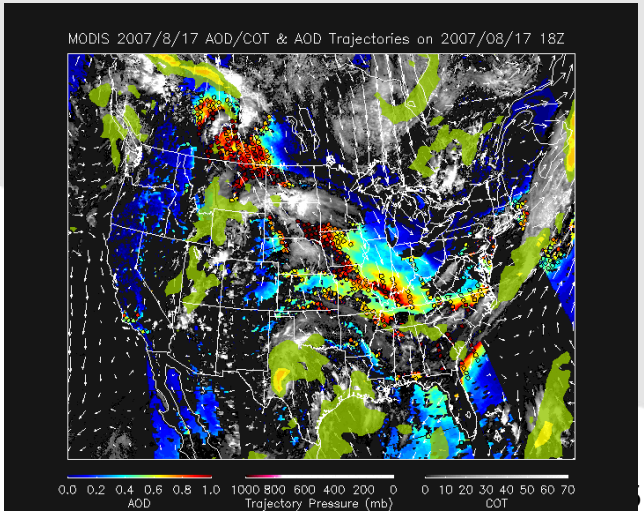
Sea surface temperature in the equatorial Pacific Ocean (above). El Niño is characterized by unusually warm temperatures and La Niña by unusually cool temperatures in the equatorial Pacific. Anomalies (below) represent deviations from normal temperature values, with unusually warm temperatures shown in red and unusually cold anomalies shown in blue.





Satellite chlorophyll image with possible HAB areas shown by red polygon(s). Cell concentration sampling data from October 3 to 12 shown as red (high), orange (medium), yellow (low b), brown (low a), blue(very low b), purple (very low a), pink (present), and green (not present). For a list of cell count data providers and a key to





National Oceanic and Atmospheric Administration's

National Weather Service

Home > Products > Valid Products > RFW

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000
WWUS82 KTAE 191842
RFWTAE

URGENT - FIRE WEATHER MESSAGE
NATIONAL WEATHER SERVICE TALLAHASSEE FL
142 PM EST THU JAN 19 2012

...A RED FLAG WARNING HAS BEEN ISSUED FOR PORTIONS OF SOUTH
CENTRAL GEORGIA UNTIL 5 PM EST THIS AFTERNOON DUE TO AROUND 4
HOURS OF RELATIVE HUMIDITY BELOW 25 PERCENT...

GAZ125>131-145>148-157>161-192200-
/O.NEW.KTAE.FW.W.0006.120119T1842Z-120119T2200Z/
DOUGHERTY-LEE-WORTH-TURNER-TIFT-BEN HILL-IRWIN-MITCHELL-COLQUITT-
COOK-BERRIEN-GRADY-THOMAS-BROOKS-LOWNDES-LANIER-
142 PM EST THU JAN 19 2012

...RED FLAG WARNING IN EFFECT UNTIL 5 PM EST THIS AFTERNOON...

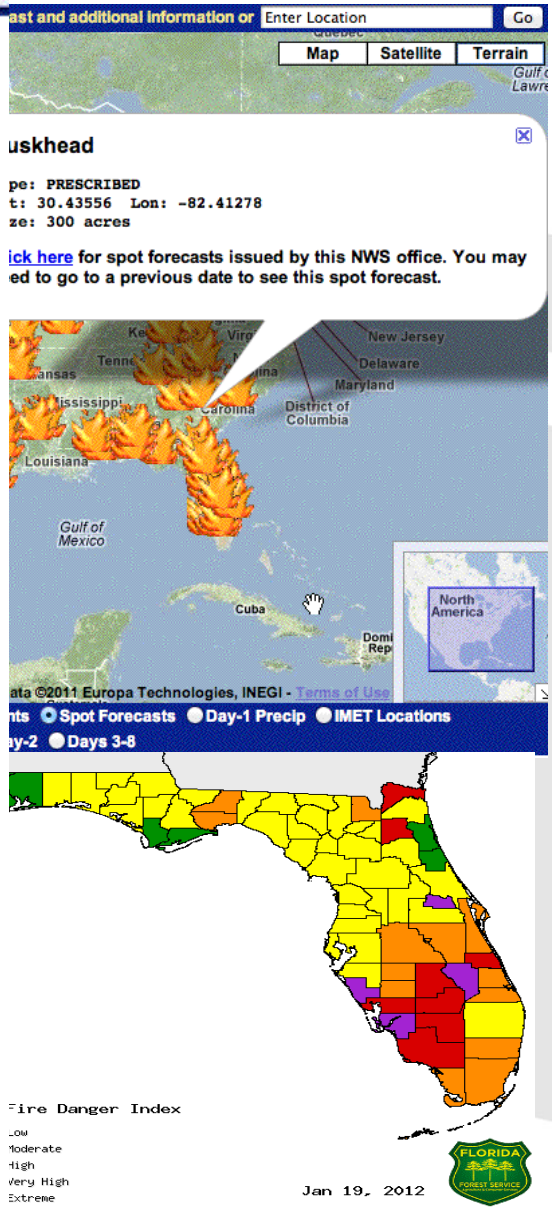
THE NATIONAL WEATHER SERVICE IN TALLAHASSEE HAS ISSUED A RED FLAG
WARNING...WHICH IS IN EFFECT UNTIL 5 PM EST THIS AFTERNOON.

* HUMIDITY...MINIMUM VALUES LESS THAN 25 PERCENT FOR FOUR HOURS.

* IMPACTS...ANY FIRES THAT DEVELOP WILL LIKELY SPREAD RAPIDLY.
  OUTDOOR BURNING IS NOT RECOMMENDED.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A RED FLAG WARNING MEANS THAT CRITICAL FIRE WEATHER CONDITIONS
ARE EITHER OCCURRING NOW...OR WILL SHORTLY. LOW RELATIVE HUMIDITY
WILL ENHANCE FIRE GROWTH POTENTIAL.
```



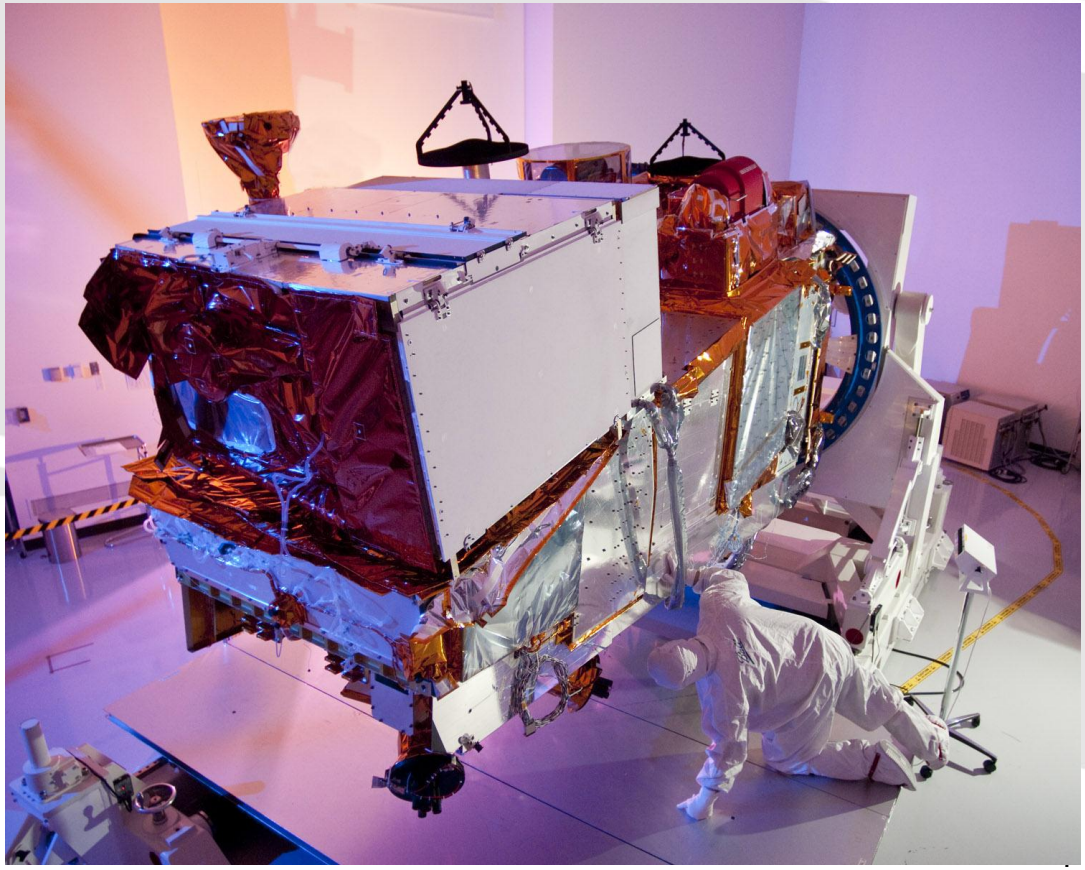
Visible Infrared Imaging Radiometer Suite
Raytheon SAS El Segundo, Ca

Description

- **Purpose:** Global observations of land, ocean, & atmosphere parameters at high temporal resolution (~ daily)
- **Predecessor Instruments:** AVHRR, OLS, MODIS, SeaWiFS
- **Approach:** Multi-spectral scanning radiometer (22 bands between 0.4 µm and 12 µm) 12-bit quantization
- **Swath width:** 3000 km

Spatial Resolution

- 16 bands at 750m
- 5 bands at 375m
- DNB



VIIRS on NPP

VIIRS has a very large cross track and near constant spatial resolution

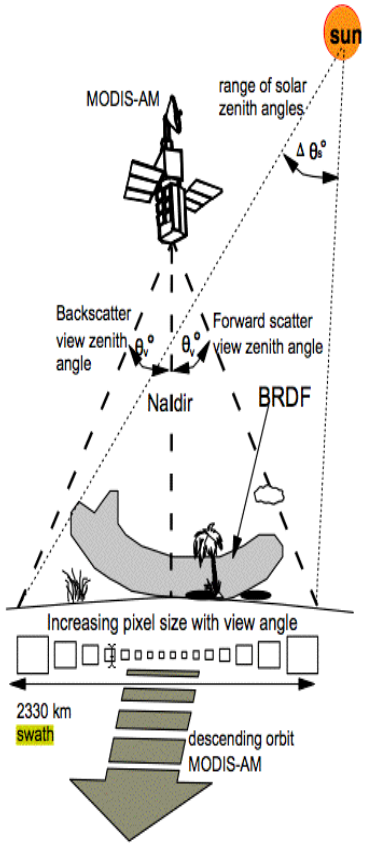
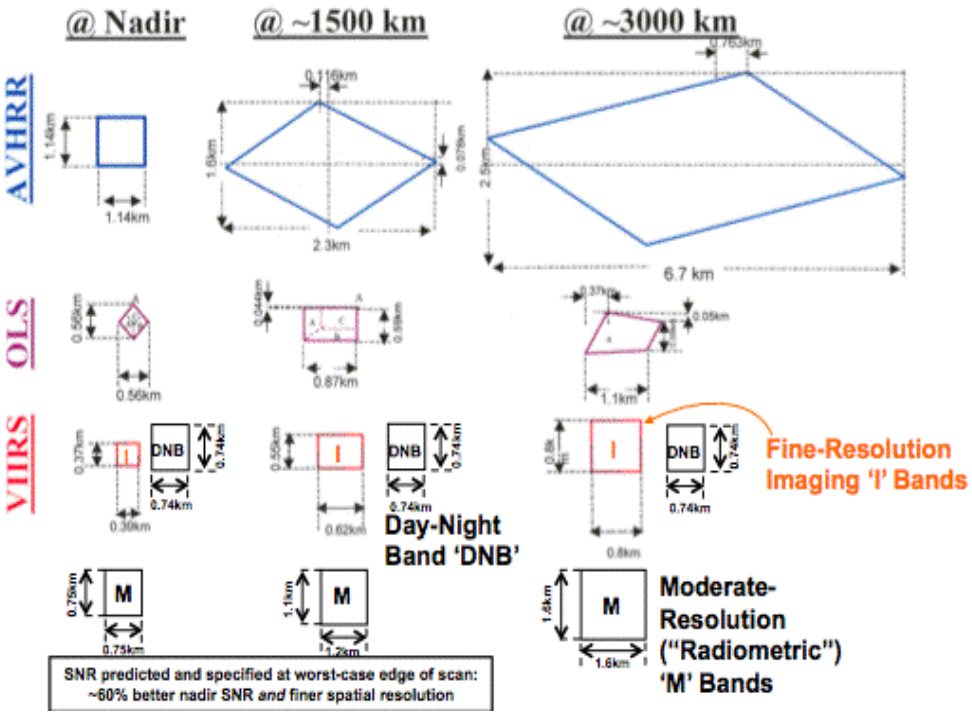


Figure 3.2.3: Illustration of MODIS data acquisition on the EOS-AM platform (not to scale). The bidirectional reflectance distribution function (BRDF) changes with view and sun geometry. Notice the shadow caused by clouds and canopy. MODIS pixel dimensions, cross-track and along-track, change with scan angles: 0° - 250 x 250 m; 15° - 270 x 260 m; 30° - 350 x 285 m; 45° - 610 x 380 m

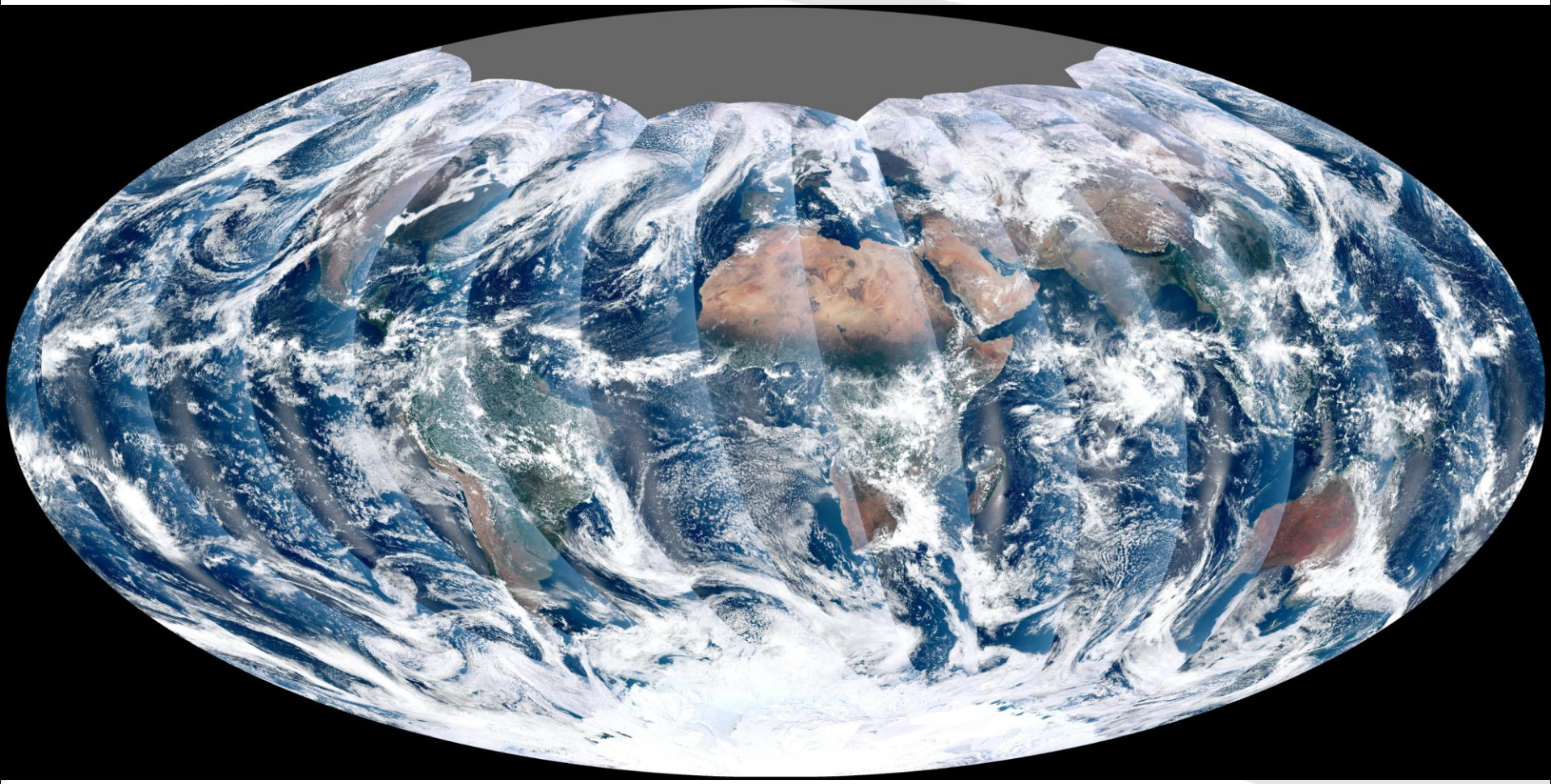


VIIRS Prelaunch Performance
(NPP F1 Bands and SNR/NEDT)

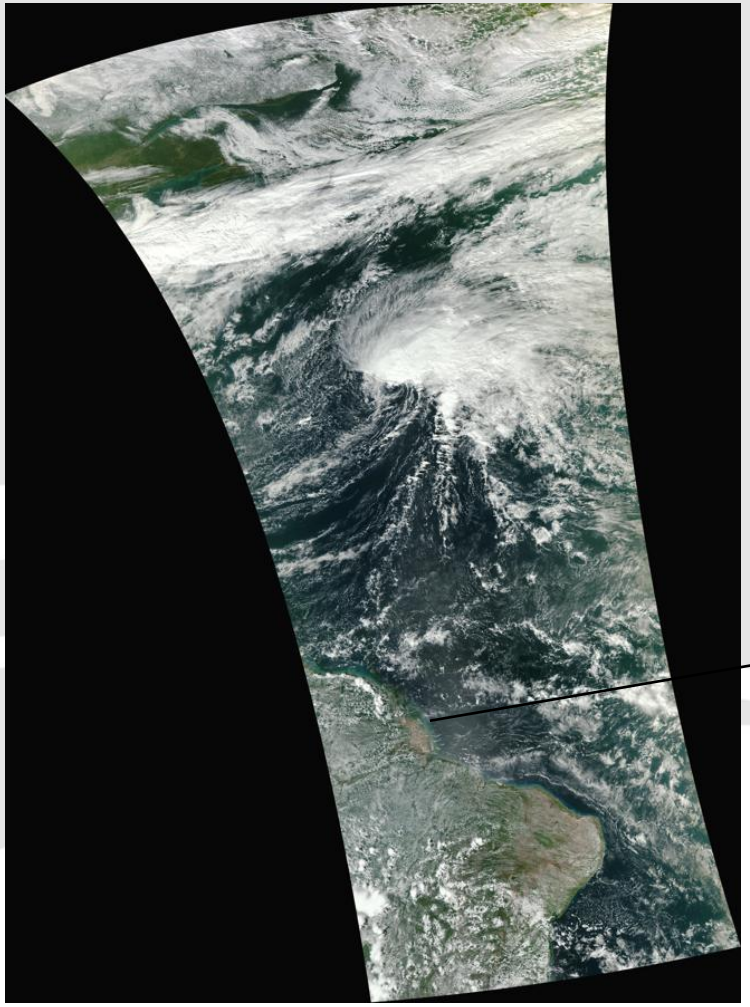
		Band No.	Driving EDR(s)	Specification: Spectral Range (um)	Horiz Sample Interval (km) (track x Scan) Nadir	Horiz Sample Interval (km) (track x Scan) End of Scan	Band Gain	Ltyp or Ttyp (Spec)	Lmax or Tmax	SNR or NEdT (K)	Measured SNR or NEdT (K)	SNR Margin (%)
Reflective Bands	VisNIR	M1	Ocean Color Aerosol	0.402 - 0.422	0.742 x 0.259	1.60 x 1.58	High Low	44.9 155	135 615	352 316	723 1327	105% 320%
Reflective Bands	VisNIR	M2	Ocean Color Aerosol	0.436 - 0.454	0.742 x 0.259	1.60 x 1.58	High Low	40 146	127 687	380 409	576 1076	51.5% 163%
Reflective Bands	VisNIR	M3	Ocean Color Aerosol	0.478 - 0.498	0.742 x 0.259	1.60 x 1.58	High Low	32 123	107 702	416 414	658 1055	58.2% 155%
Reflective Bands	VisNIR	M4	Ocean Color Aerosol	0.545 - 0.565	0.742 x 0.259	1.60 x 1.58	High Low	21 90	78 667	362 315	558 882	54.1% 180%
Reflective Bands	VisNIR	I1	Imagery EDR	0.600 - 0.680	0.371 x 0.387	0.80 x 0.789	Single	22	718	119	265	122.7%
Reflective Bands	VisNIR	M5	Ocean Color Aerosol	0.662 - 0.682	0.742 x 0.259	1.60 x 1.58	High Low	10 68	59 651	242 360	360 847	49% 135%
Reflective Bands	VisNIR	M6	Atmosph. Correct.	0.739 - 0.754	0.742 x 0.776	1.60 x 1.58	Single	9.6	41	199	394	98.0%
Reflective Bands	VisNIR	I2	NDVI	0.846 - 0.885	0.371 x 0.387	0.80 x 0.789	Single	25	349	150	299	99.3%
Reflective Bands	VisNIR	M7	Ocean Color Aerosol	0.846 - 0.885	0.742 x 0.259	1.60 x 1.58	High Low	6.4 33.4	29 349	215 340	545 899	154% 164%
Reflective Bands	S/WMIR	M8	Cloud Particle Size	1.230 - 1.250	0.742 x 0.776	1.60 x 1.58	Single	5.4	165	74	349	371.6%
Reflective Bands	S/WMIR	M9	Cirrius/Cloud Cover	1.371 - 1.386	0.742 x 0.776	1.60 x 1.58	Single	6	77.1	83	247	197.6%
Reflective Bands	S/WMIR	I3	Binary Snow Map	1.580 - 1.640	0.371 x 0.387	0.80 x 0.789	Single	7.3	72.5	6	165	2650.0%
Reflective Bands	S/WMIR	M10	Snow Fraction	1.580 - 1.640	0.742 x 0.776	1.60 x 1.58	Single	7.3	71.2	342	695	103.2%
Reflective Bands	S/WMIR	M11	Clouds	2.225 - 2.275	0.742 x 0.776	1.60 x 1.58	Single	0.12	31.8	10	18	80.0%
Emissive Bands	S/WMIR	I4	Imagery Clouds	3.550 - 3.930	0.371 x 0.387	0.80 x 0.789	Single	270	353	2.5	0.4	84.0%
Emissive Bands	S/WMIR	M12	SST	3.660 - 3.840	0.742 x 0.776	1.60 x 1.58	Single	270	353	0.396	0.12	69.7%
Emissive Bands	S/WMIR	M13	SST Fires	3.973 - 4.128	0.742 x 0.259	1.60 x 1.58	High Low	300 380	343 634	0.107 0.423	0.044 --	59% --
Emissive Bands	LWIR	M14	Cloud Top Properties	8.400 - 8.700	0.742 x 0.776	1.60 x 1.58	Single	270	336	0.091	0.054	40.7%
Emissive Bands	LWIR	M15	SST	10.263 - 11.263	0.742 x 0.776	1.60 x 1.58	Single	300	343	0.07	0.028	60.0%
Emissive Bands	LWIR	I5	Cloud Imagery	10.500 - 12.400	0.371 x 0.387	0.80 x 0.789	Single	210	340	1.5	0.41	72.7%
Emissive Bands	LWIR	M16	SST	11.538 - 12.488	0.742 x 0.776	1.60 x 1.58	Single	300	340	0.072	0.036	50.0%

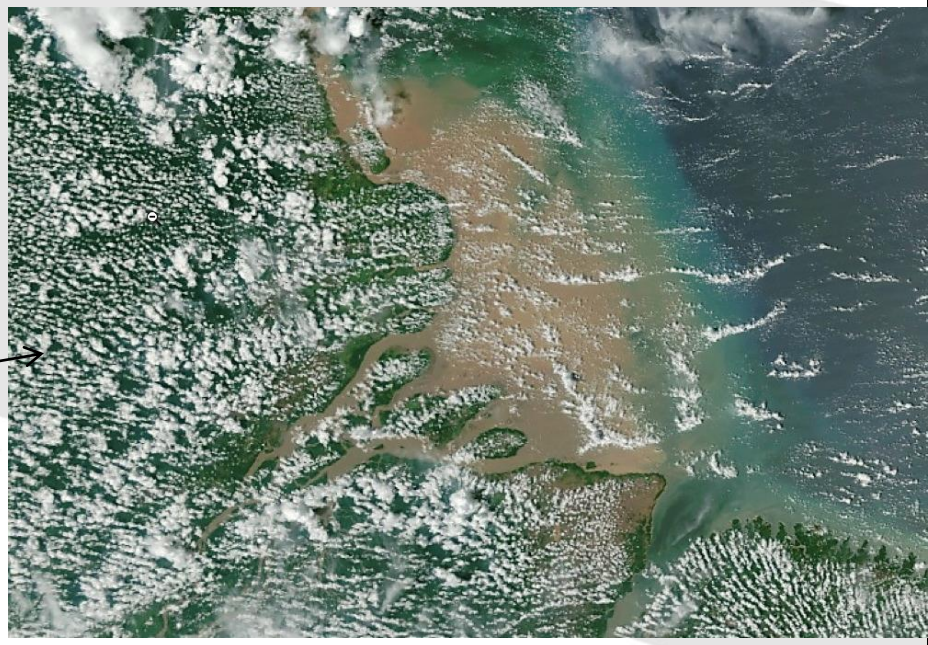
HSI uses 3 in-scan pixels aggregation at Nadir

Courtesy of H. Oudrari

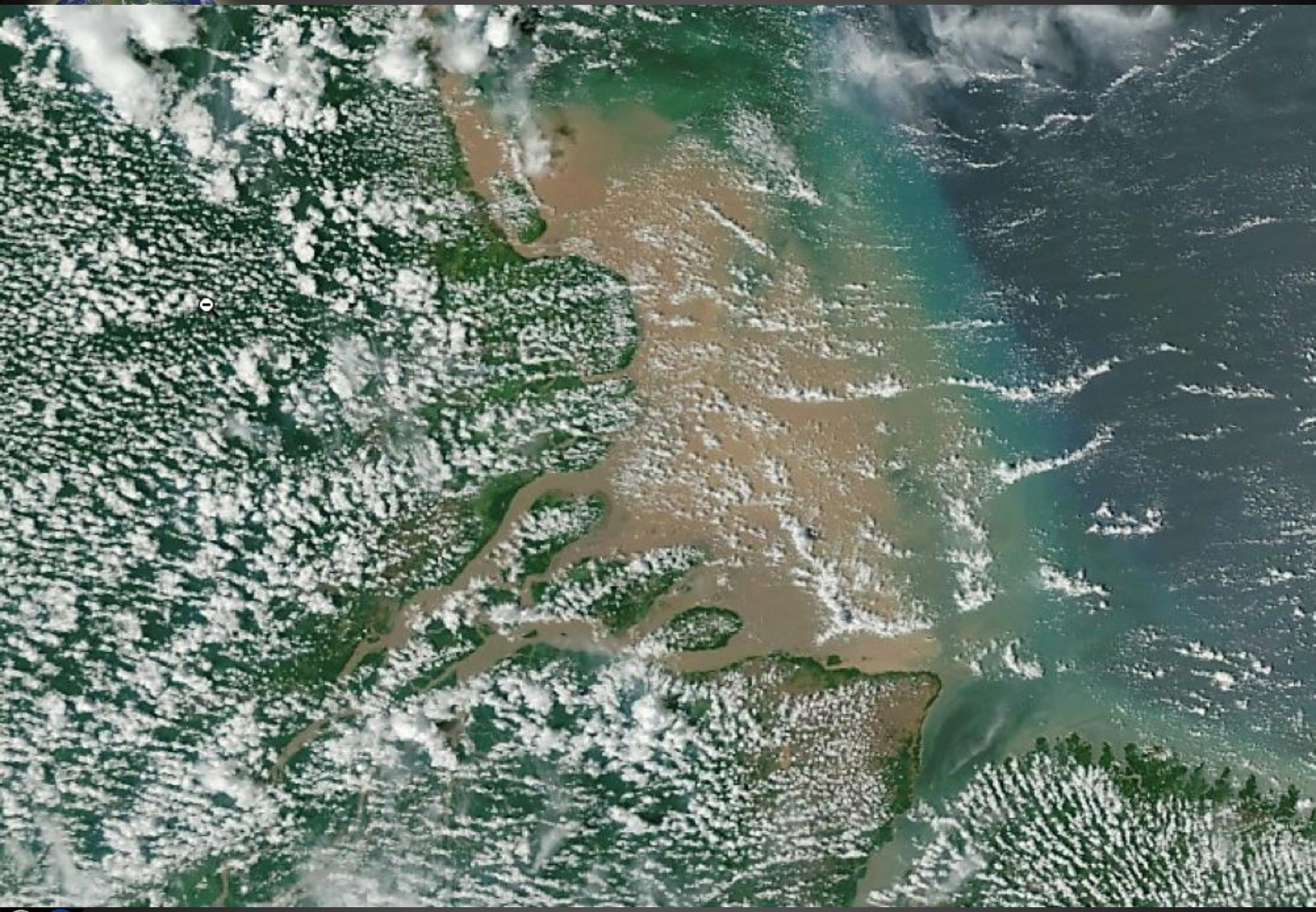


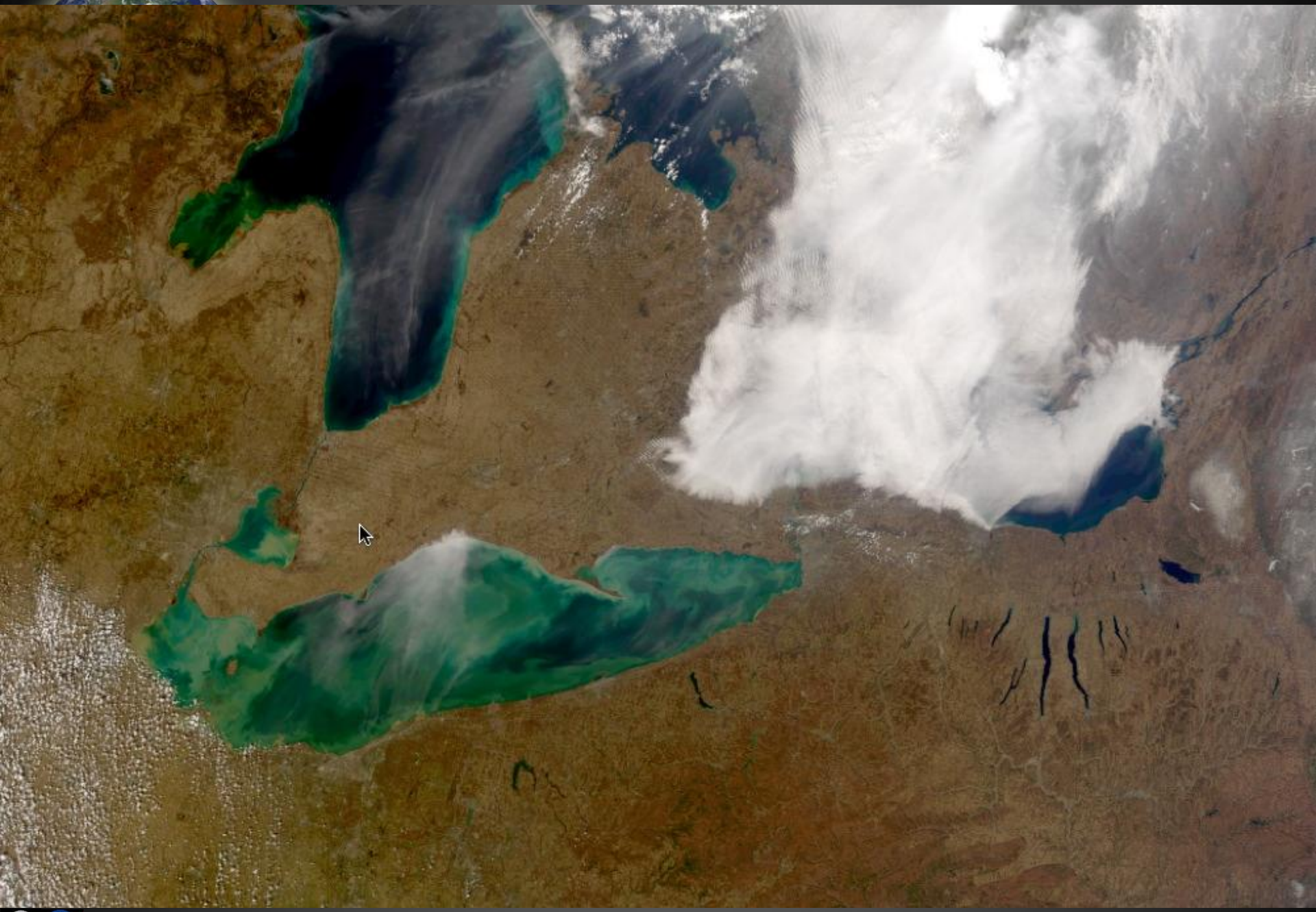
First VIIRS Imagery





11

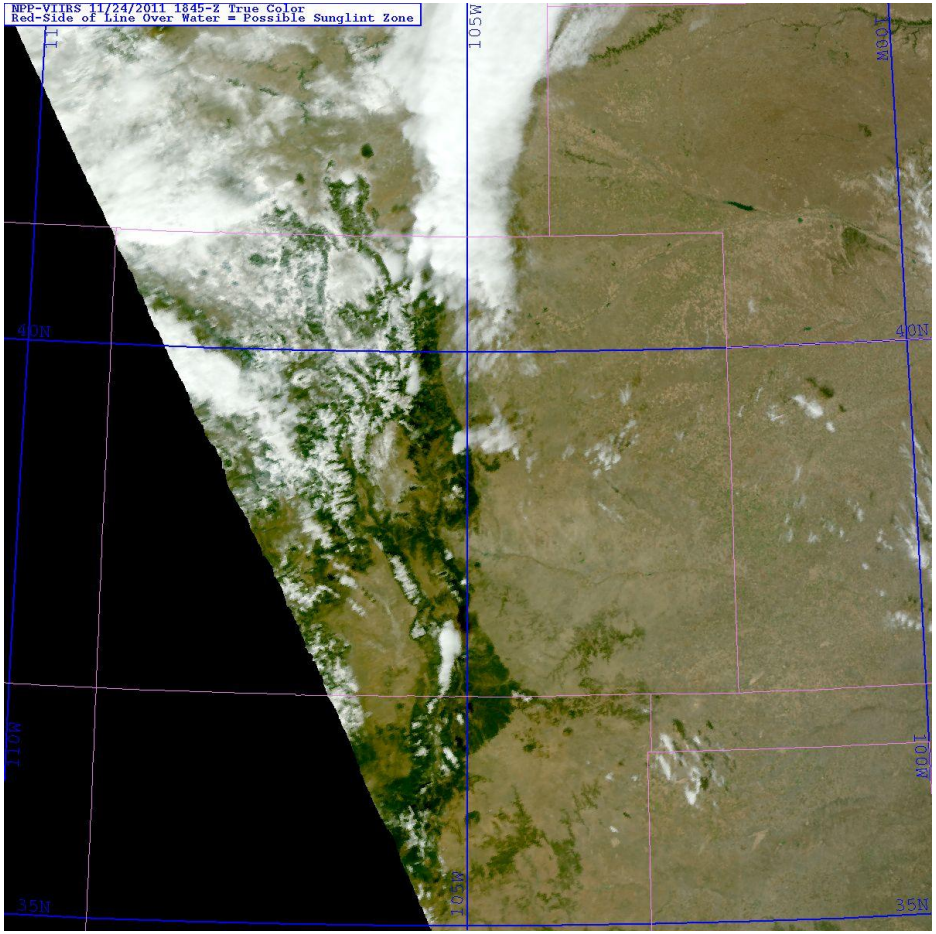




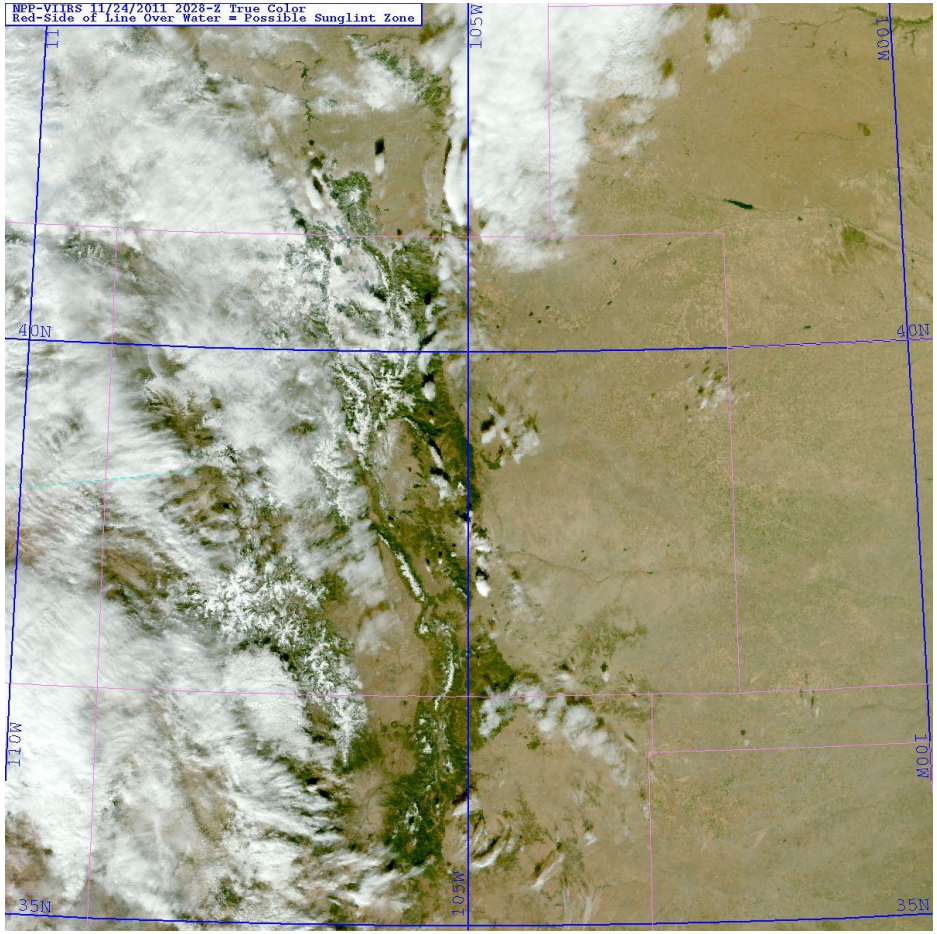
NPP VIIRS True Color Examples

Colorado

11.24.2011 1845 Z, Near Edge of Scan



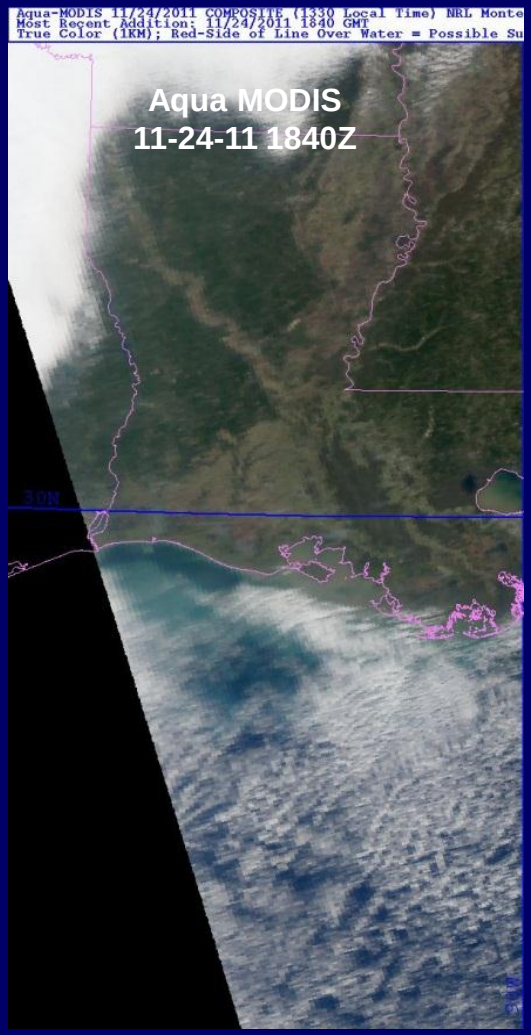
11.24.2011 2028 UTC, Near Nadir

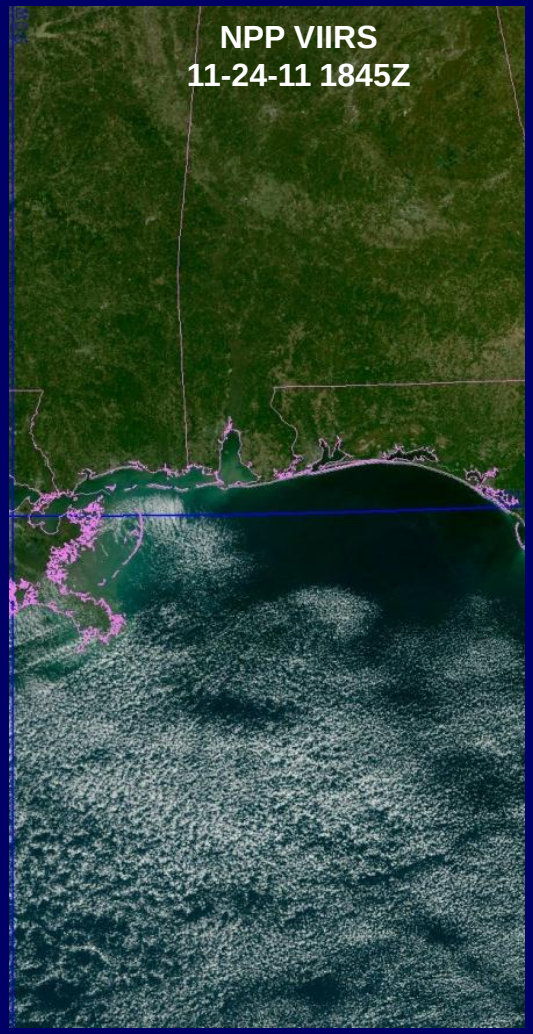


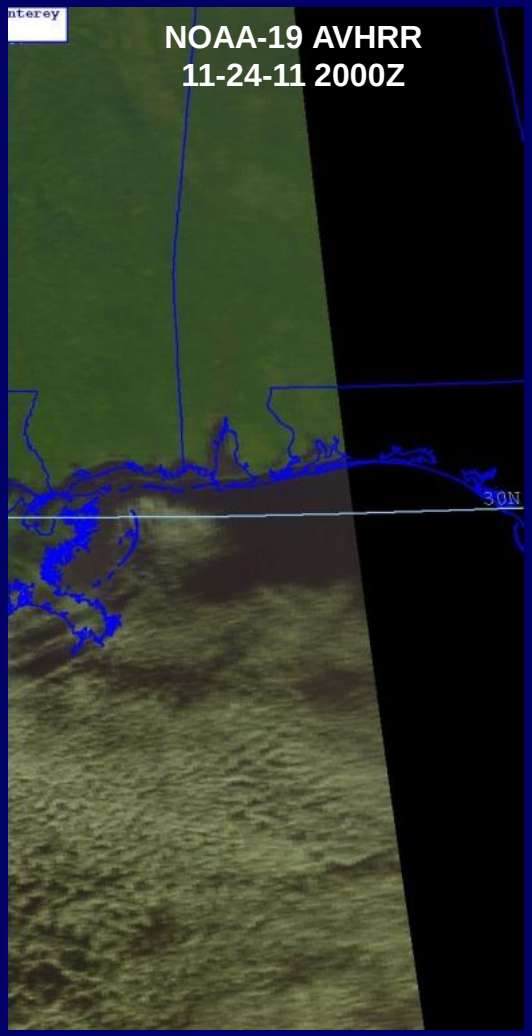
→ VIIRS maintains similar spatial resolution quality at edge of 3000 km swath

NPP VIIRS True Color Examples

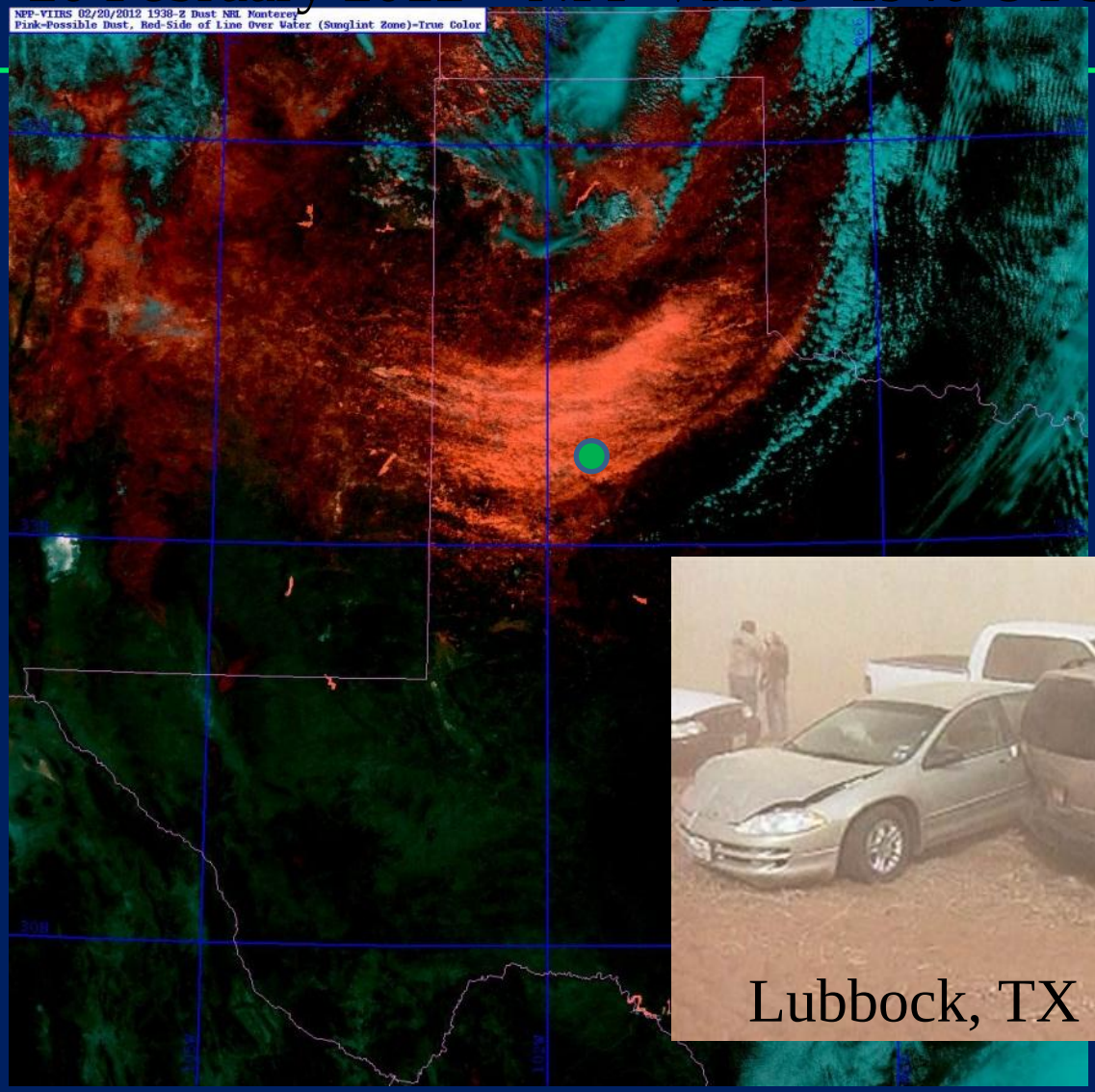
Edge of Scan Intercomparisons







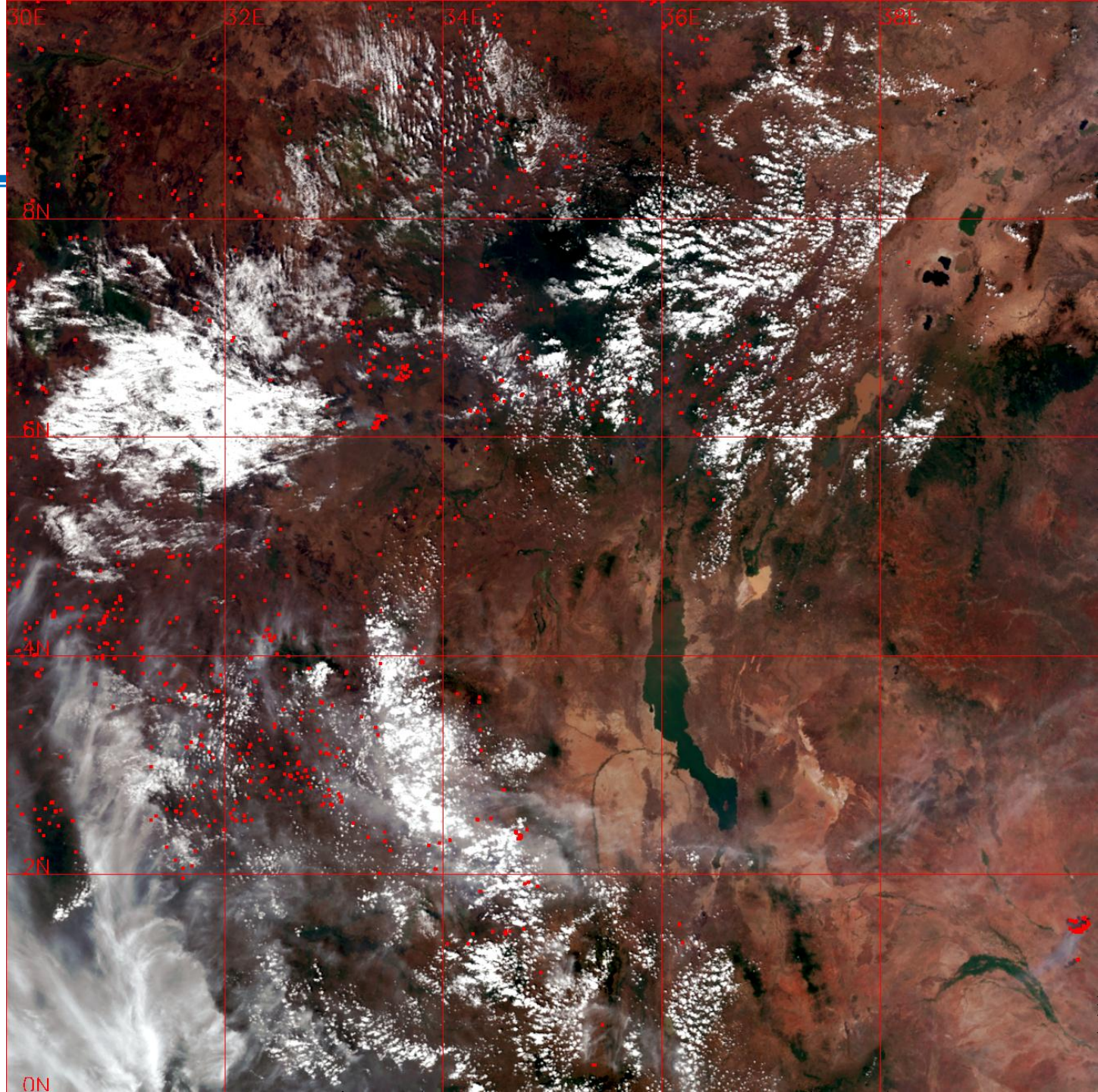
20 February 2012 NPP VIIRS 1940 UTC



US 84 between Southland and Post, TX (~20 miles SE of L
63 mph winds, 50 ft visibility

First light NPP VIIRS fire data

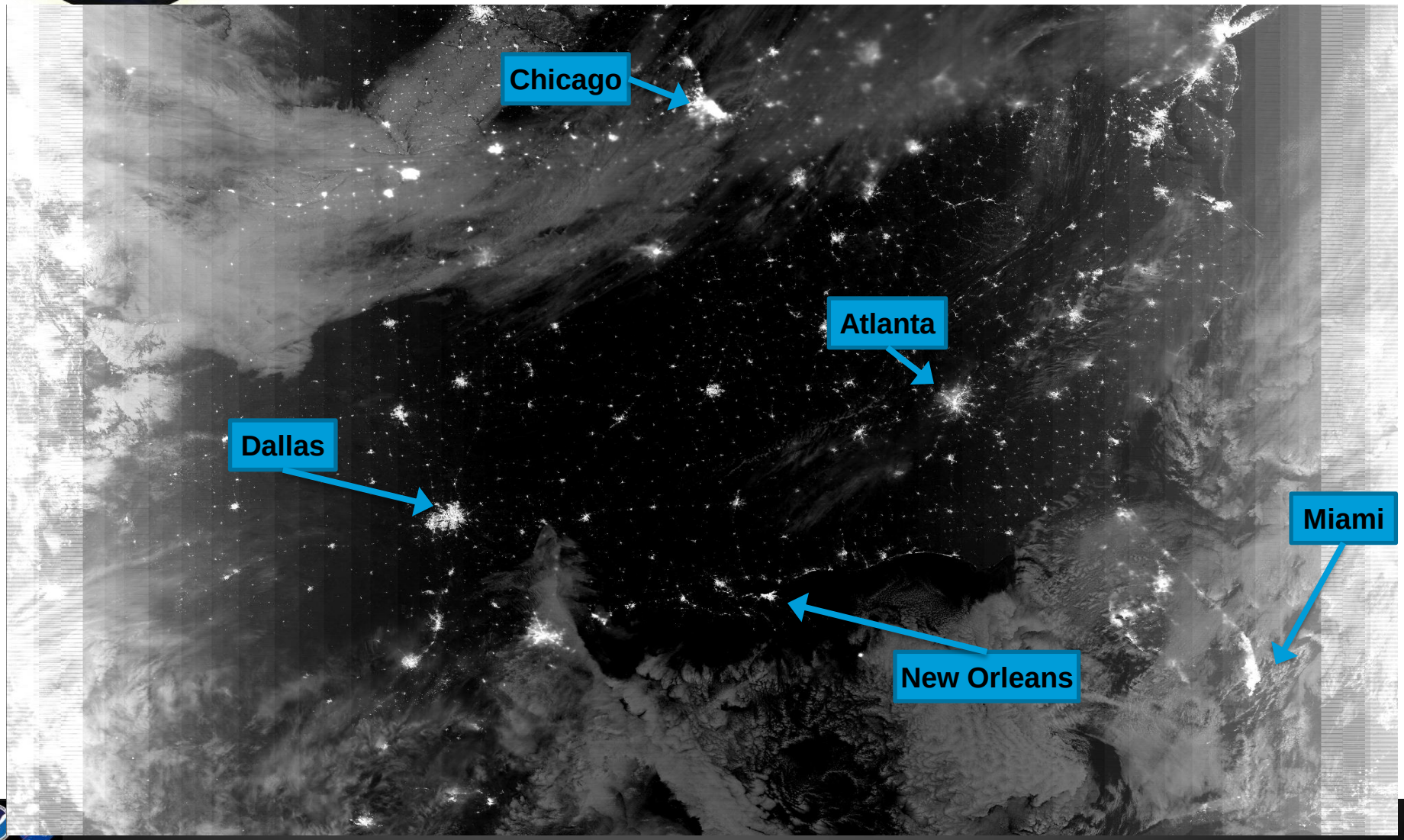
M5-M4-M3 RGB
+
IDPS Active Fire ARP



January 19, 2012
~11:05 UTC

Images froom VIIRS Land Team; Ivan Csiszar, NOAA/NESDIS/STAR

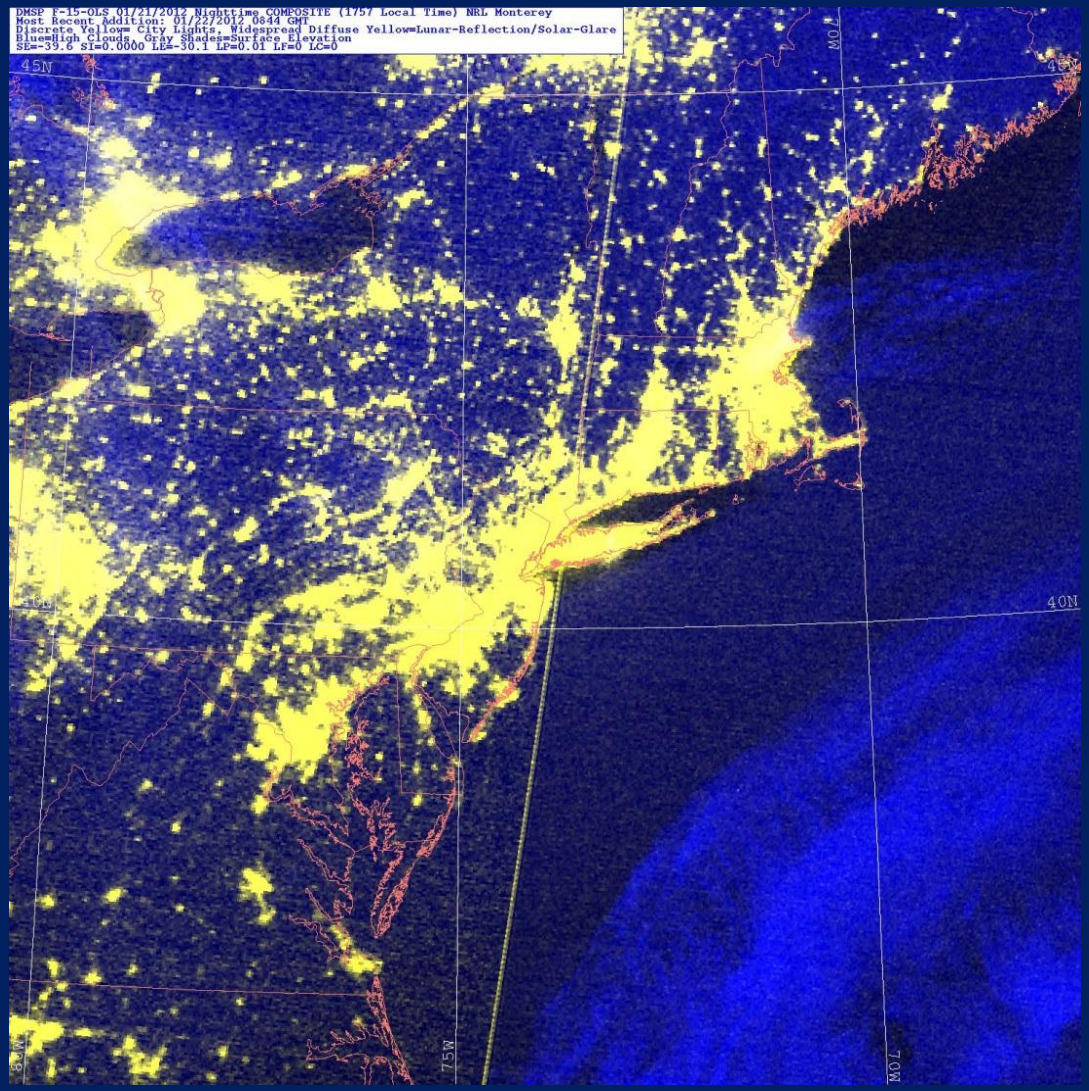
VIIRS Day Night Band



VIIRS Nighttime Visible - DNB

OLS 08:44Z
DNB 0718Z

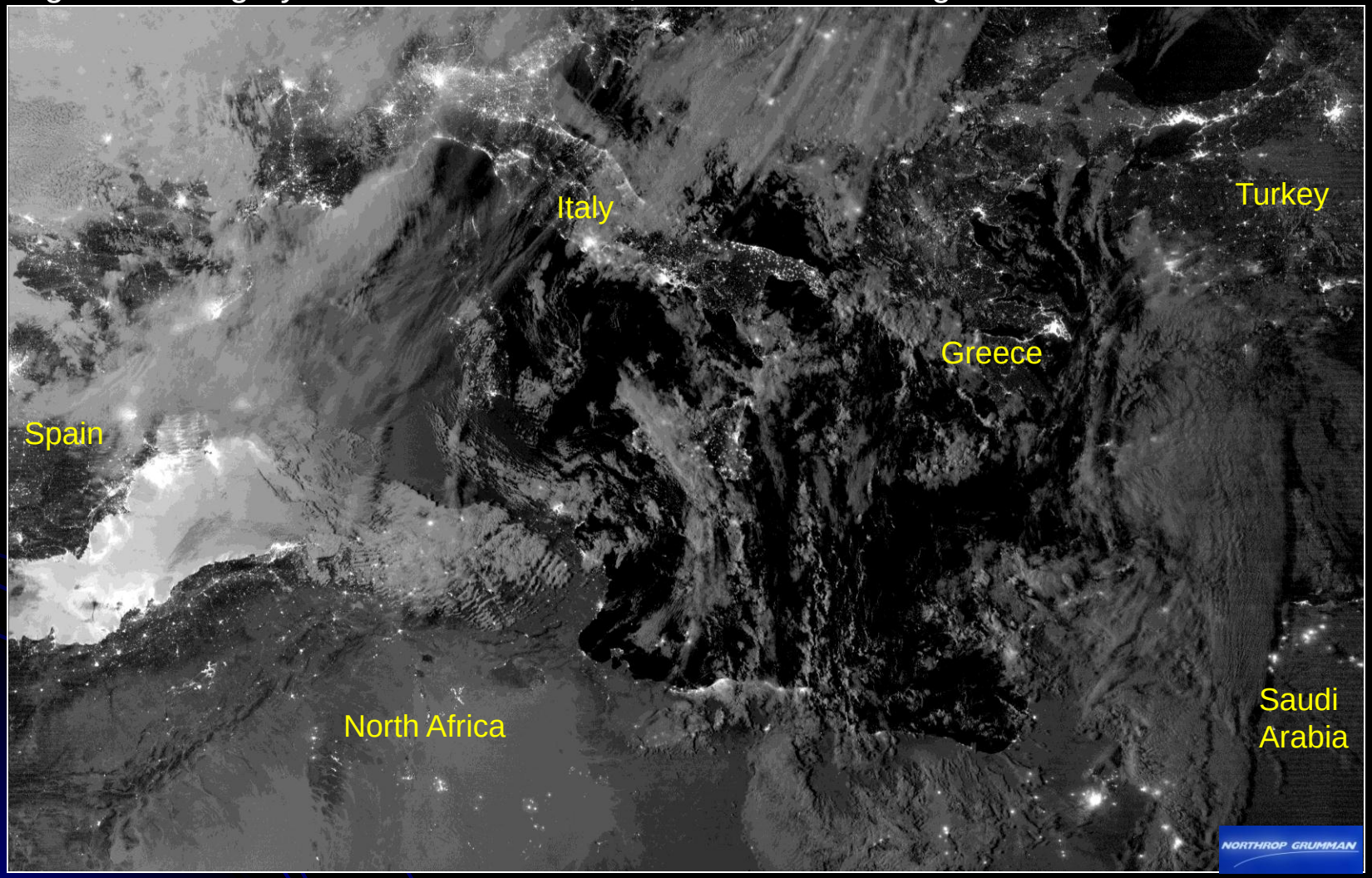
Geolocation not corrected



Enhanced city light definition due to spatial resolution and quantization

Moonlight Imagery

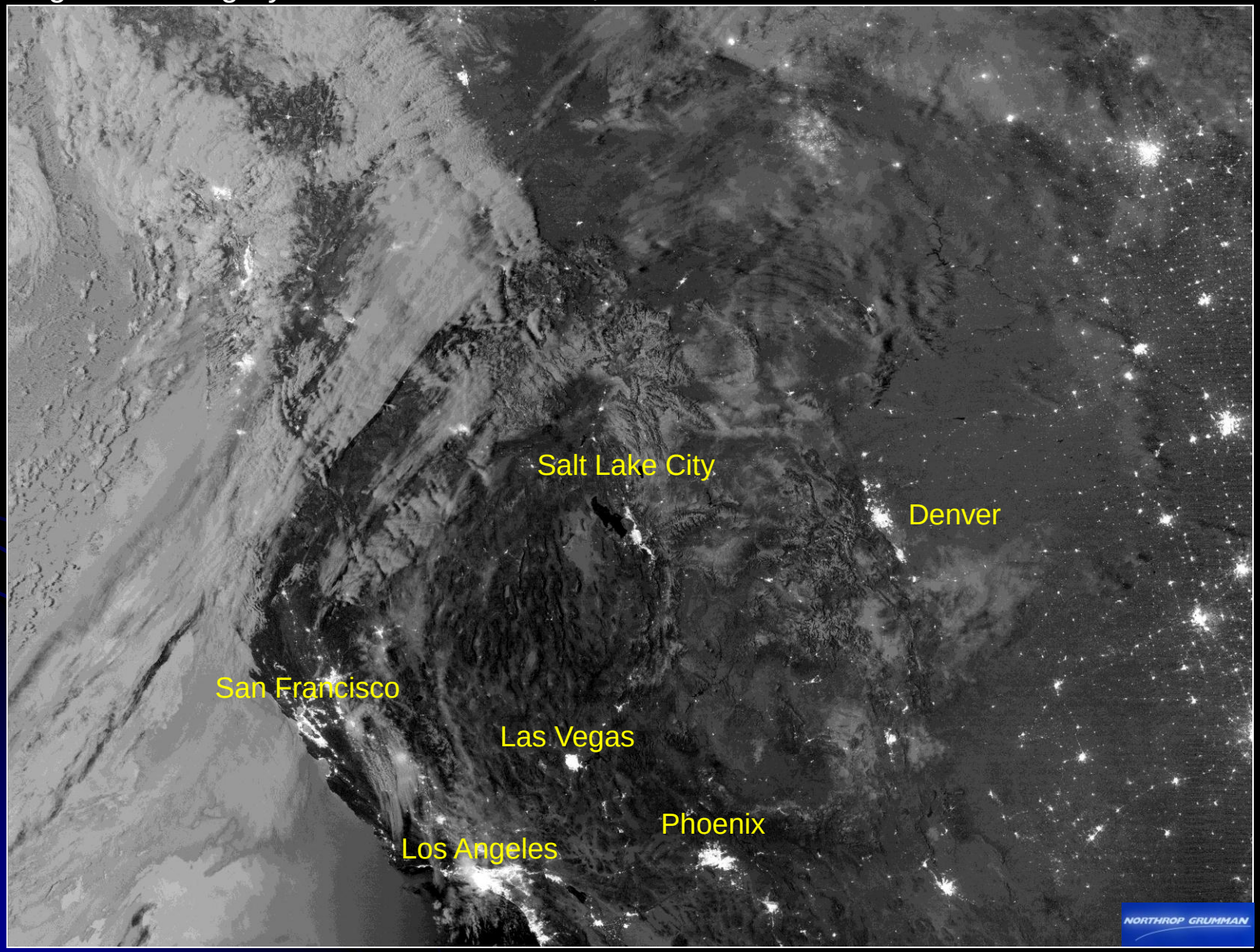
Nighttime Imagery: 1/5/2012 0053 UTC, Mediterranean Region



→ Moonglint scenes showcase the tremendous dynamic range and radiometric resolution of the new DNB sensor.

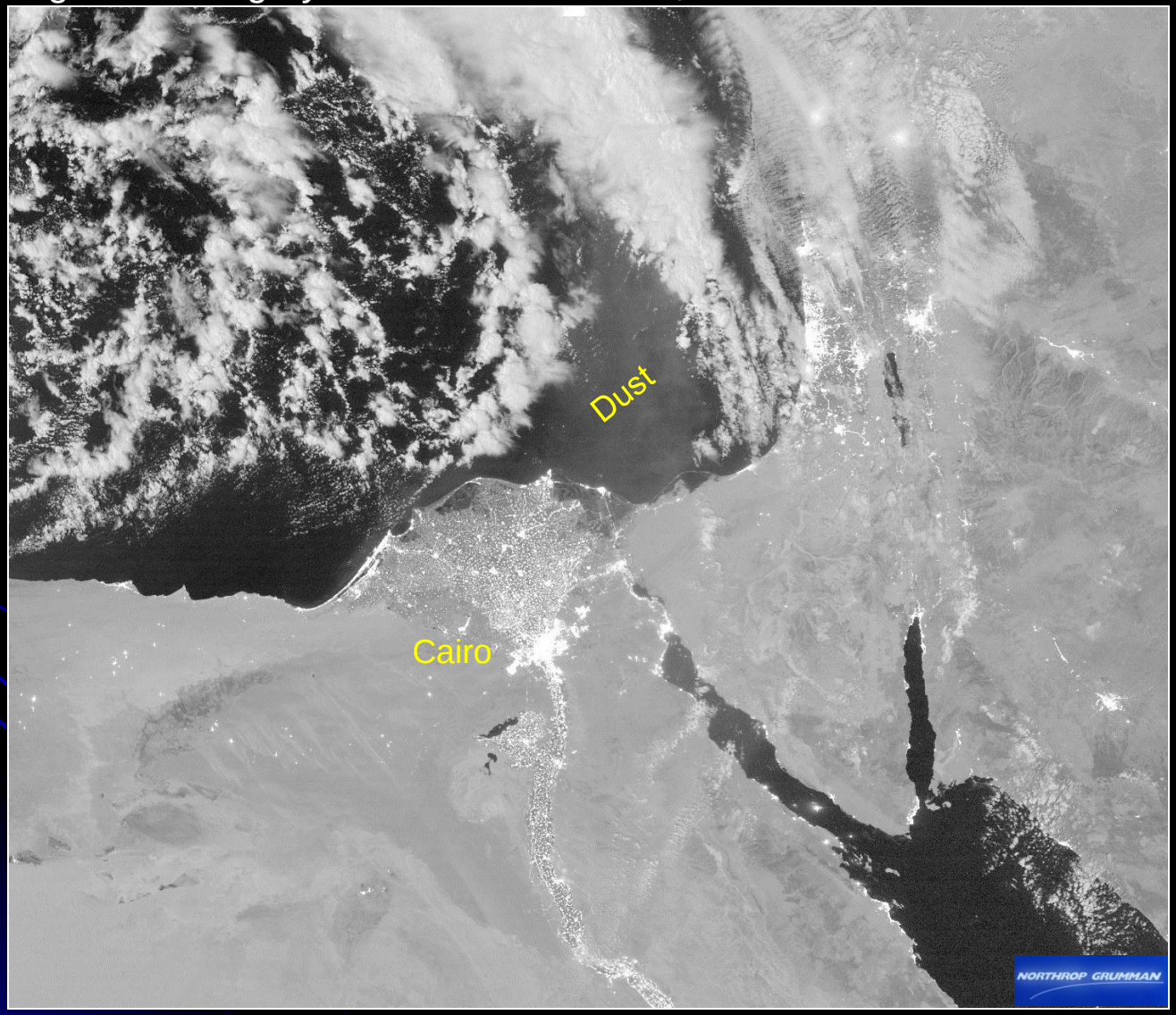
Moonlight Imagery

Nighttime Imagery: 1/5/2012 0920 UTC, Western U.S.



Dust Storm

Nighttime Imagery: 1/7/2012 2359 UTC, Eastern Mediterranean



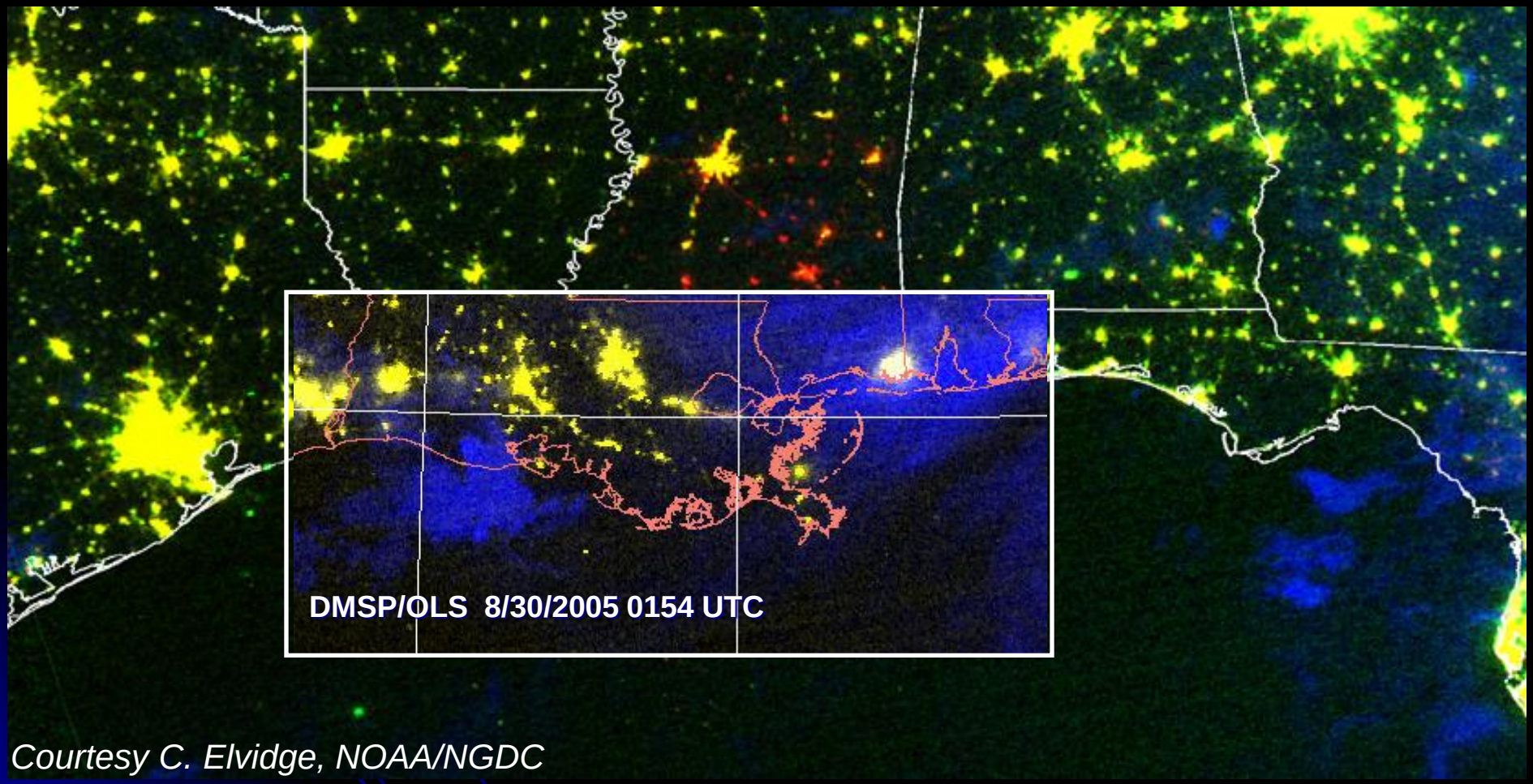
Volcanic Ash

Puyehue-Cordon Caulle Volcanic Chain
12-13 Dec 2011

Afternoon | Night | Morning

→ Nighttime pass fills in the temporal gap between last PM and first available AM visible-light observations.

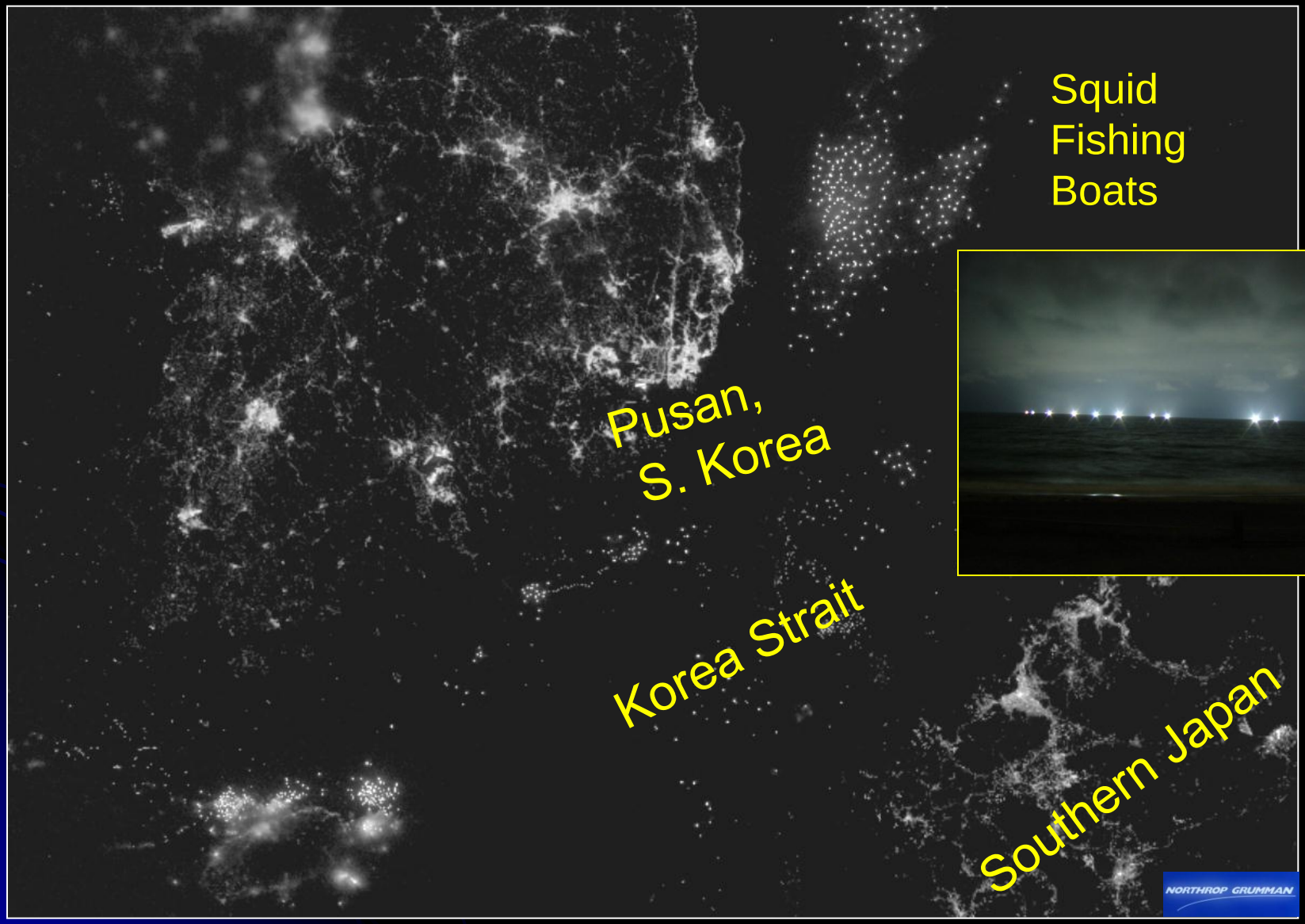
City Lights: Katrina Power Outage



Courtesy C. Elvidge, NOAA/NGDC

→ The DNB 0.74 km resolution will further improve the capabilities of these 'residual light' applications.

The Korean Strait



GOES-R

Advanced Baseline Imager (ABI)

Exelis, Fort Wayne, IN

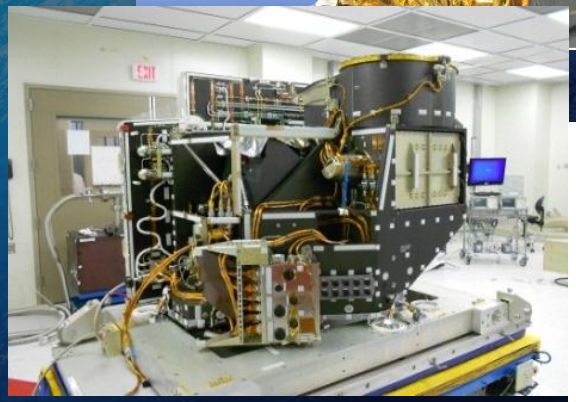
Specifications

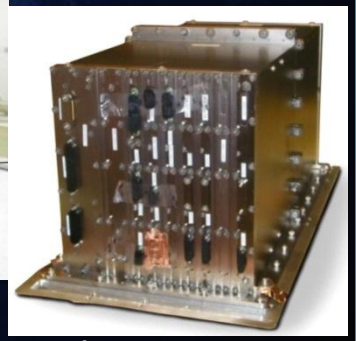
- 16 channel imager
- Measures radiances in the visible and near-infrared wavelengths
- Improves upon current capabilities in spectral information (3X), spatial coverage (4X), and temporal resolution (5X)
- Improves every product from current GOES Imager and will offer new products for severe weather forecasting, fire and smoke monitoring, volcanic ash advisories, and more

Status

- ABI delta Critical Design Review (CDR) held Feb. 2011
- Proto-Flight Model (PFM) fabrication and testing is well underway
- Pre-Environmental Review scheduled for July 2012
- Instrument delivery scheduled for March 2013
- Integration with spacecraft to be completed by December 2013

ABI Proto-Type Model (PTM)

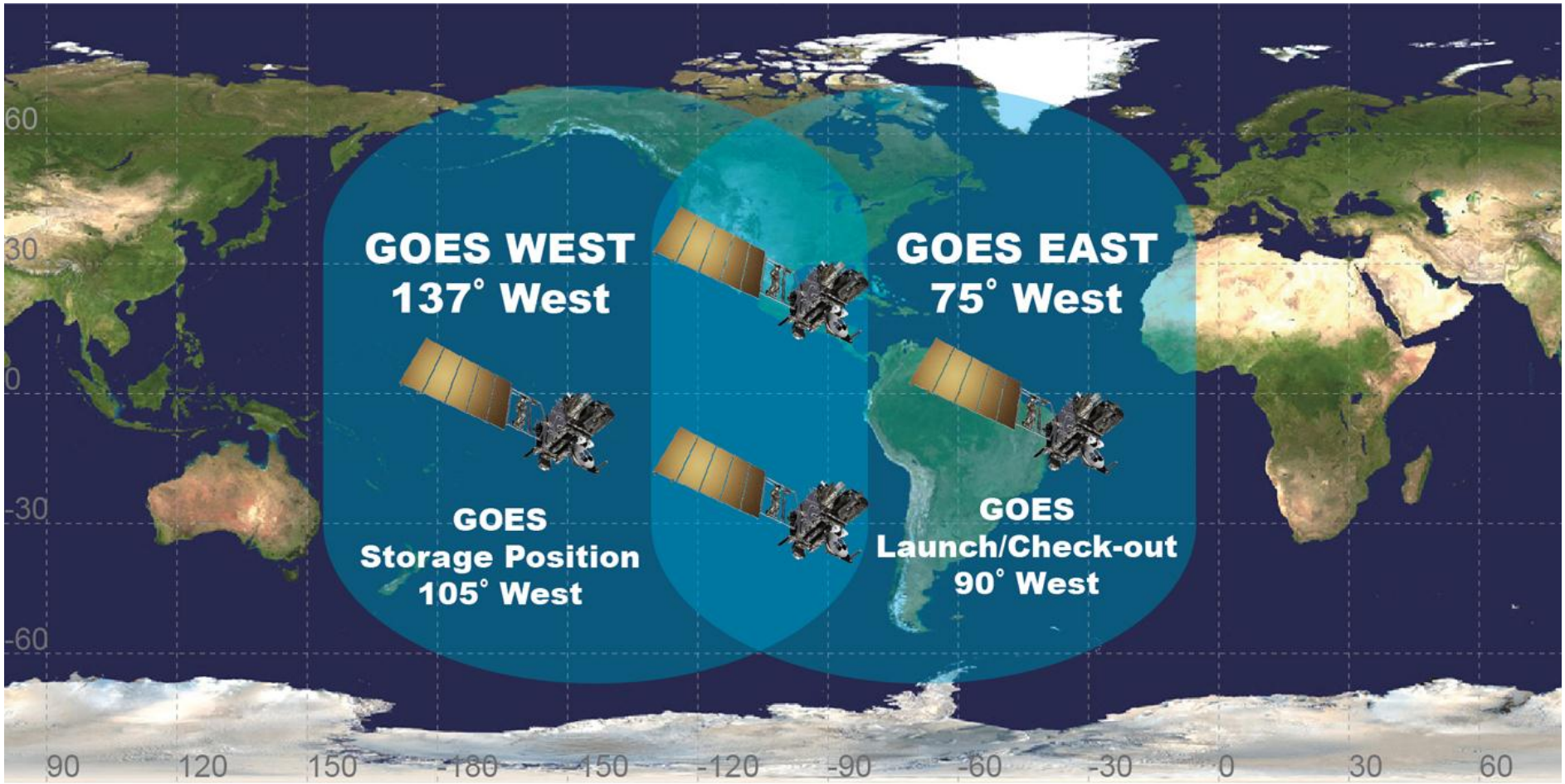




Electronics Unit

ITT Exelis of Ft. Wayne, IN is primary contractor

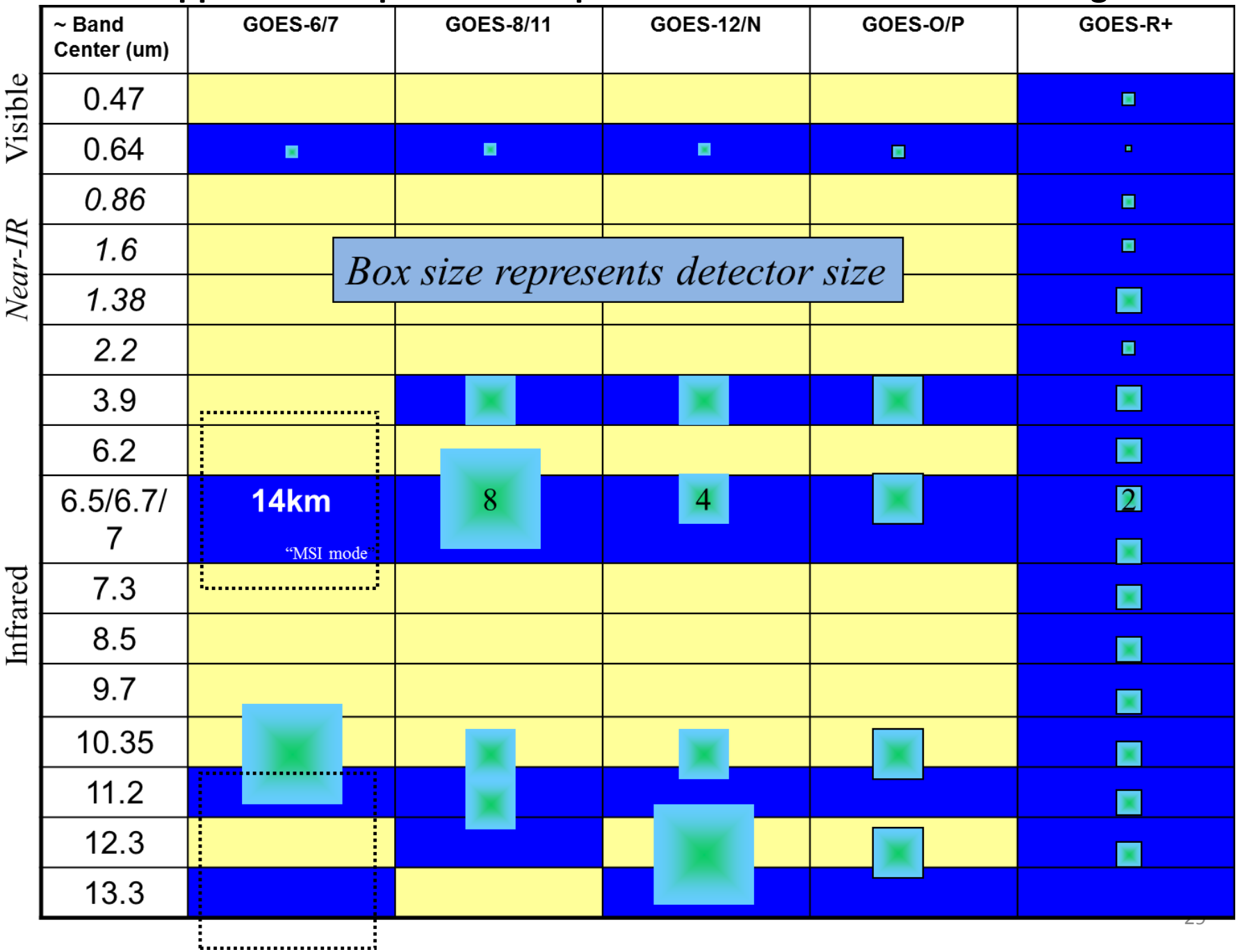
GOES Fleet


GOES WEST
137° West
GOES EAST
75° West
GOES
Storage Position
105° West
GOES
Launch/Check-out
90° West
60
30
0
-30
-60
90
120
150
-180
-150
-120
-90
-60
-30
0
30
60

ABI Comparison to Current Imager

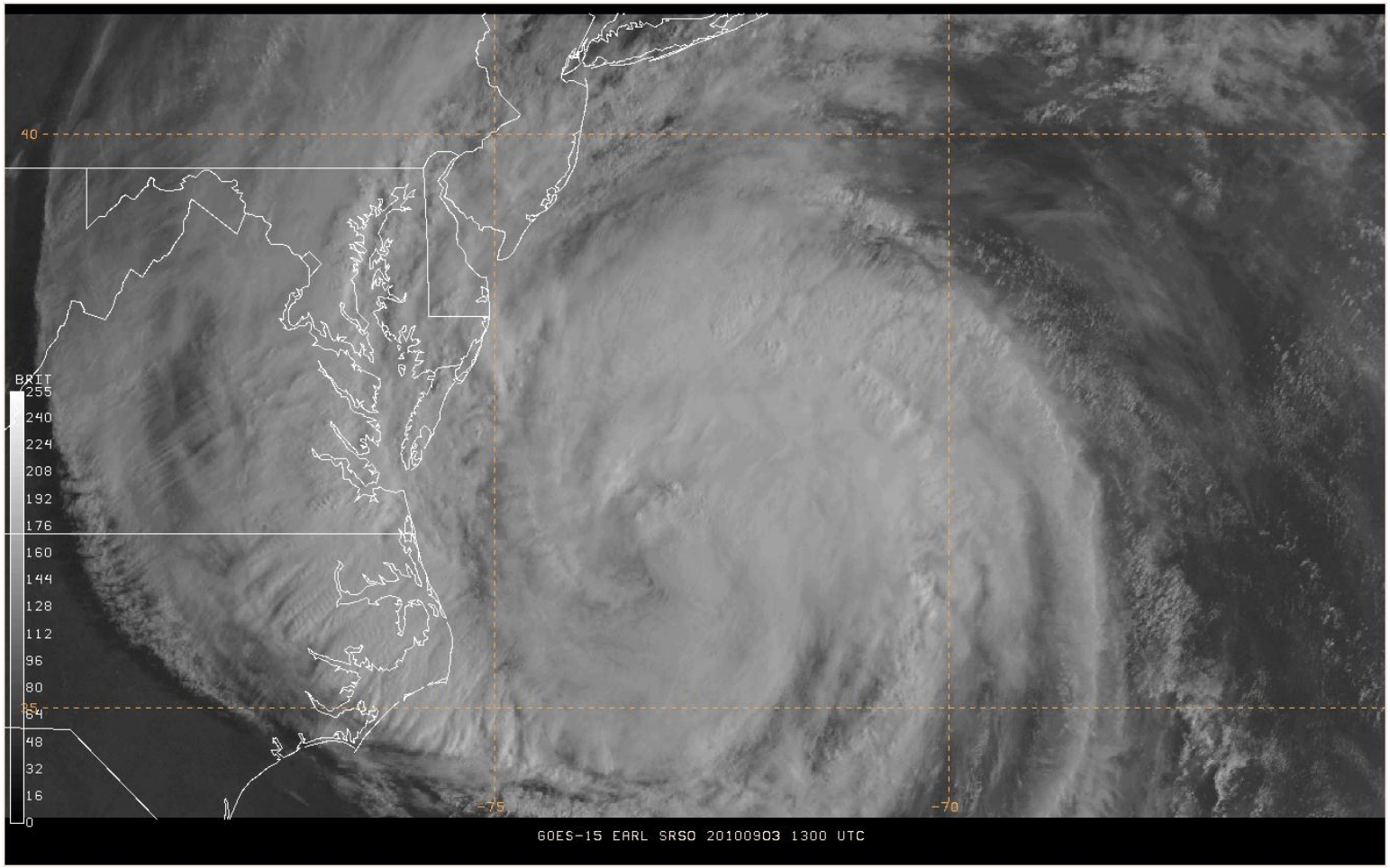
	ABI	Current
Spectral Coverage	16 bands	5 bands
Spatial resolution		
0.64 mm Visible	0.5 km	1 km
Other Visible/near-IR	1.0 km	n/a
Bands (>2 mm)	2 km	4 km
Spatial coverage		
Full disk	4 per hour	every 3 hr
CONUS	12 per hour	~4 per hour
Mesoscale	30 sec (typical)	n/a
Visible (reflective bands)		
On-orbit calibration	Yes	No

Approximate spectral and spatial resolutions of US GOES Imagers

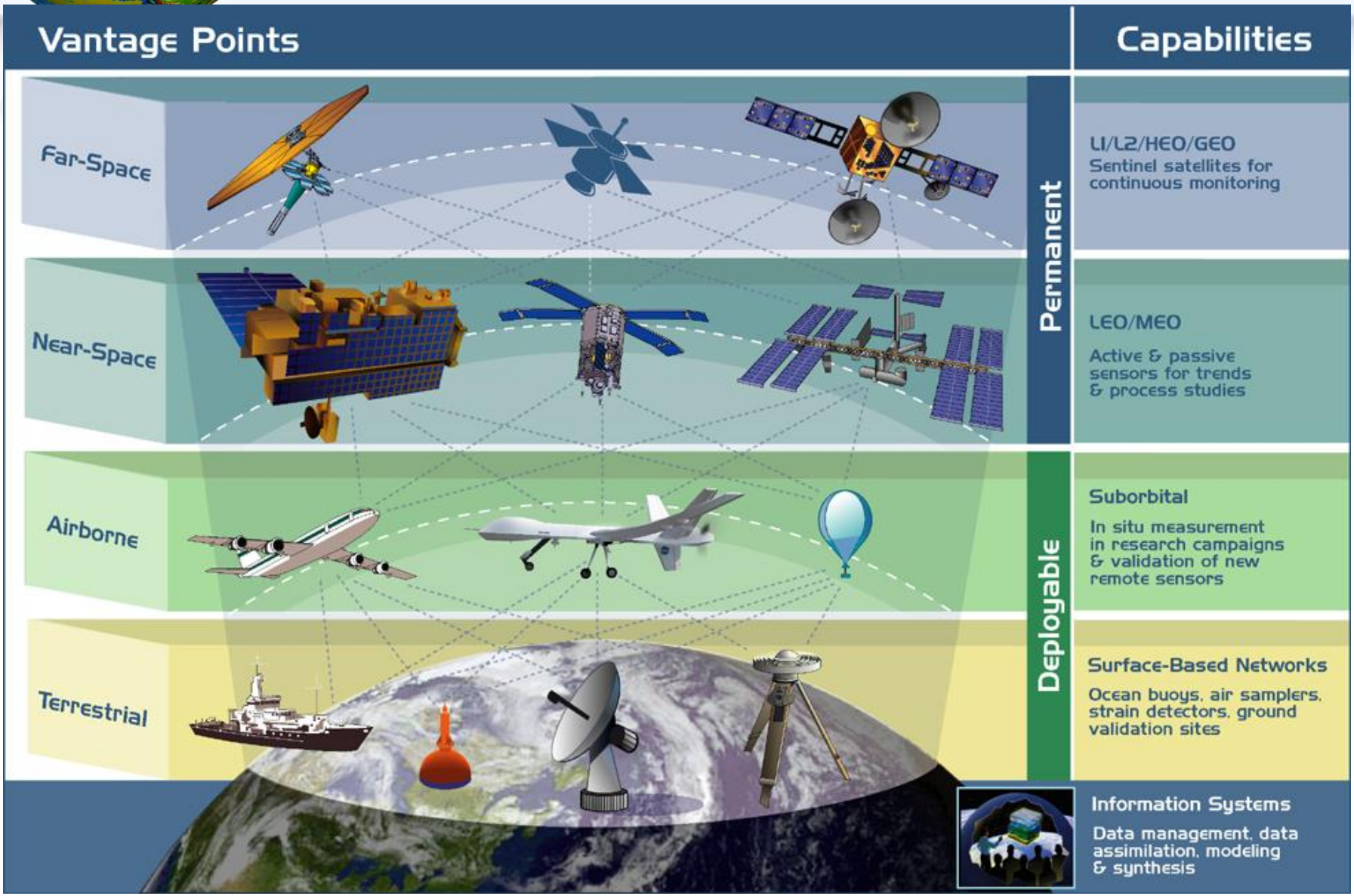


Rapid Scan for Hurricane Earl

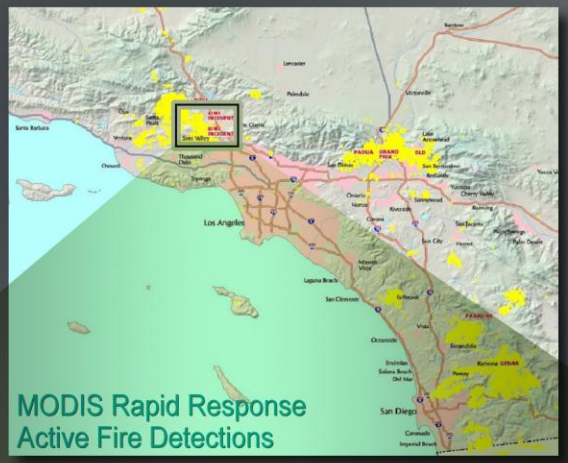
ABI provides more routine rapid imaging
(from GOES-15 SRSO 3 September 2010)

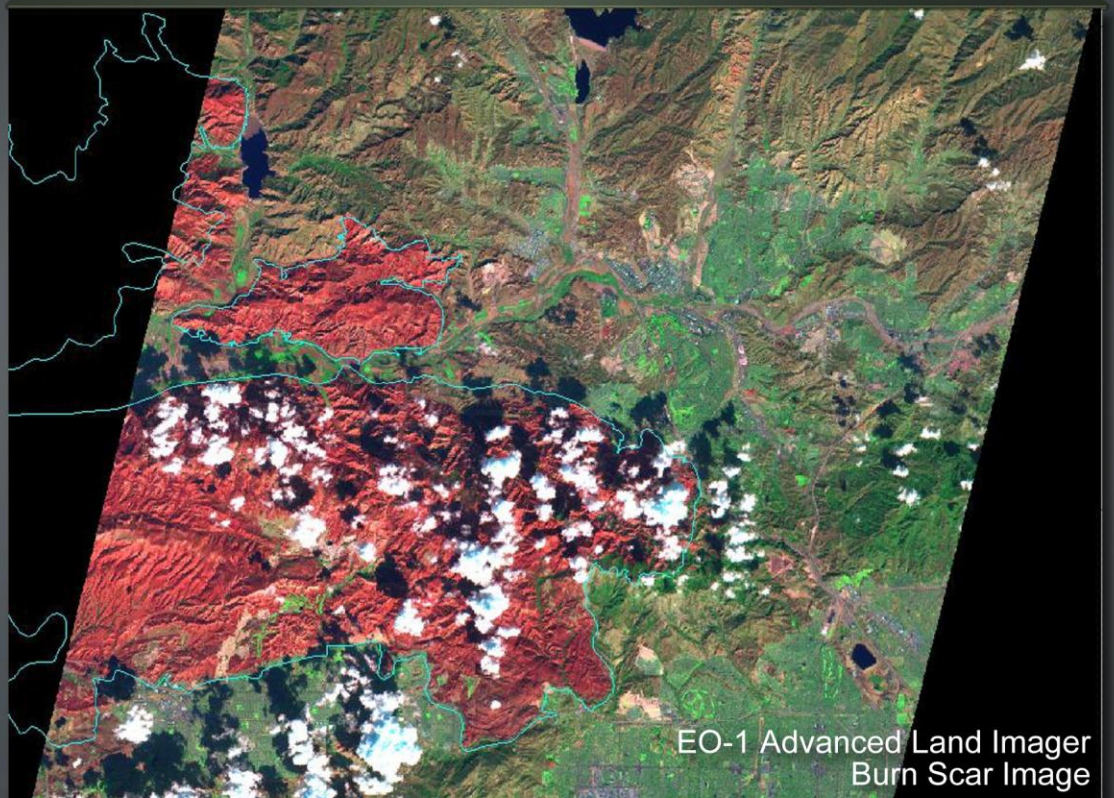


Vision for Future 'Ad Hoc" Data Fusion with Existing Assets



Wildfire SensorWeb





On 11-2-03, the NASA Wildfire SensorWeb was employed to collect data on the burn scars resulting from the Simi Valley, Val Verde and Piru fires in Southern California. MODIS active fire detections for the duration of the event were used to target an acquisition by the ALI and Hyperion instruments onboard EO-1. Such data are employed by the USDA Forest Service for Burned Area Emergency Response mapping. BAER maps are used to target high risk areas for erosion control treatments. In this image, burned areas appear **red** while the unburned areas appear **green**. The **blue** burn perimeter vector is based on ground data.

Conclusions

NOAA provides sustained decadal operational missions.

NPP VIIRS and GOES-R Imager plus international geostationary satellites will provide constant surveillance at 0.375 Km to 2 Km resolution.

Excellent opportunity for on-demand commanding of high spatial resolution imagers for impact assessments