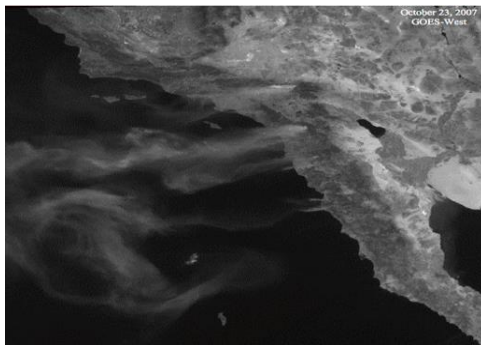


NESDIS Satellite Analysis Branch

Hazard Mitigation Programs



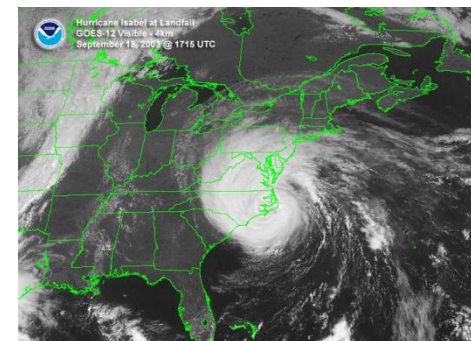
David Street - NESDIS Satellite Analysis Branch Chief
davida.streett@noaa.gov



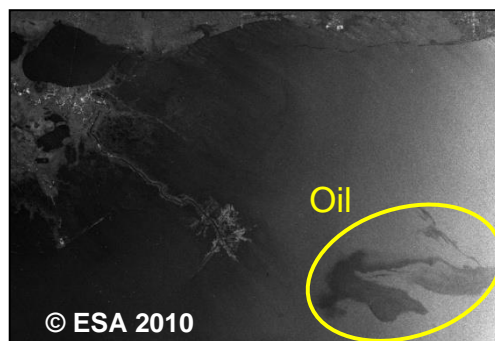
**Fire and Smoke
Detection**

- **manmade and man-machine mix products**
- **can tailor information gathering to event**
- **can interact with affected responders**

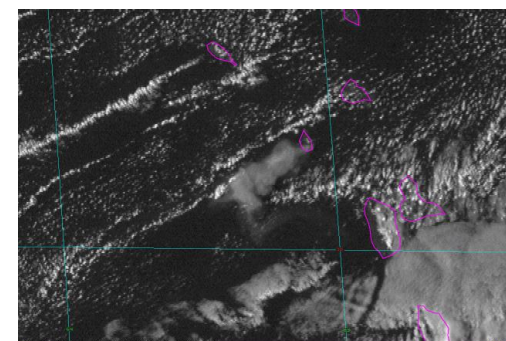
- **24 x 7 x 365**
- **group of ~ 20 satellite analysts**



**Tropical Position
and Intensity
Classification**



**Oil Spill and Marine
Debris Detection**



**Volcanic Ash Detection
and Forecast**



Volcanic Ash Program

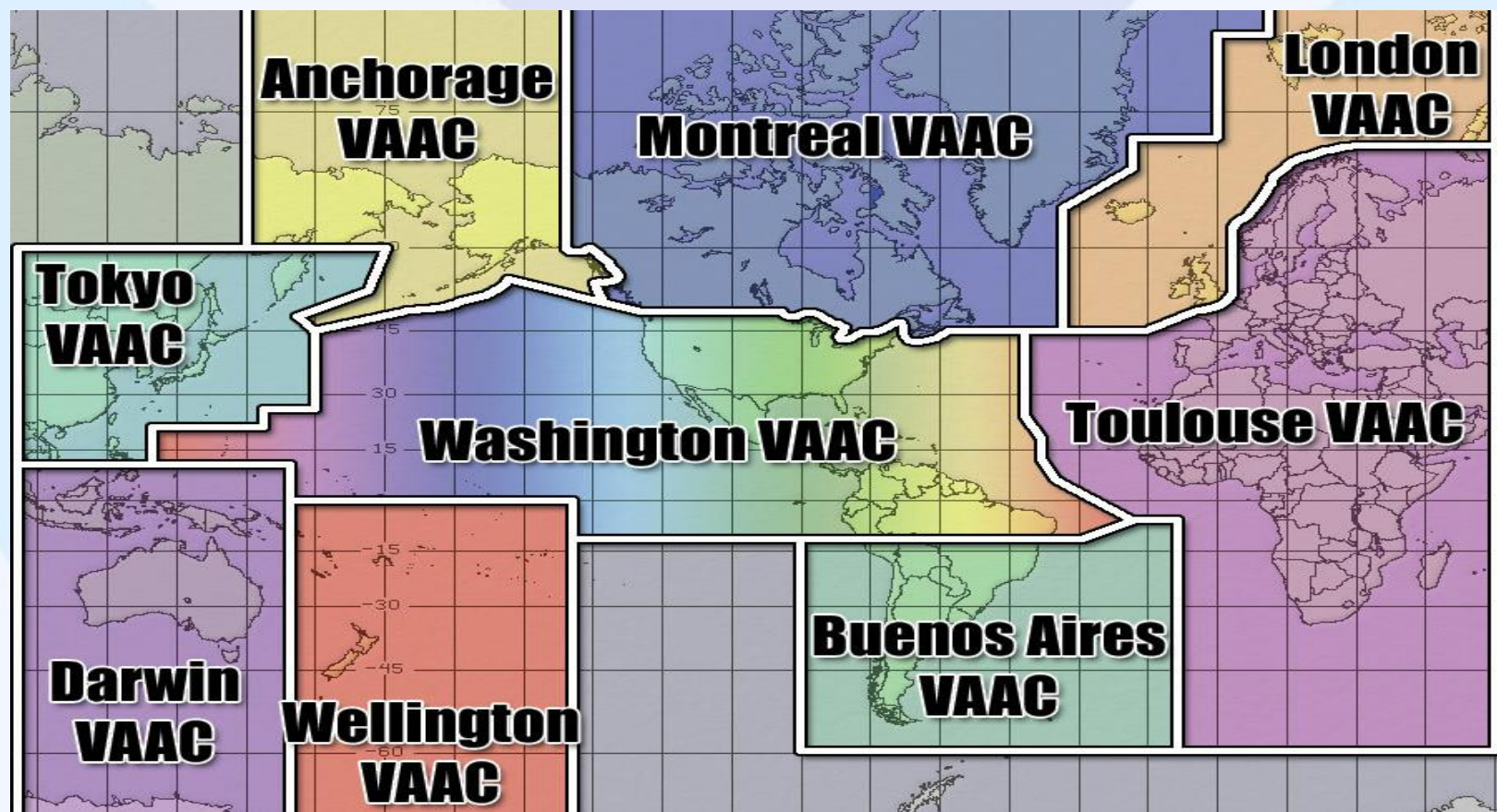
- **OVERVIEW:** SAB issues satellite based information about airborne volcanic ash, a dangerous hazard for aircraft. The advisories/graphics are provided to government, commercial and private users in the aviation and weather communities, domestically and internationally. Supports Meteorological Watch Offices in Mexico City, Tegucigalpa, Quito, etc. as they issue aviation warnings.
- **OPERATIONS:** SAB personnel maintain a watch over the many volcanoes in their area by using geostationary and polar orbiting satellite imagery (including RGB and multi-spectral imagery), webcams and receiving daily and special reports by email from Volcano Observatories (VO). The personnel are responsible for issuing Volcanic Ash Advisories (VAA) and Volcanic Ash Graphics (VAG) when a volcano is emitting volcanic ash.



(Top: Image of January 15th eruption of Colima volcano in western Mexico. Bottom: Image of Turrialba volcano in Costa Rica – roughly 20 miles east of San Jose airport, second largest airport in Central America).

Volcanic Ash Program

- **INTERNATIONAL STRUCTURE:** SAB's role was formalized in 1997 by the International Civil Aviation Organization (ICAO) and involves ongoing interactions with ICAO and the World Meteorological Organization (WMO), as well as international counterparts (8 other "Volcanic Ash Advisory Centers") that collectively nearly cover the entire world.

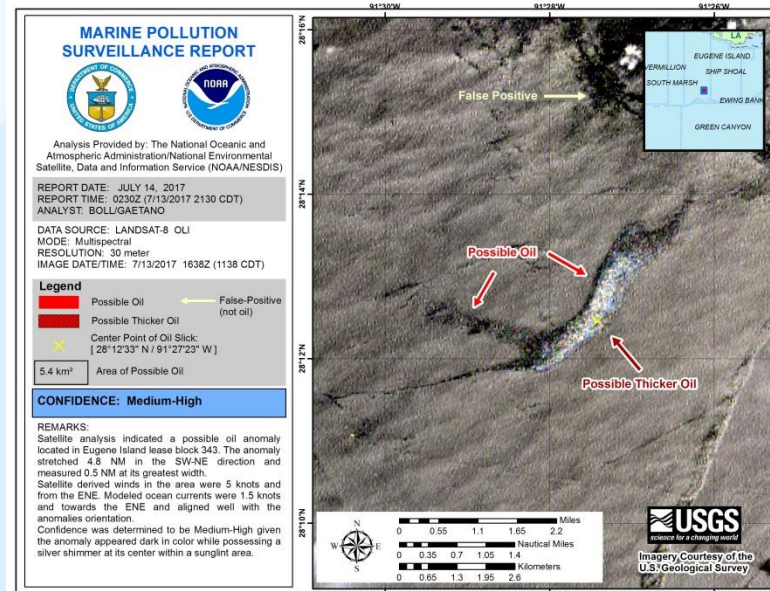


Marine Pollution Surveillance Program

- **OVERVIEW:** SAB personnel detect and map oil spills in high-resolution satellite imagery over US waters (and international waters when requested). SAB issues products in near real time whenever an accidental or intentional crude oil discharge is detected in imagery. (During major spills, the number of users vastly increase; during Deepwater for example, media outlets disseminated the SAB product to hundreds of millions, possibly billions, of viewers, and the product was included in every daily briefing of the President.)
- **ROUTINE OPERATIONS:** The Program uses moderate to high resolution optical and Synthetic Aperture Radar (SAR) satellite imagery. Optical imagery includes MODIS Terra and Aqua (NASA), NPP VIIRS (NOAA/NASA), Sentinel-2A/B (ESA, Copernicus) and Landsat7/8 (USGS). SAR includes Sentinel-1A/B (ESA, Copernicus) and RADARSAT-2 (MDA). Once a possible area of oil is identified, a very wide array of ancillary data (e.g., currents, winds, ice edge, seep locations, oil rig locations etc.,) is consulted to help confirm the presence of oil.
- **OPERATIONS DURING DISASTERS/MAJOR EVENTS:** In addition for high impact spills, SAB personnel play a lead role in tasking and acquiring diverse commercial and public-private satellite imagery to assure essential satellite support for the Incident Command Center and oil spill response activities.

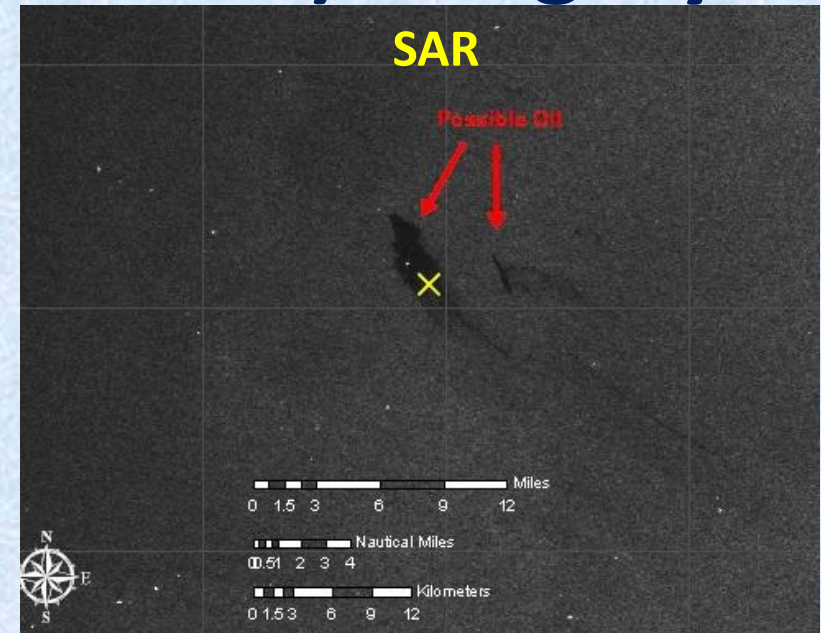


Image from NASA's MODIS Aqua satellite over the Deepwater Horizon oil spill on May 25th, 2010 in the N Gulf of Mexico.



MPSR for possible oil in the N Gulf of Mexico where the white silvery portion represents oil that is relatively thicker than the darker portion.

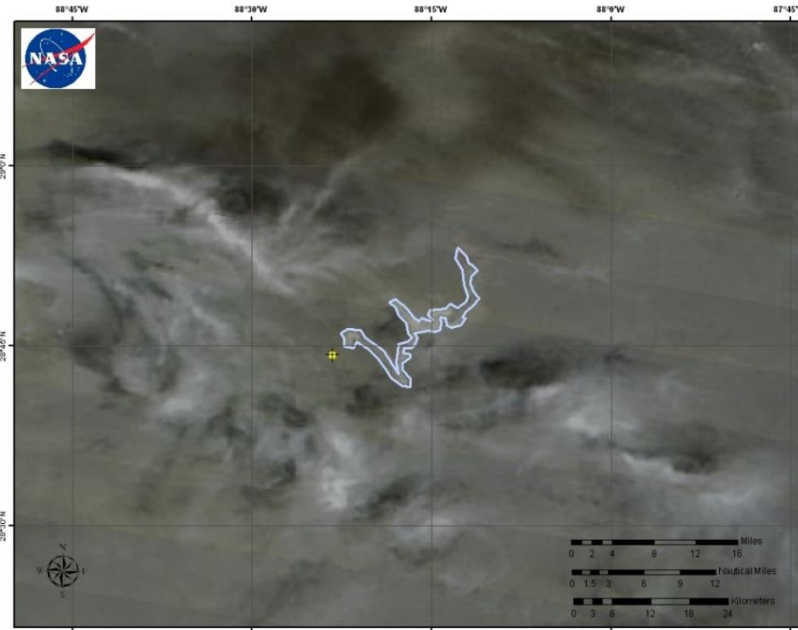
We use both multispectral and SAR (Synthetic Aperture Radar) imagery



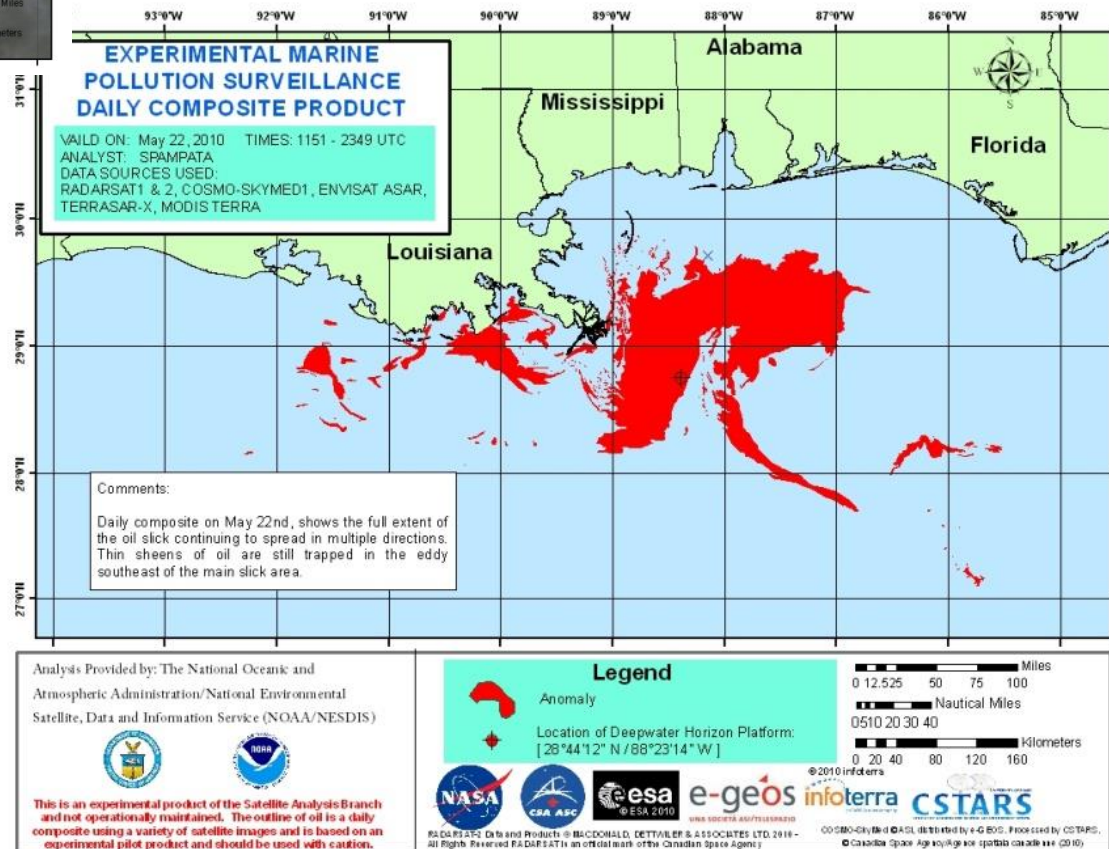
Each has advantages

- SAR can be used at night or to see through most clouds
- But there are more free multispectral satellites at this time
- We currently believe that it is easier to infer oil thickness from multispectral imagery.

Development is underway to enable us to infer some



Deepwater Horizon spill



Multispectral Satellites that we Use Frequently

- **LANDSAT**
- **MODIS**
- **ASTER**
- **FORMOSAT**
- **Worldview**
- **Sentinel 2**

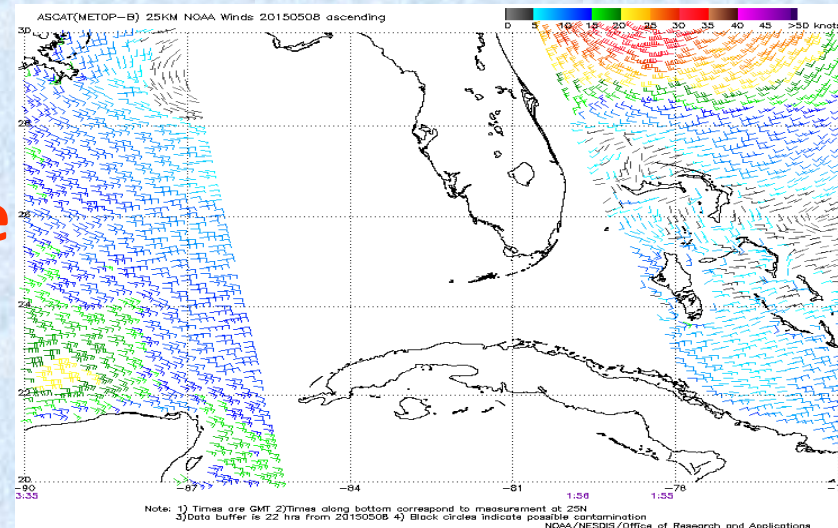
SAR Satellites that we Use Frequently

- **Sentinel 1**
- **RADARSAT**

Ancillary Data (reduces false positives and negatives)

- Surface and Ship Winds
- Scatterometer Winds (ASCAT, WindSAT, RapidSCAT)
- Modeled Ocean Currents (HYCOM model)
- Chlorophyll Concentration and Anomaly Products (MODIS)
- GOES Sea Surface Temperature
Ocean Frontal Product

ASCAT winds
from METOP-B



Collaborations (Oil Spills)

- MOA between groups representing NESDIS and Taiwan's Center for Space and Remote Sensing Research providing, among other things, access to FORMOSAT.
- Recent Annex to the NOAA-Environment Canada MOA that formalizes collaboration between SAB and ISTOP (Integrated Satellite Tracking of Pollution) creating a North American collaboration.
- Discussions with CIEMAD about expanding collaboration to the south.

Fire and Smoke Program

OVERVIEW: SAB produces a graphical analysis of fires and smoke using NOAA GOES, VIIRS, and AVHRR and NASA MODIS data, and is currently incorporating Sentinel and Landsat capabilities. Users include the National Weather Service (NWS), NOAA Air Resources Lab (ARL), US Forestry Service, Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), Bureau of Land Management (BLM), and numerous state and local air quality and land management agencies.

OPERATIONS: Fire data analyses are performed for the entire U.S., extending over neighboring countries. The procedure is a man machine mix in which SAB personnel quality control several satellite based automated fire detection algorithms using custom software solution. Prominent smoke plumes are digitized using visible satellite imagery. The graphical fire/smoke analyses are available on the internet

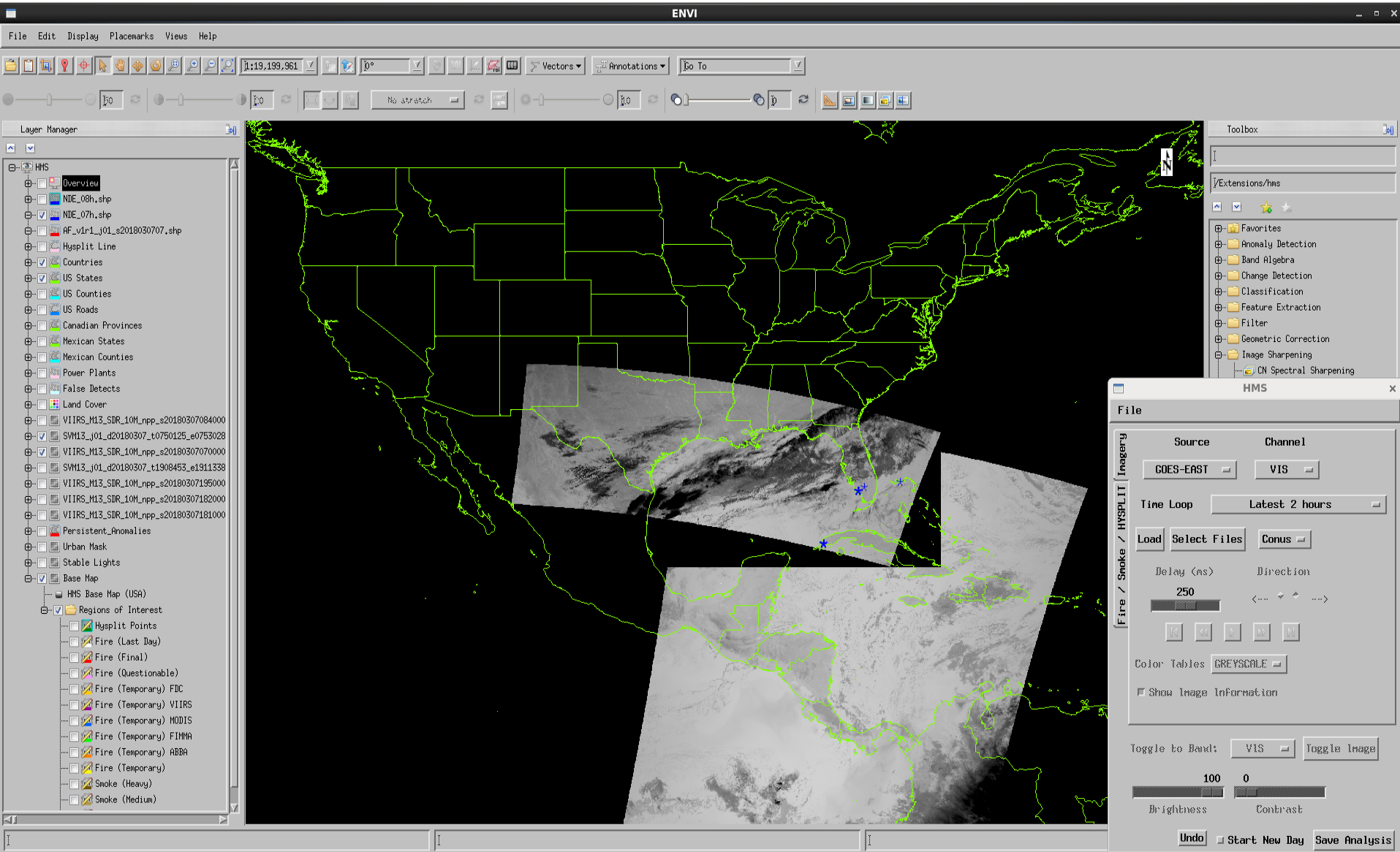


<http://www.ospo.noaa.gov/Products/land/hms.html>



Credit: Joe McManus

NOAA's system that satellite analysts use to display and interrogate satellite imagery for fires and smoke. This system could also be exported to other nations if desired.

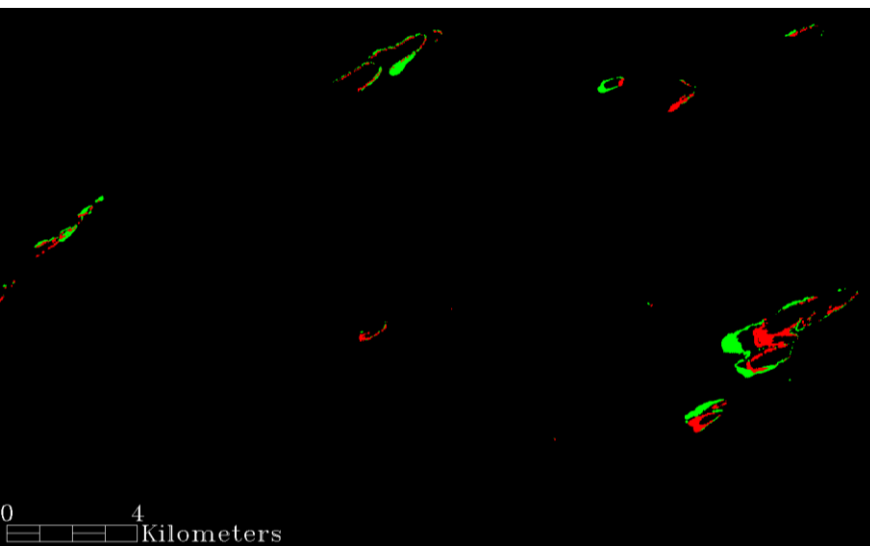
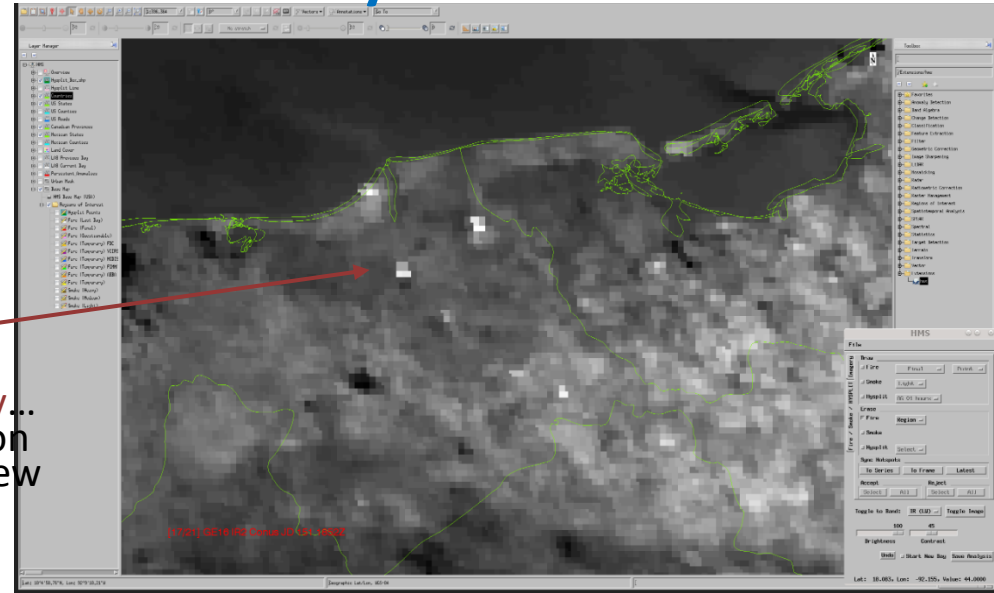


Three types of satellite-based fire mitigation information; SAB only does 2 of these currently ...



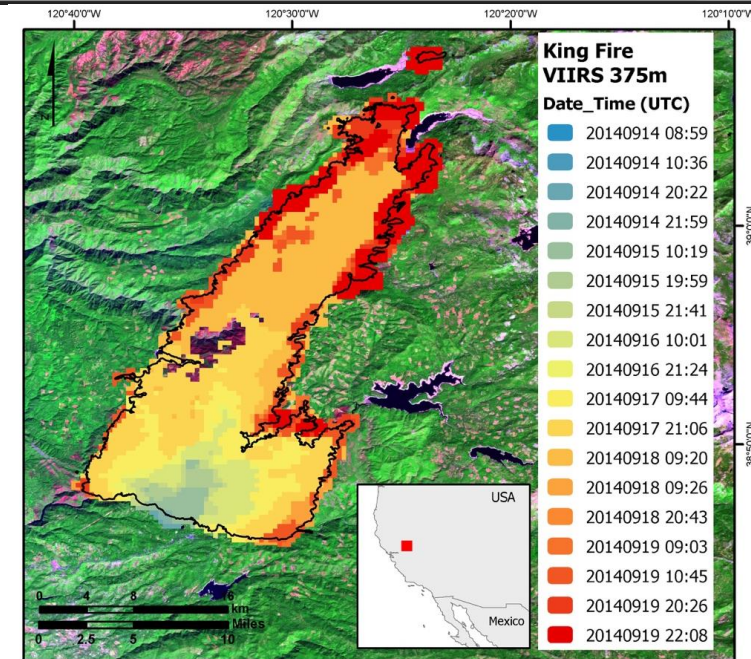
- Automated fire points...
computer algorithm identifies fire location from a satellite image)

- Satellite imagery... requires a person in the loop to view the image and determine fire locations.



Fire spread

“In depth” fire information such as active burning area, spread rate, fire behavior, etc.



Fire area

Collaborations (Fires)

- Discussions with CIEMAD about forming new collaboration for manual analyses of fires and oil spills.
- Discussions with SMN about re-starting a previous manual fire analysis collaboration.
- Broad discussions with INPE, possibly with NOAA providing VIIRS/GOES imagery as backup to downlink.
- Discussions with Indonesia about 375 m VIIRS automated detections, possible manual involvement, and in-depth fire information.

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