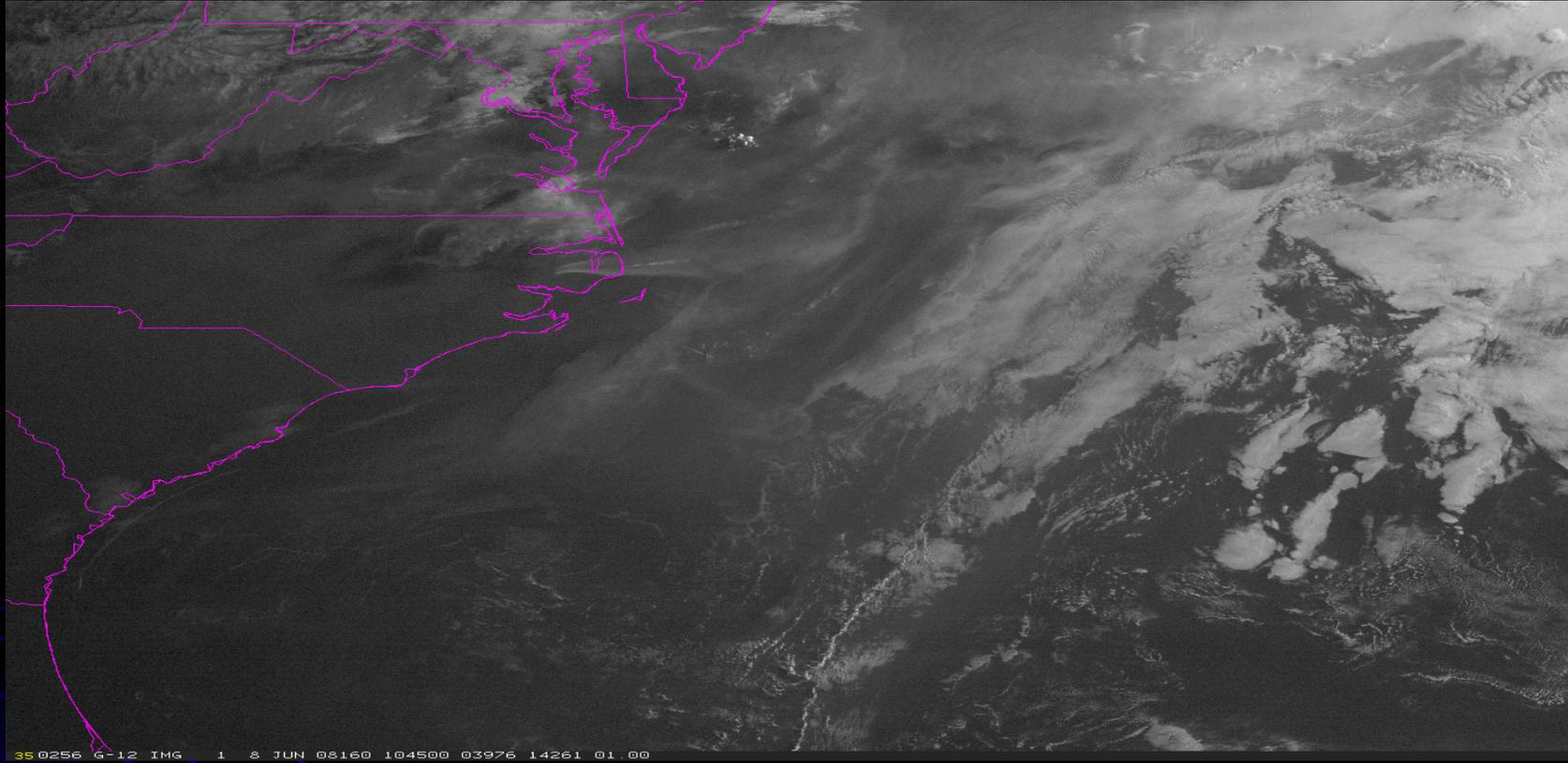


# Wildland Fire Monitoring Using NOAA Satellites



**National Ocean and Atmospheric Administration  
2013 Satellite Conference**



**Presented by: Jamie Kibler**  
**Contributors: Mark Ruminski**  
**April 12, 2013**

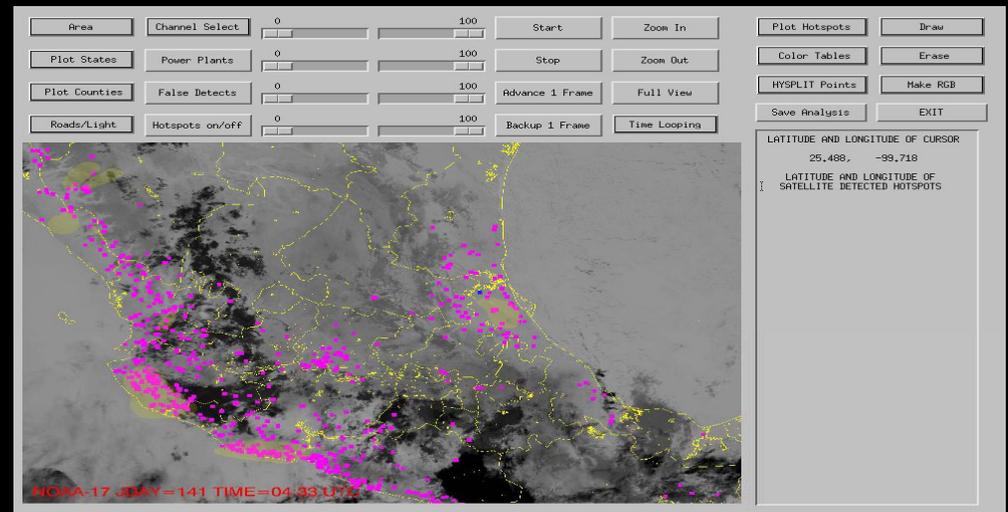
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## Outline

- Overview of the Fire and Smoke Program
  - **GOES vs. POES**
  - Forecasting smoke from wildfires using NOAA satellites
  - **The monitoring of the Wallow Wildfire**
  - Product, website, Questions and Comments
- 

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- **The Fire and Smoke Analysis is performed for the Continental US, Hawaii, Puerto Rico and Central America year around:**



- **Seasonal analysis performed for Alaska and Canada from May through November**



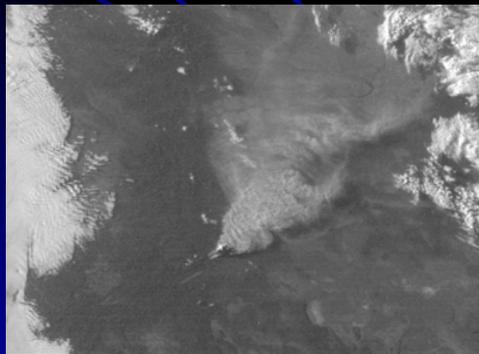
# NOAA SATELLITES CURRENTLY USED FOR FIRE AND SMOKE DETECTION

- **GOES 13 and GOES 15**
- NOAA 15, 18 and 19 and METOP-A and B (NPP soon)
- **MODIS Aqua and Terra**

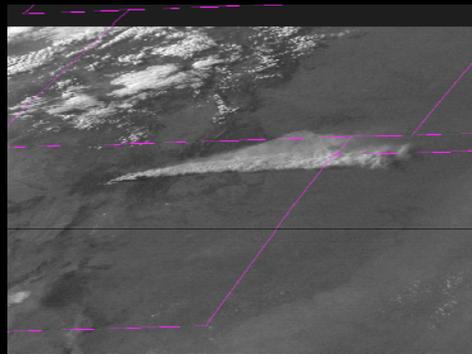
Over 200 looks per day in areas of GOES-East and GOES-West overlap.

Two looks per satellite per day with Polar spacecraft in mid latitudes – more at high latitudes

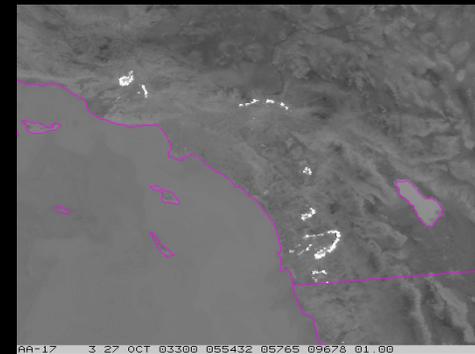
**Future – GOES-R/JPSS !!**



GOES-WEST

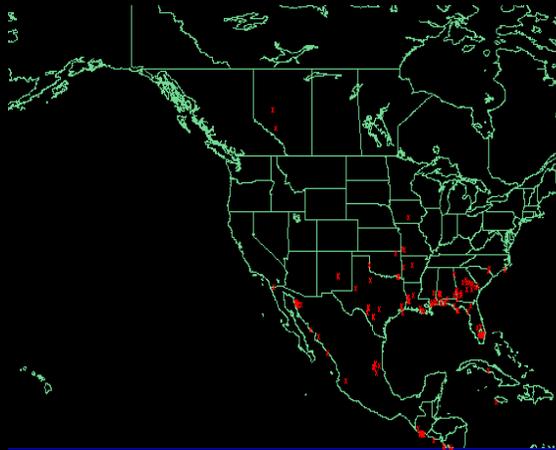


GOES-EAST



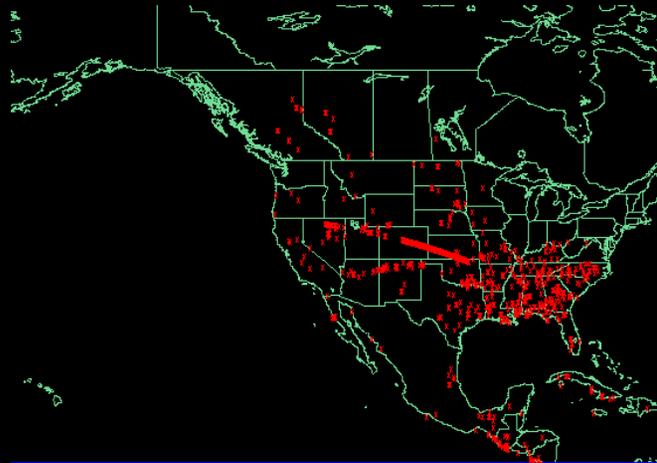
NOAA-AVHRR

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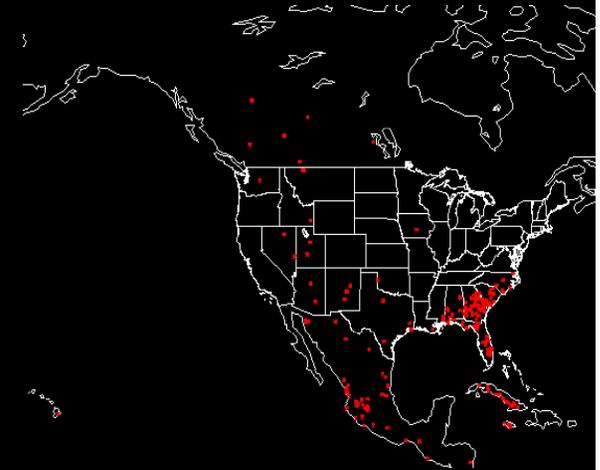
WF-ABBA All Fires Day 004, 2012

McIDAS



FIMMA All Fires Day 004 2012

McIDAS



MODIS Fire positions Received 24 hrs  
Before 1/05/2012 1745Z

**Automated fire detection algorithms are employed for each of the sensors:**

- WildFire Automated Biomass Burning Algorithm (WF-ABBA) for GOES
- Fire Identification Mapping and Monitoring Algorithm (FIMMA) for AVHRR
- MOD14 product for MODIS

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## THE SMOKE AND FIRE ANALYST

### THEIR JOB

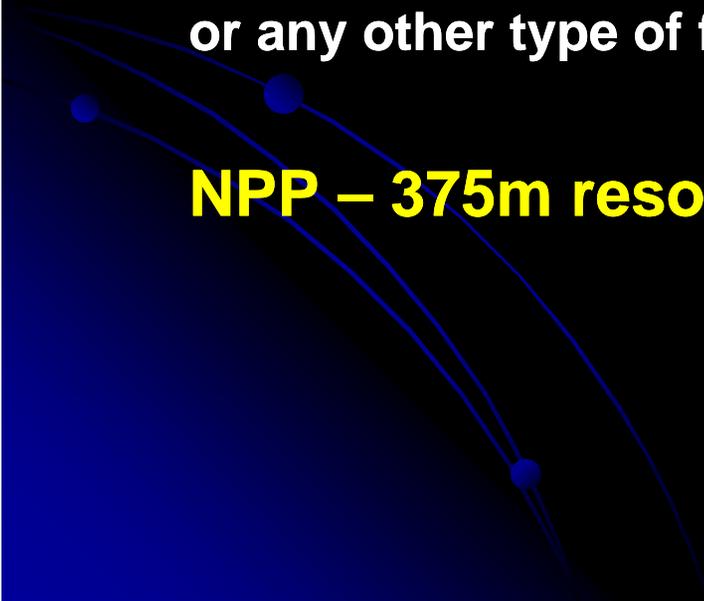
- Quality checks fire points produced by the ABBA, FIMMA, and MODIS algorithms by looking at the associated satellite data. Adds fire the algorithms have not detected (can be substantial).
- **Draws in the smoke produced by the fires. The analyst can identify the smoke as thin, moderately dense or dense with an assigned numerical value (5, 16 and 27 ug/m<sup>3</sup>) for each plume.**
- Provides locations of significant smoke producing fires as input to the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model which provides a 48 hour forecast movement of the smoke that is used in NWS AQ forecast.

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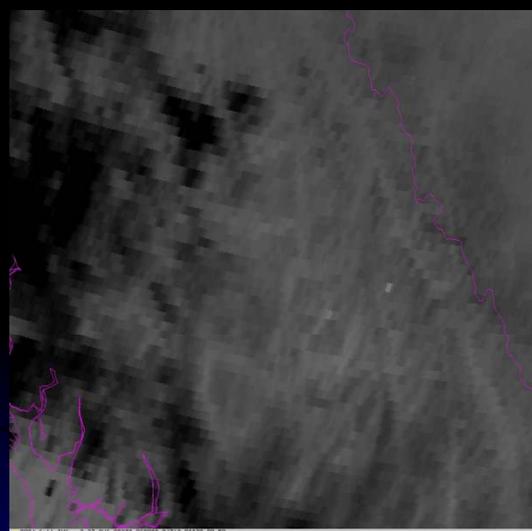
## The Advantages of GOES vs. POES

- **The temporal resolution of GOES vs. POES (15/30 min vs. 2 views a day per satellite)**
- **The spatial resolution of POES vs. GOES for locating wildfires or any other type of fires (1 km vs. 4 km)**

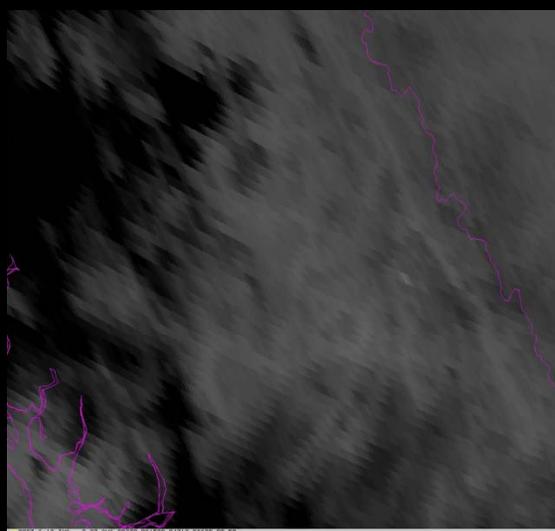
**NPP – 375m resolution and much wider swath**

A decorative graphic in the bottom-left corner of the slide. It features three curved blue lines representing satellite orbits, with three small blue circles placed at different points along the curves, suggesting satellite positions or ground stations.

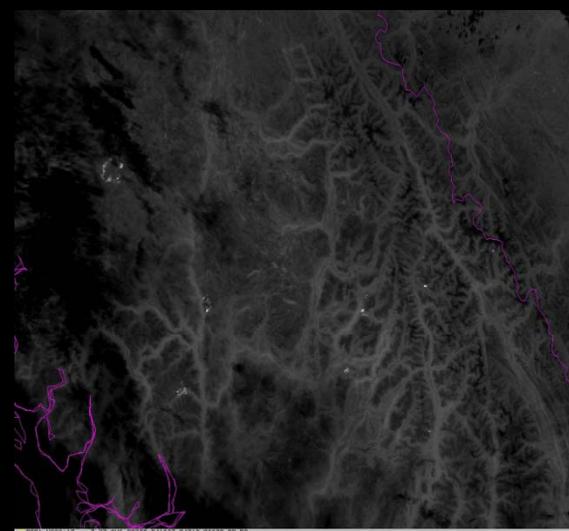
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GOES-11 0600z



GOES-12 0615z

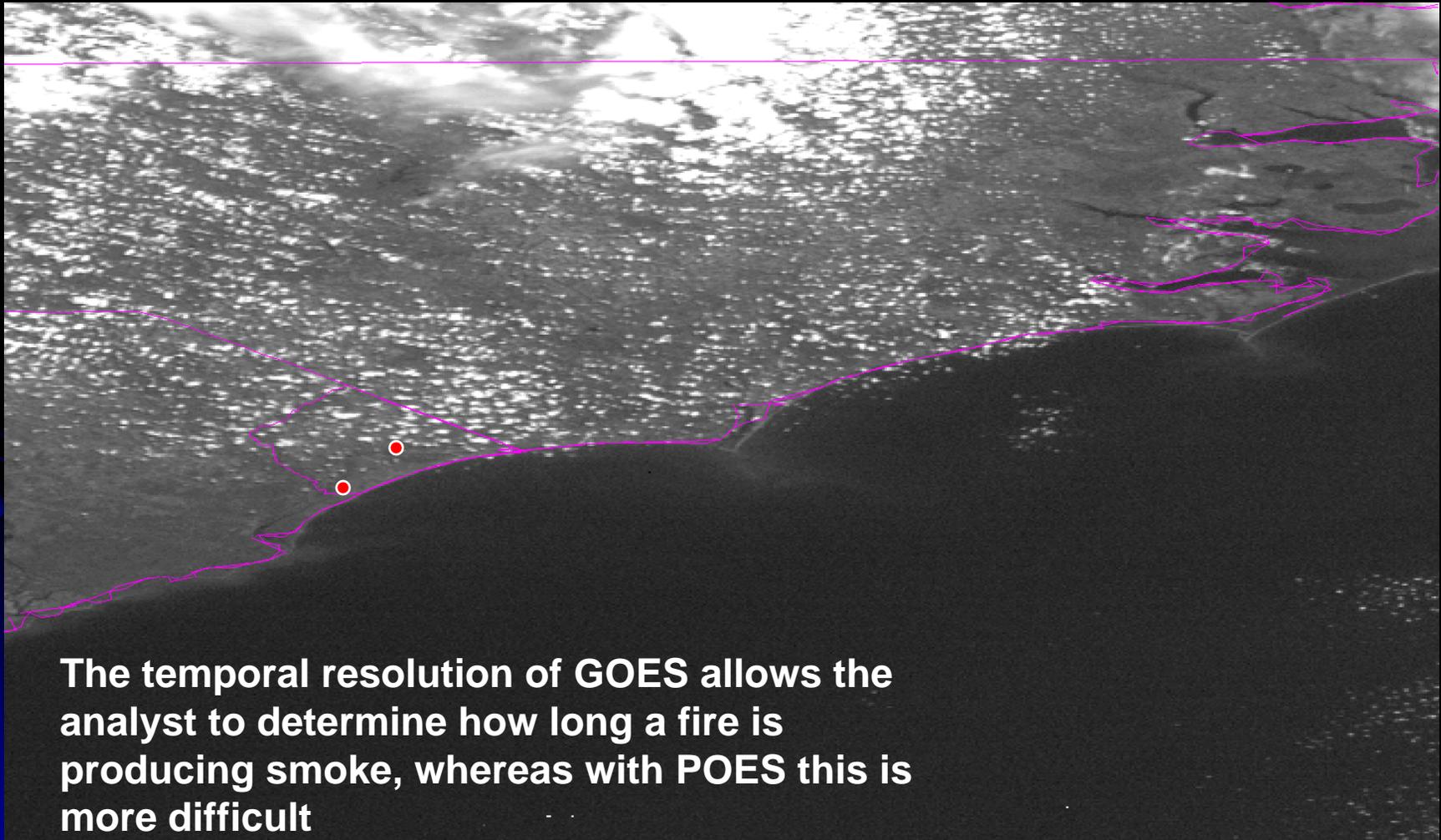


NOAA-18 0416z

**The spatial resolution of NOAA-17 allowed the analyst to detect cooler and smaller fires when compared to GOES imagery**

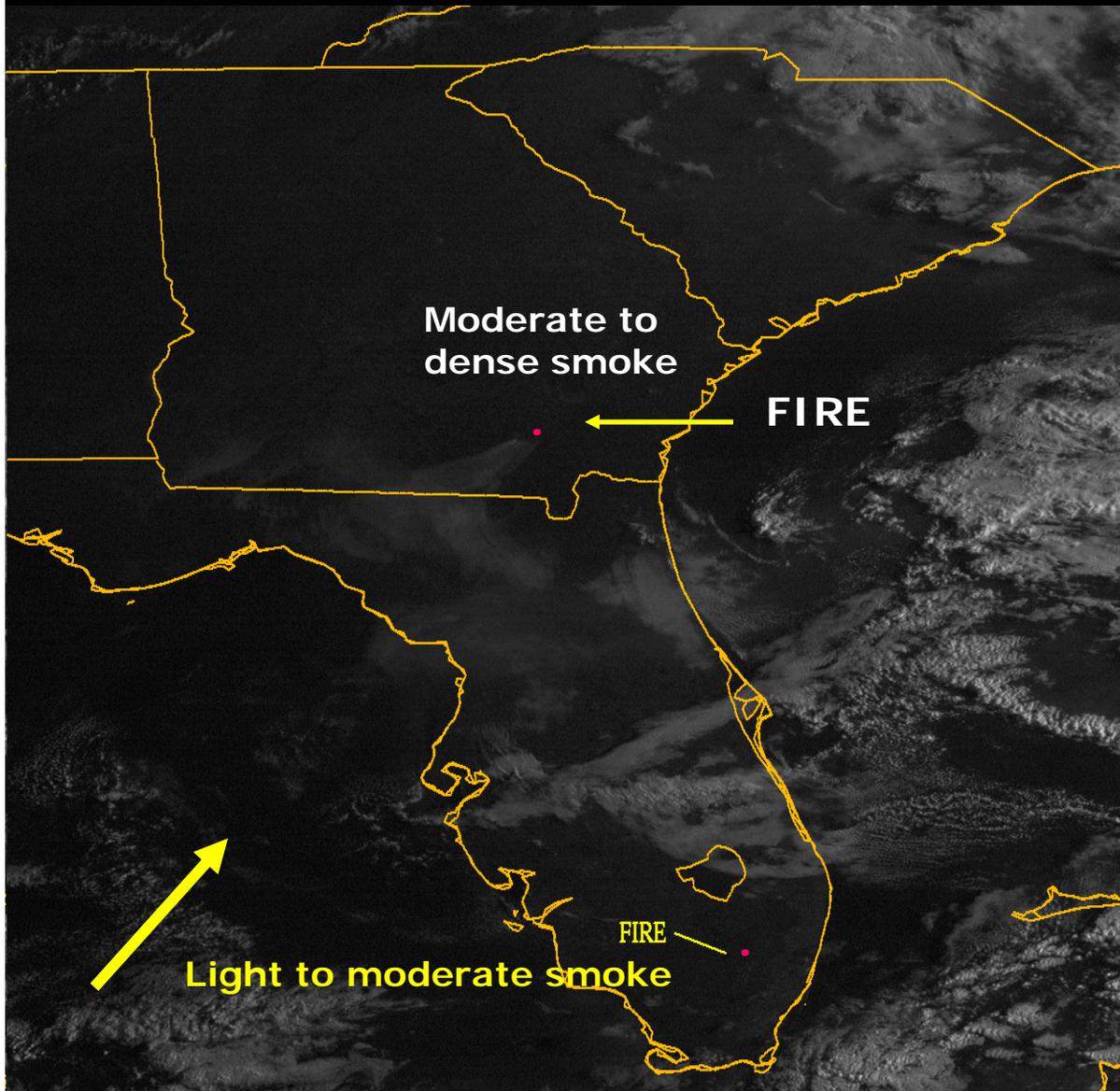
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## 2009 Horry County Wildfire in Eastern South Carolina



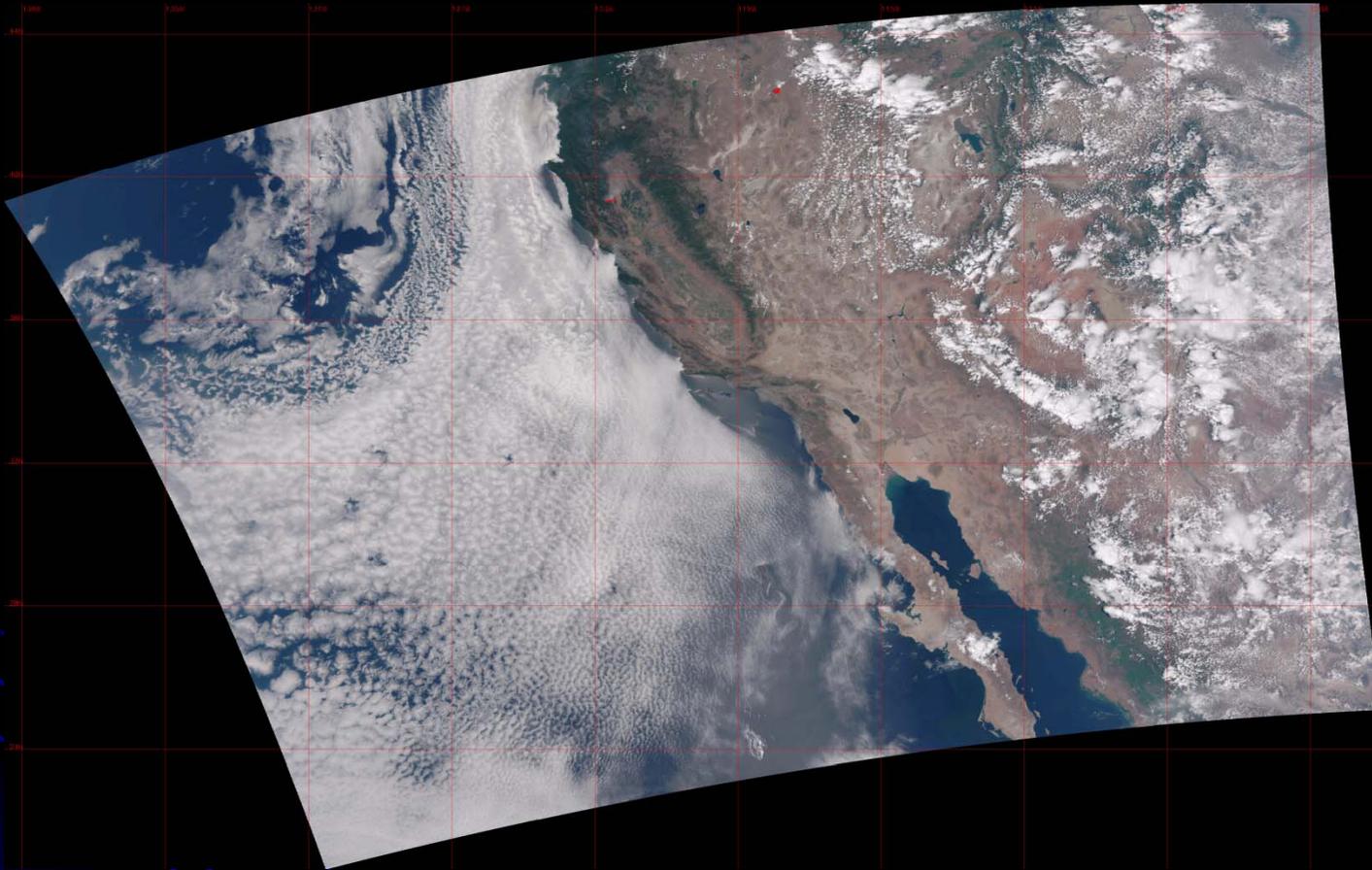
The temporal resolution of GOES allows the analyst to determine how long a fire is producing smoke, whereas with POES this is more difficult

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**These are easily identified as wildfires. However, sea breezes and shifting winds present challenges. The temporal resolution of GOES helps the analyst see the changes whereas POES may not show these changes as easily**

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## NPP data

Better spatial resolution for picking up small and cooler burning fires  
when compared to GOES and even the current POES series

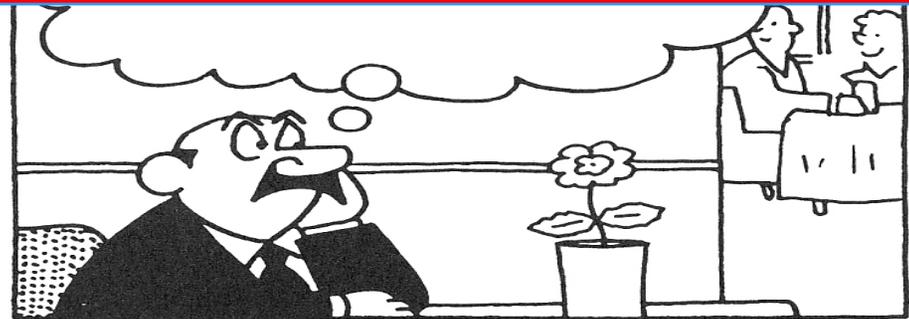
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## Forecasting Smoke

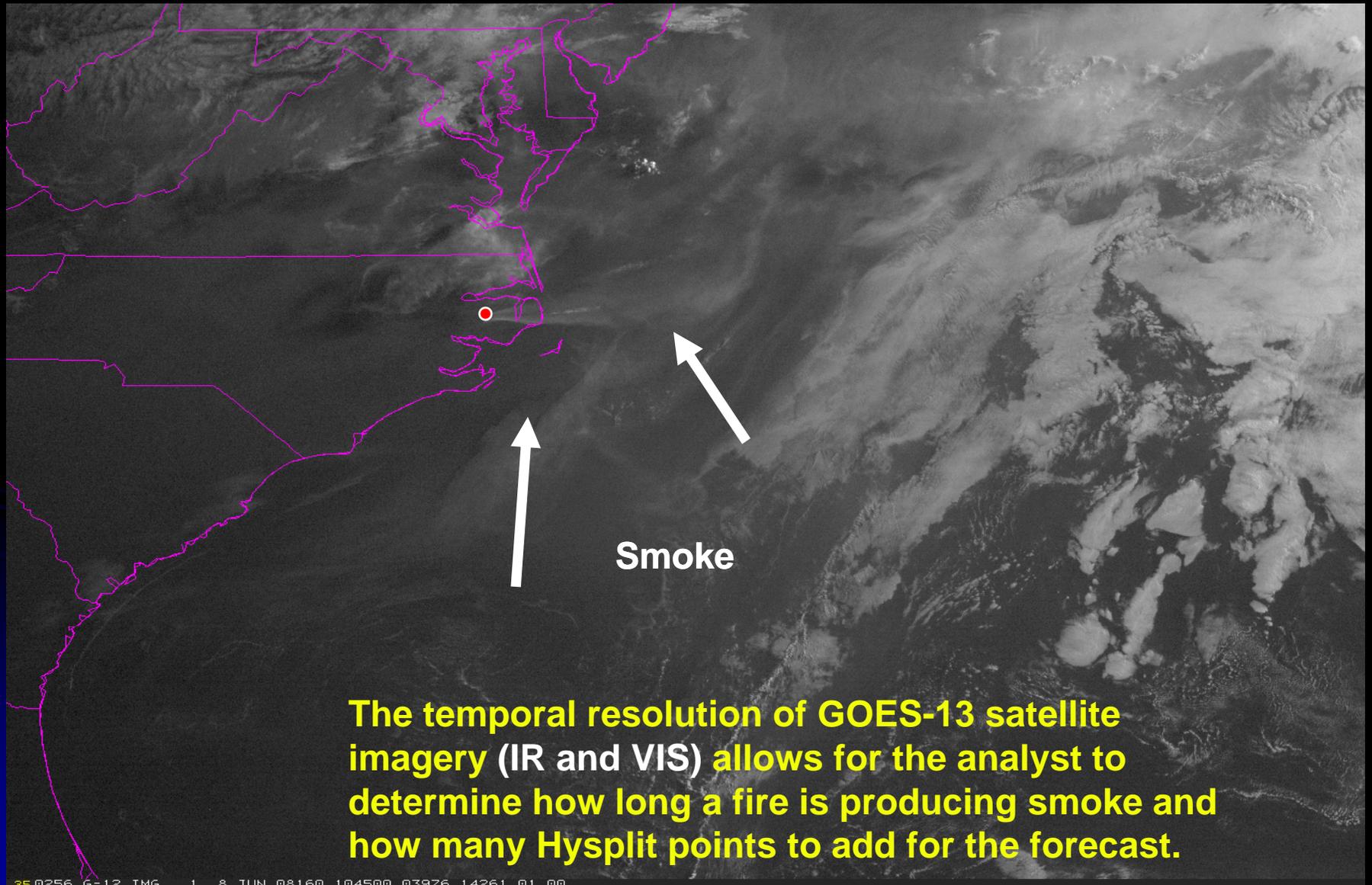
Analyst input to the HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) Model which is used in the National Weather Service (NWS) Air Quality Forecast:

- Locations of smoke emitting fires
- Each point represents 1 square km
- Start time and duration of smoke emissions

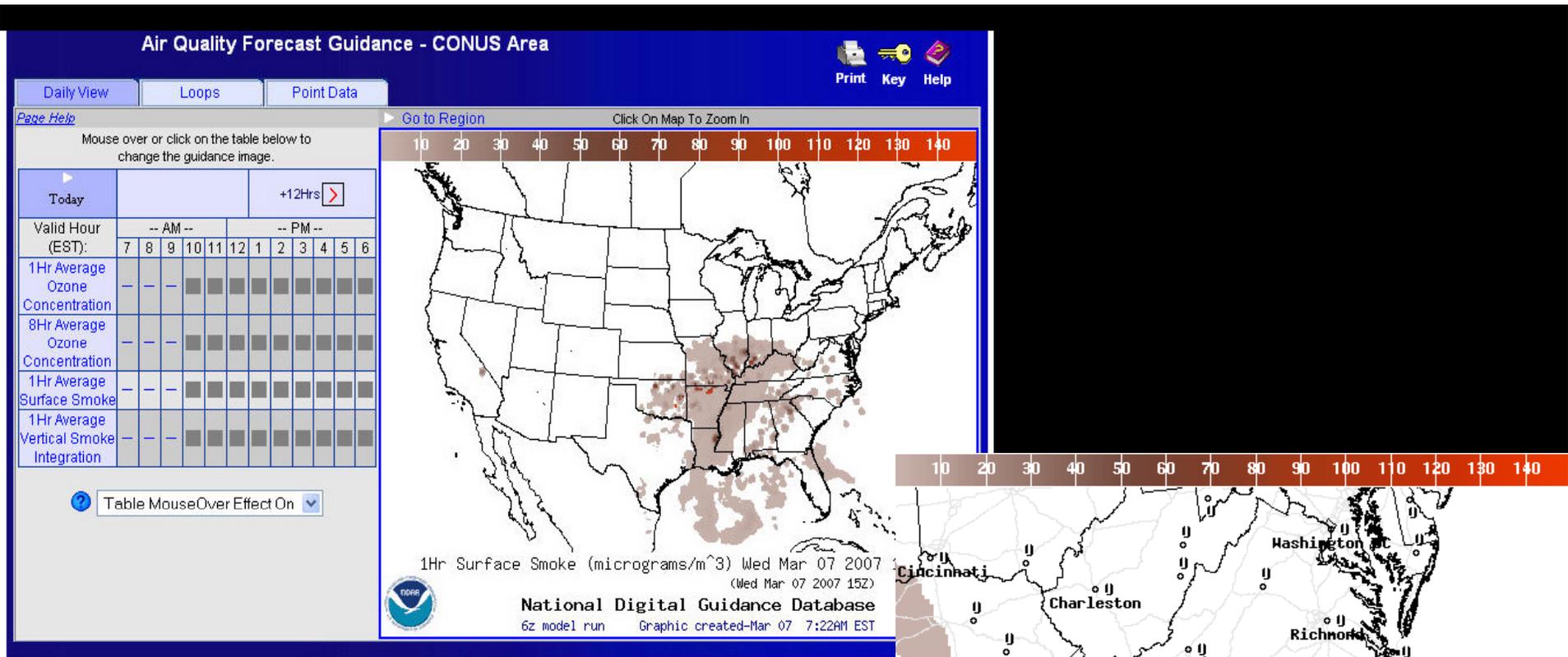
***Is this fire a prescribe burn or a wildfire? How long has it been producing smoke?***



# Evans Fire in Eastern North Carolina

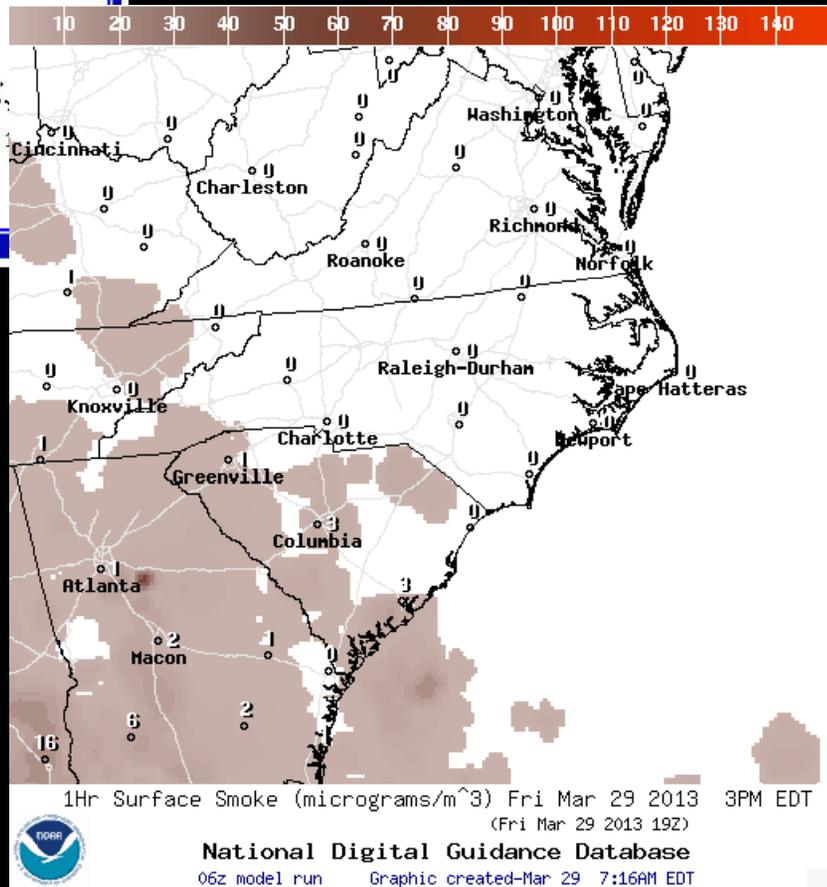


The temporal resolution of GOES-13 satellite imagery (IR and VIS) allows for the analyst to determine how long a fire is producing smoke and how many Hysplit points to add for the forecast.



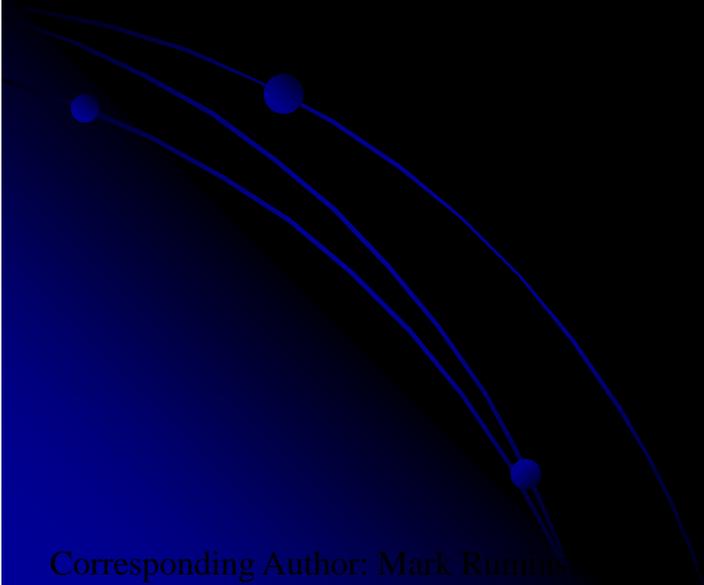
NWS Air Quality Forecast Guidance using HYSPLIT is run by NWS at 10Z on the following day using the 06Z NAM run for meteorology.

airquality.weather.gov/



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**The Arizona Wallow Wildfire:  
Monitoring Its Progress, Extreme Behavior  
and Long Range Smoke Transport from  
Multiple Satellite Platforms**

A decorative graphic in the bottom-left corner of the slide. It features three curved, parallel lines representing satellite orbits, with three small blue circular dots placed at various points along these curves. The background of this graphic is a gradient from dark blue to black.

Corresponding Author: Mark Rumins

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## Fire Statistics

- **Largest wildfire in Arizona's history; 538,000 acres**
- High winds, dry conditions, and a surplus of fuel directly contributed to the size and duration of the wildfire
- **Beat out the Rodeo-Chediski wildfire (2002; 467,000 acres) as Arizona's largest and bumped the Cave Creek Complex (2005; 244,000) to third**
- Started on May 29<sup>th</sup>, 2011
- **Destroyed 32 residences**
- Reached 100% containment on July 8<sup>th</sup>, 2011
- **PyroCBs generated on 6 consecutive days (June 1-6)**

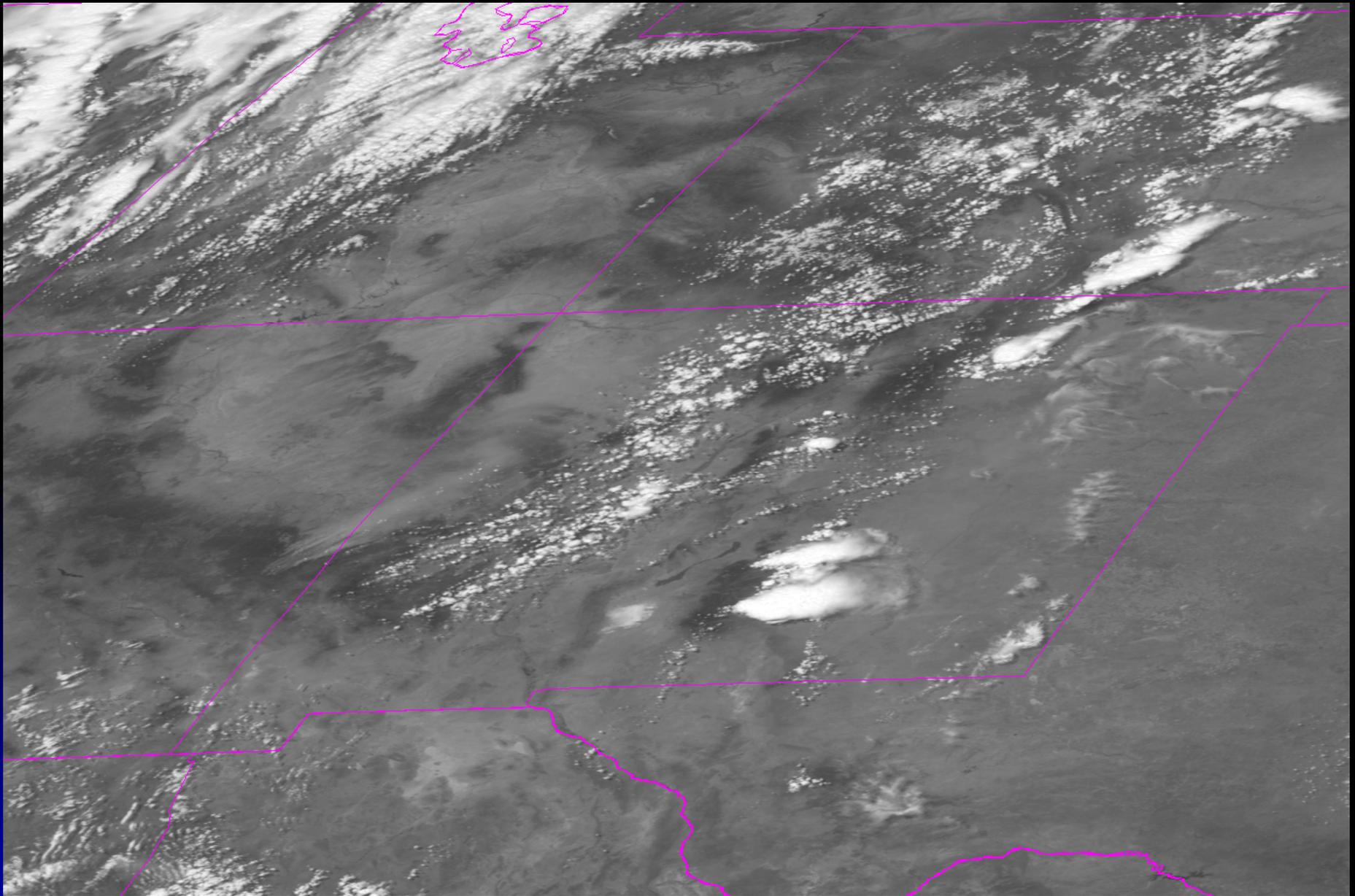
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**AVHRR ANIMATION**  
**May 31 – June 10 2011**  
**NOAA-15/16/18/19**  
**METOP-A**

**FIRE 'SURGES':**

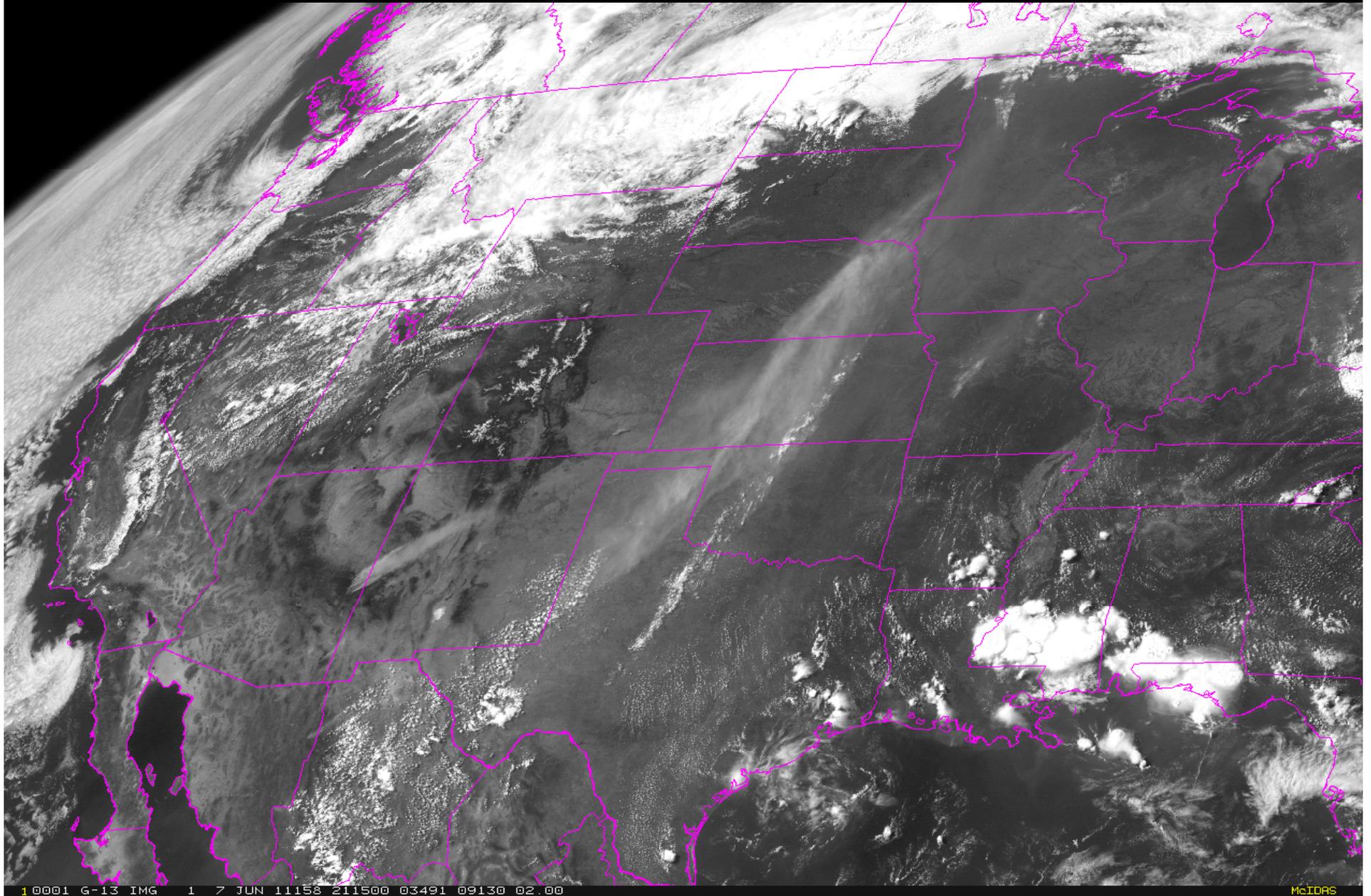
- June 1-3
- June 6-8

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35 0009 G-13 IMG 1 6 JUN 11157 191500 04146 10159 01.00

# National Ocean and Atmospheric Administration 2013 Satellite Conference



10001 G-13 IMG 1 7 JUN 1158 211500 03491 09130 02.00

McIDAS

# PRODUCT ACCESS

The screenshot shows the NOAA Hazard Mapping System Fire and Smoke Product website. The browser address bar displays [www.osdspd.noaa.gov/ml/land/hms.html](http://www.osdspd.noaa.gov/ml/land/hms.html). The page title is "Hazard Mapping System Fire and Smoke Product - Satellite Services Division - Office of Satellite Data Processing and Distribution - Mozilla Firefox". The main content area is titled "Hazard Mapping System Fire and Smoke Product" and "Current HMS Analysis". It features three maps: "Current HMS Fire and Smoke Analysis", "Interactive GIS HMS Product", and "Google KML files: Fire | Smoke". Below these are "Real-Time Satellite Imagery Loops" with four panels: "Active Fire Floater Imagery", "GOES West", "GOES East", and "NASA MODIS Rapid Response". The footer includes "NESDIS Products".



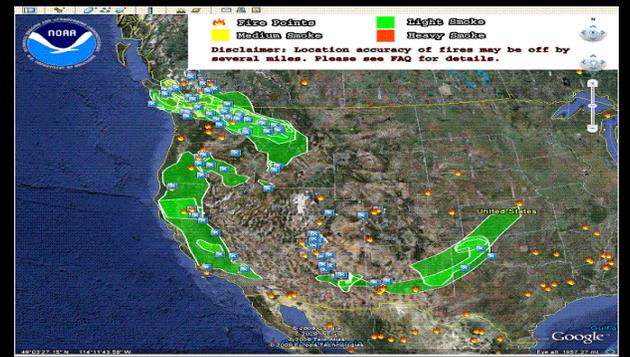
The screenshot shows a detailed view of the NOAA Hazard Mapping System Fire and Smoke Product website. The main map displays a grid of fire locations and smoke plumes, primarily concentrated in the western and central regions. The map is overlaid on a satellite-style background. The right side of the page features a "Layers" panel with various options for data visualization, including "Analyzed Fire from Satellite", "GOES 3hr", "GOES 2hr", "AQUOS", "AQOS", "Analyzed Smoke from Satellite", "Fire Potential", "State and Province Boundaries", "Land Use", "County Boundaries", "Radar 2hr Imagery", and "Land Cover". The bottom of the page includes a "CONTACT INFORMATION" section.

[www.osdspd.noaa.gov/ml/land/hms.html](http://www.osdspd.noaa.gov/ml/land/hms.html)

Includes links to

- archived products
- GIS page
- near real time imagery

- automated algorithms
- smoke forecasts
- manual quality controlled analysis



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**THANK YOU**

**QUESTIONS OR COMMENTS?**

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and

[Mark.Ruminski@noaa.gov](mailto:Mark.Ruminski@noaa.gov)