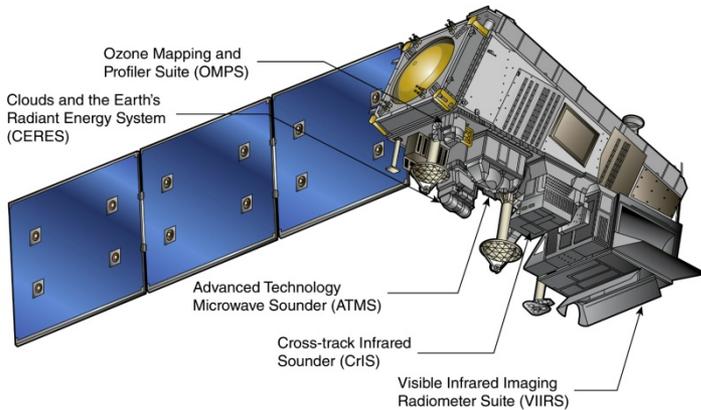




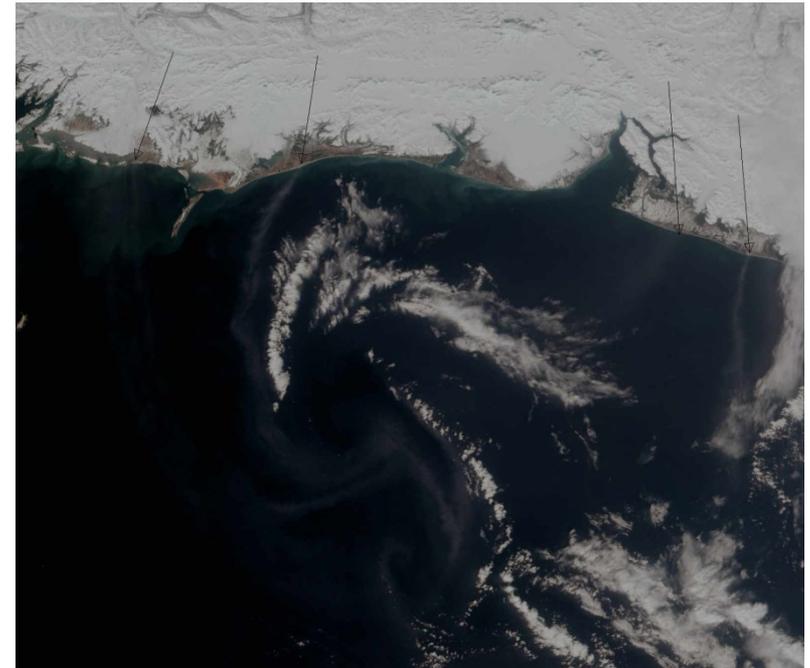
1

Introducing VIIRS Aerosol Products for Exceptional Events Monitoring and Forecasting in Alaska



Shobha Kondragunta

NOAA/NESDIS Center for Satellite Applications and Research

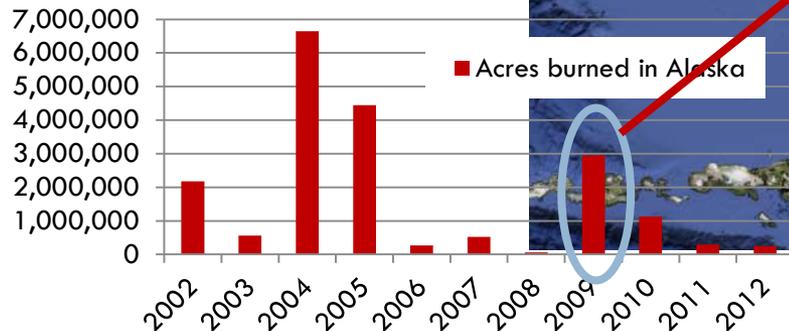
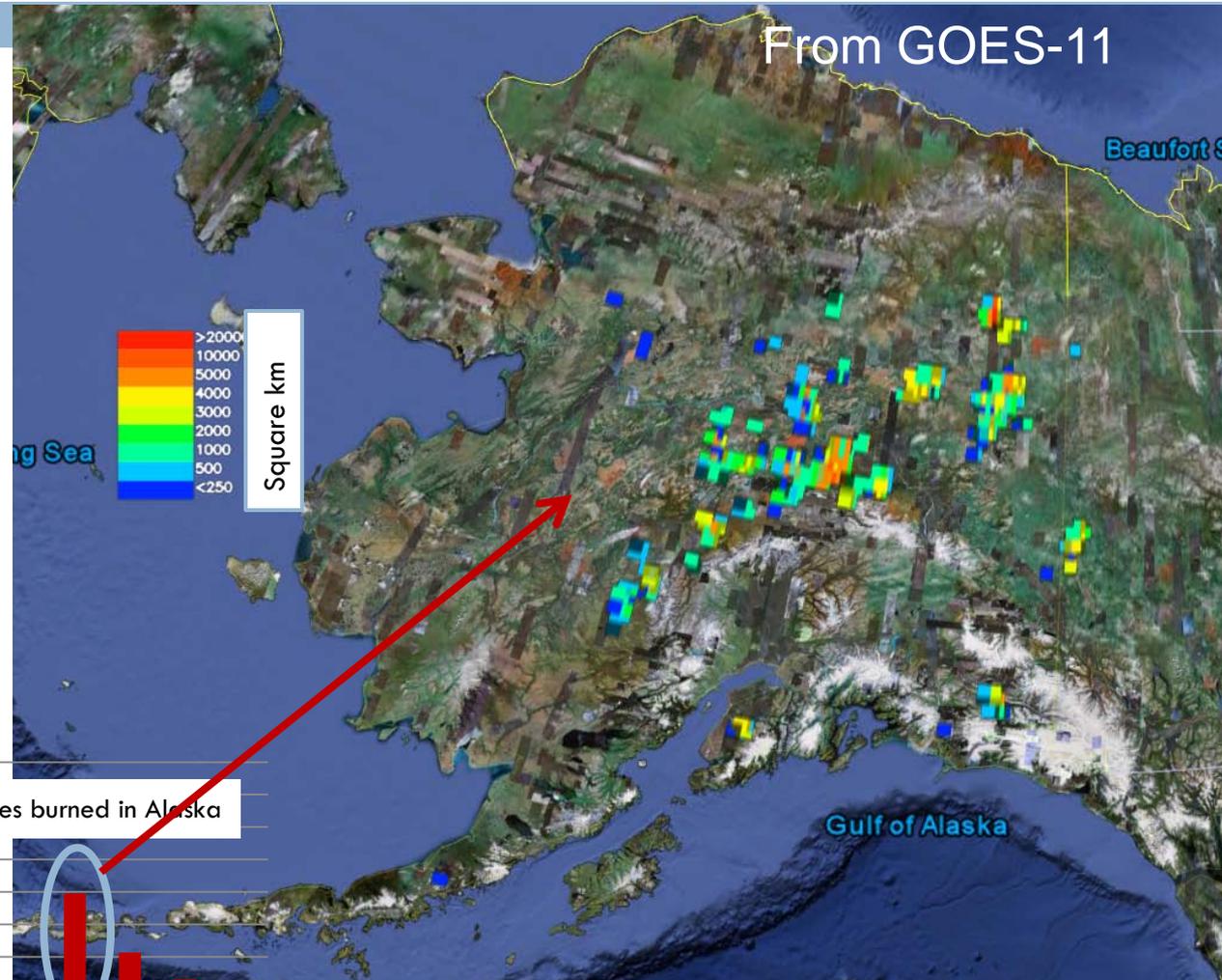


Contributions from: Hai Zhang, Chuanyu Xu, and Pubu Ciren, IMSG at NOAA

Alaska Burned Area

2

Thousands of acres burn each year in Alaska and smoke from fires has an adverse impact on human health and economy



From National Interagency Fire Center

Eleven years of GOES burned area product available from NESDIS/STAR for applications

JPSS Proving Ground Project

3

- Enable NWS Alaska to use near real time smoke plume imagery in monitoring, tracking, and forecasting of the Exceptional Events (EEs)
 - Adapt algorithms developed for GOES/GOES-R to VIIRS fire and aerosol products
 - Automated Smoke Detection and tracking Algorithm (ASDA) developed for GOES
 - Aerosol detection (smoke and dust) algorithm developed for GOES-R ABI
 - Aerosol detection (smoke and dust) algorithm developed for VIIRS
 - Run the smoke detection algorithms at NESDIS/STAR on VIIRS DB data and test/evaluate the product by comparing to event analysis and CALIPSO data
 - Transition the code to UF for implementation

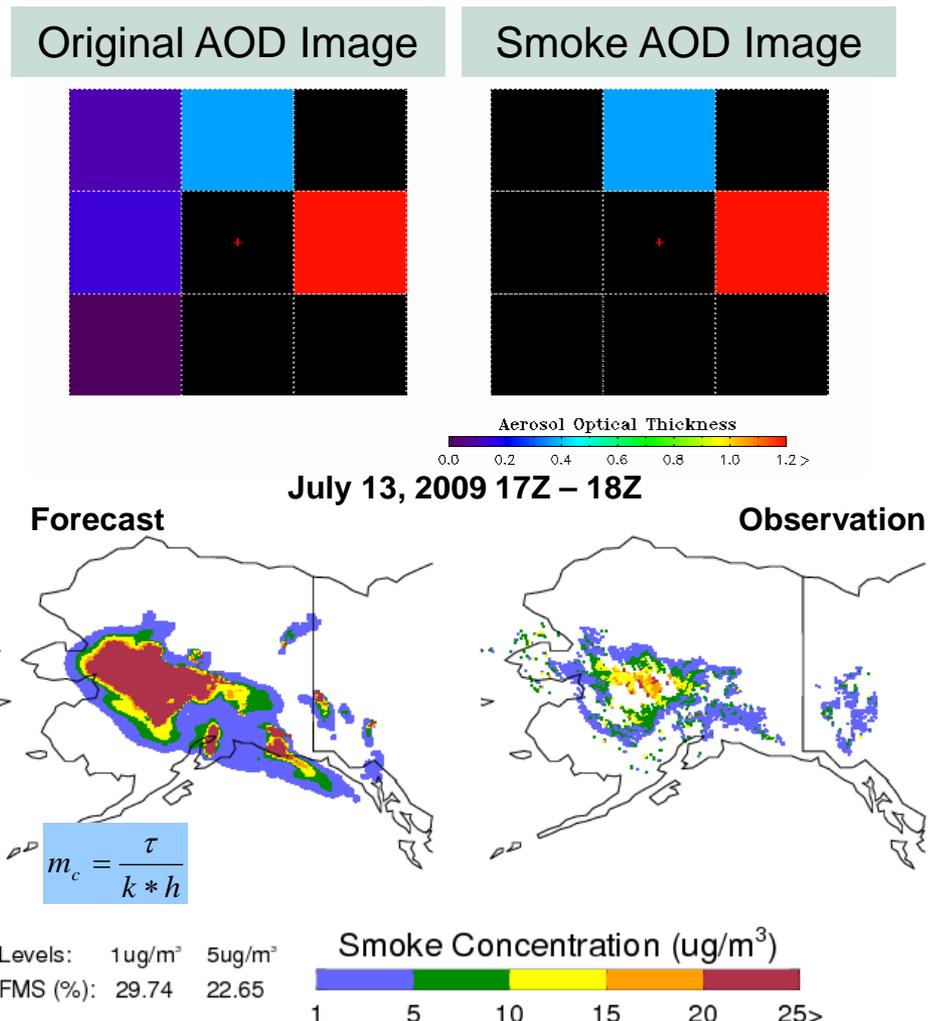
Automatic Smoke Detection and Tracking Algorithm

4

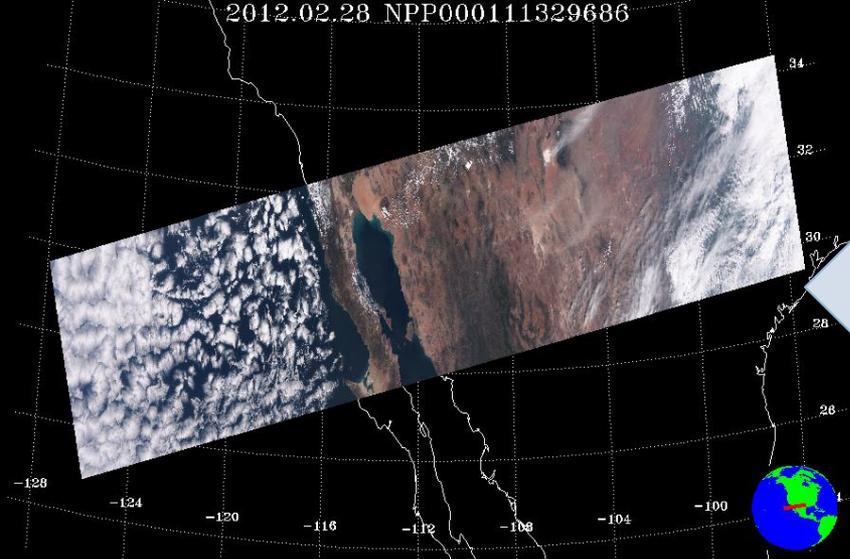
- Column average smoke concentration ($\mu\text{g}/\text{m}^3$) using AOD and fire hot spots from GOES
 - Uses source apportionment and pattern recognition techniques to isolate smoke aerosols from other type of aerosols
 - Smoke mass concentration (m_c) is obtained using AOD (τ), mass extinction efficiency (k), and aerosol height (h)
- Product specifications
 - **Name:** ASDTA
 - **Satellites:** GOES-East and GOES-West (includes Alaska and Hawaii)
 - **Accuracy:** 60%
 - **Spatial resolution:** 0.15°
 - **Temporal resolution:** hourly
 - **Latency:** one day
 - **Data format:** binary file, GRIB file, JPEG imagery
 - **Data availability:** 2007 - present

<http://airquality.weather.gov>

Animation of Smoke Plume Detection



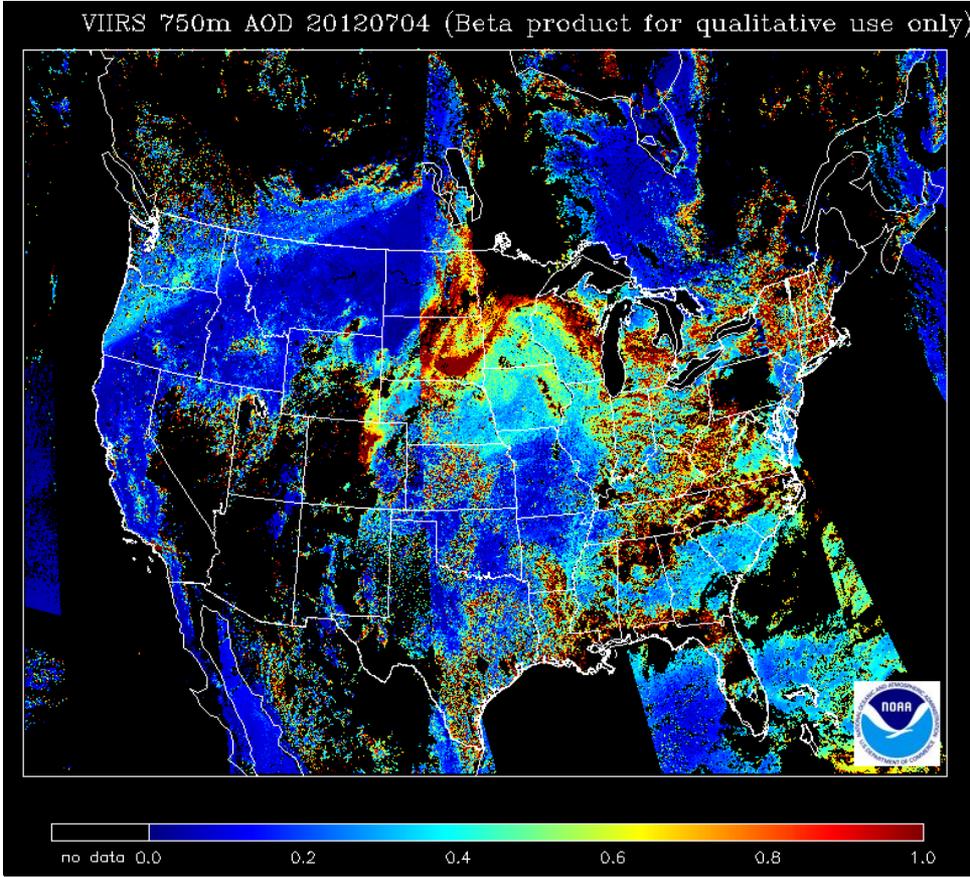
2012.02.28 NPP000111329686



VIIRS Granule: 86 seconds; 48 scan lines; 3040 km swath width; 16 M-bands (412 nm to 12 μm); 768 X 3200 fixed array size per granule.

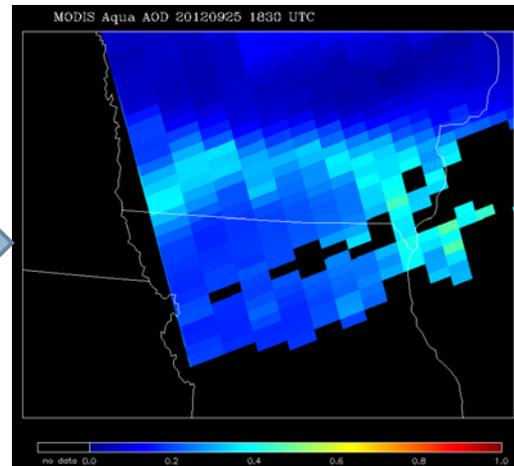
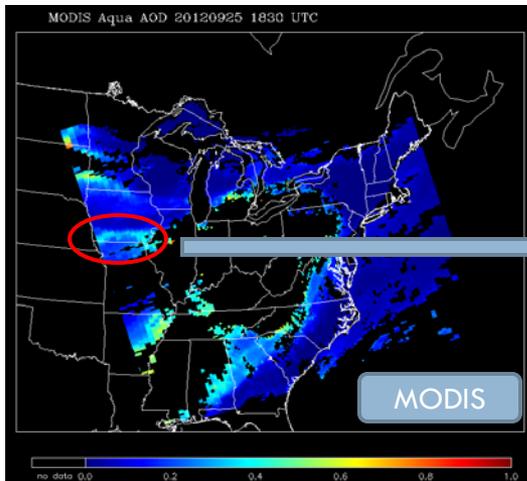
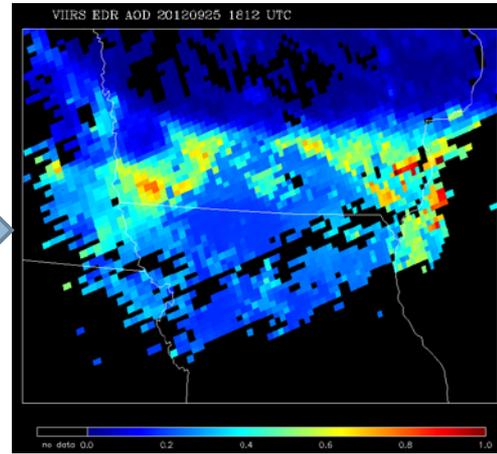
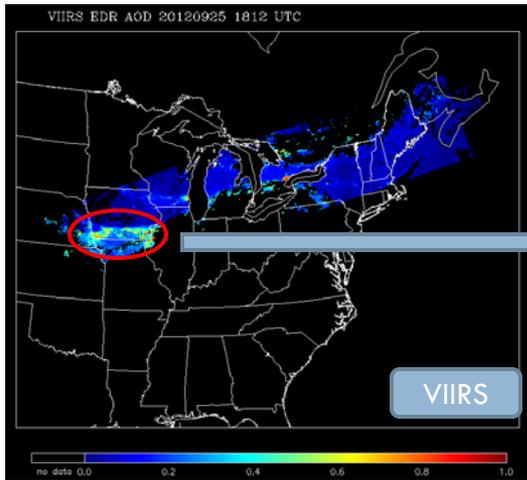
Outputs (HDF5): (1) AOT Intermediate Product, IP; (2) AOT Environmental Data Record, EDR; (3) Suspended Matter; (4) Aerosol Model Information; (5) Geolocation file for IP; (6) Geolocation file for EDR.

Need to know: IP is a pixel level AOT retrieval; EDR is an aggregate of about 8 X 8 IP pixels; IP product has Navy Aerosol Analysis and Prediction System AOT filled in for pixels with no retrievals but this is not included in EDR; **no AOT over inland water bodies**; **no negative retrievals allowed**; **no AOTs over 2.0 reported**; **VIIRS products come with several quality flags that are useful to screen the data.**



VIIRS vs. MODIS EOS

6



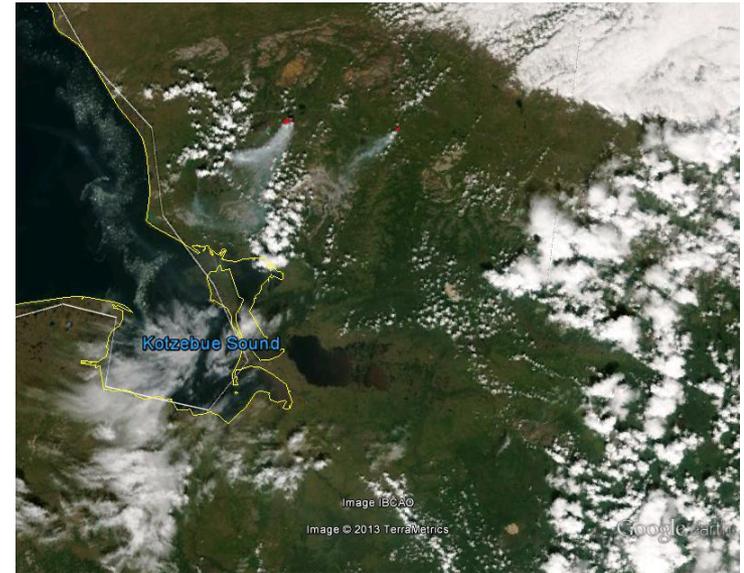
	MODIS	VIIRS
Orbit altitude	690 km	824 km
Equator crossing time	13:30 LT	13:30 LT
Granule size	5 min	86 sec
swath	2330 km	3040 km
Pixel nadir	0.5 km	0.75 km
Pixel edge	2 km	1.5 km
EDR AOT Product nadir	10 km	6 km
EDR AOT Product EOS	40 km	12 km

Fire/Smoke Events in 2012

2012-07-07 2141 UTC RGB



2012-07-07 2324 UTC RGB



2012-07-08 2122 UTC RGB

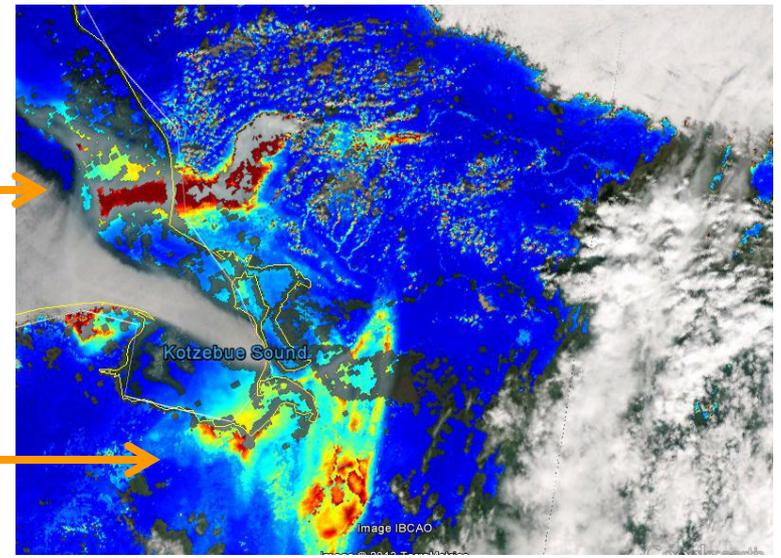
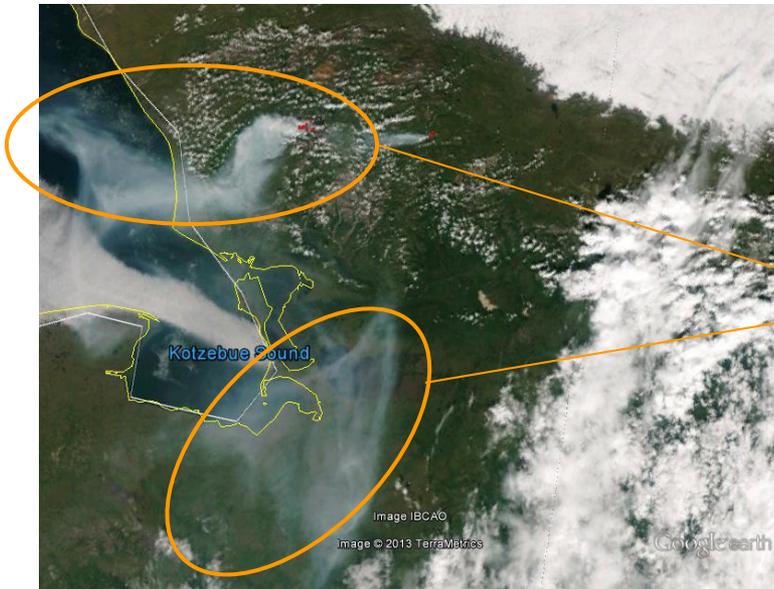


2012-07-08 2303 UTC RGB



2012-07-08 2122 UTC RGB

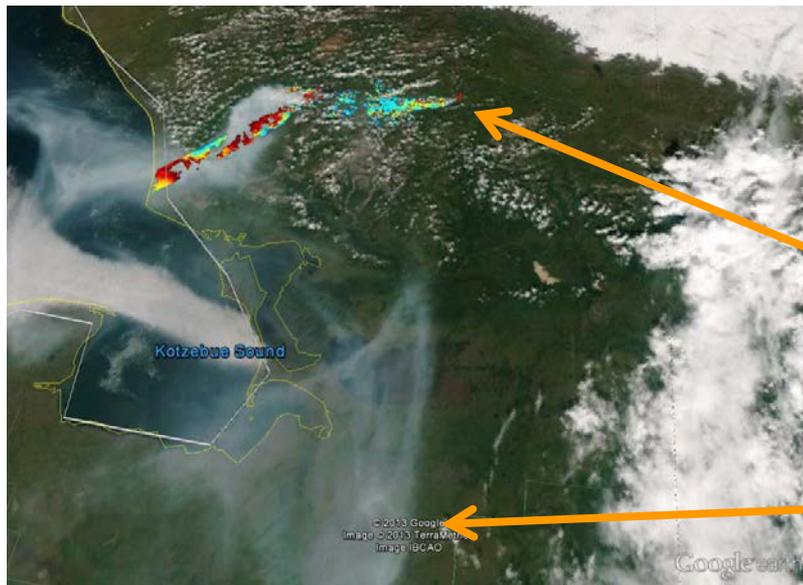
2012-07-08 2122 UTC IP AOT



Smoke visible in the RGB image is detected nicely in the VIIRS AOT product

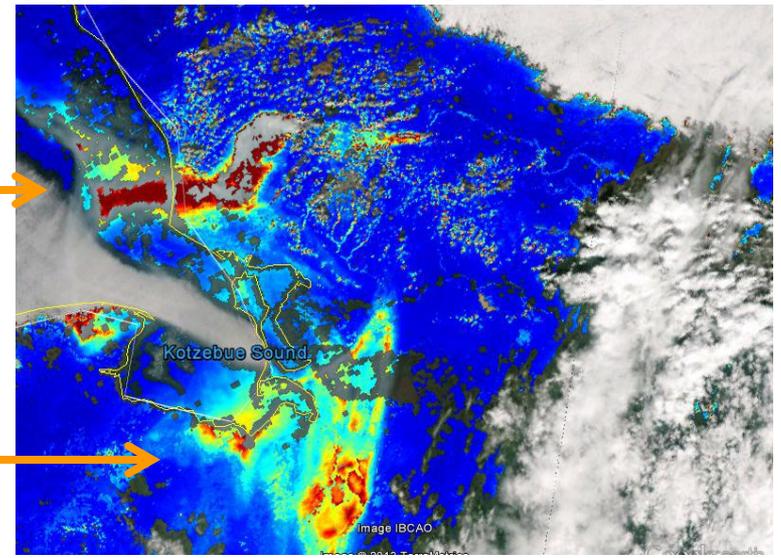
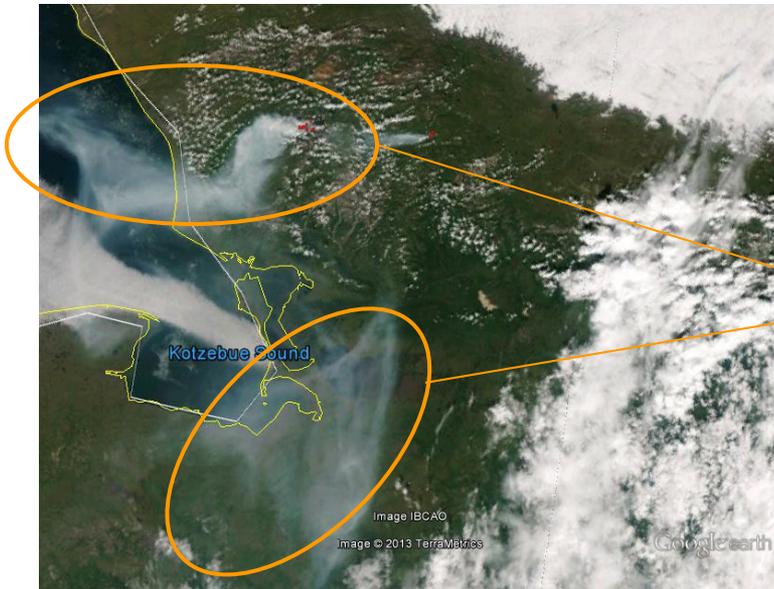
ASDA algorithm applied to VIIRS granules identifies a narrow smoke plume associated with fire

Smoke plume transported away from the fire source not detected because it is detached from the source.

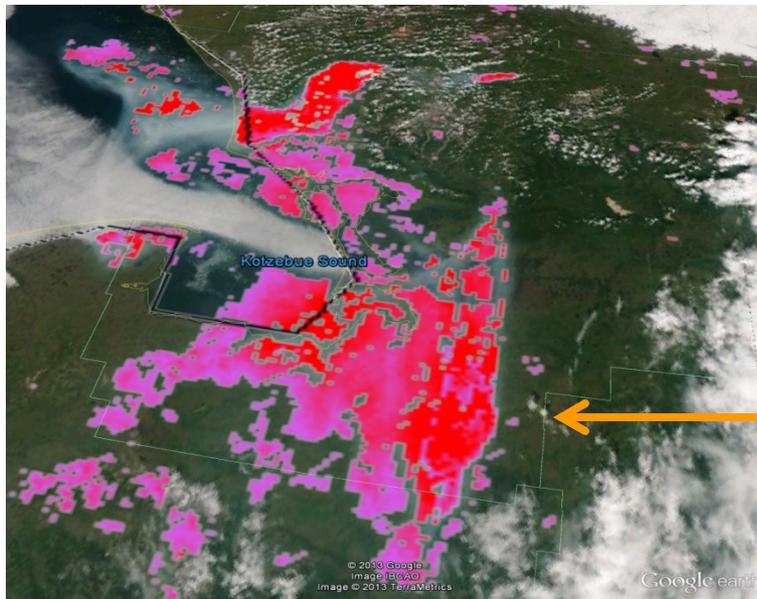


2012-07-08 2122 UTC RGB

2012-07-08 2122 UTC IP AOT

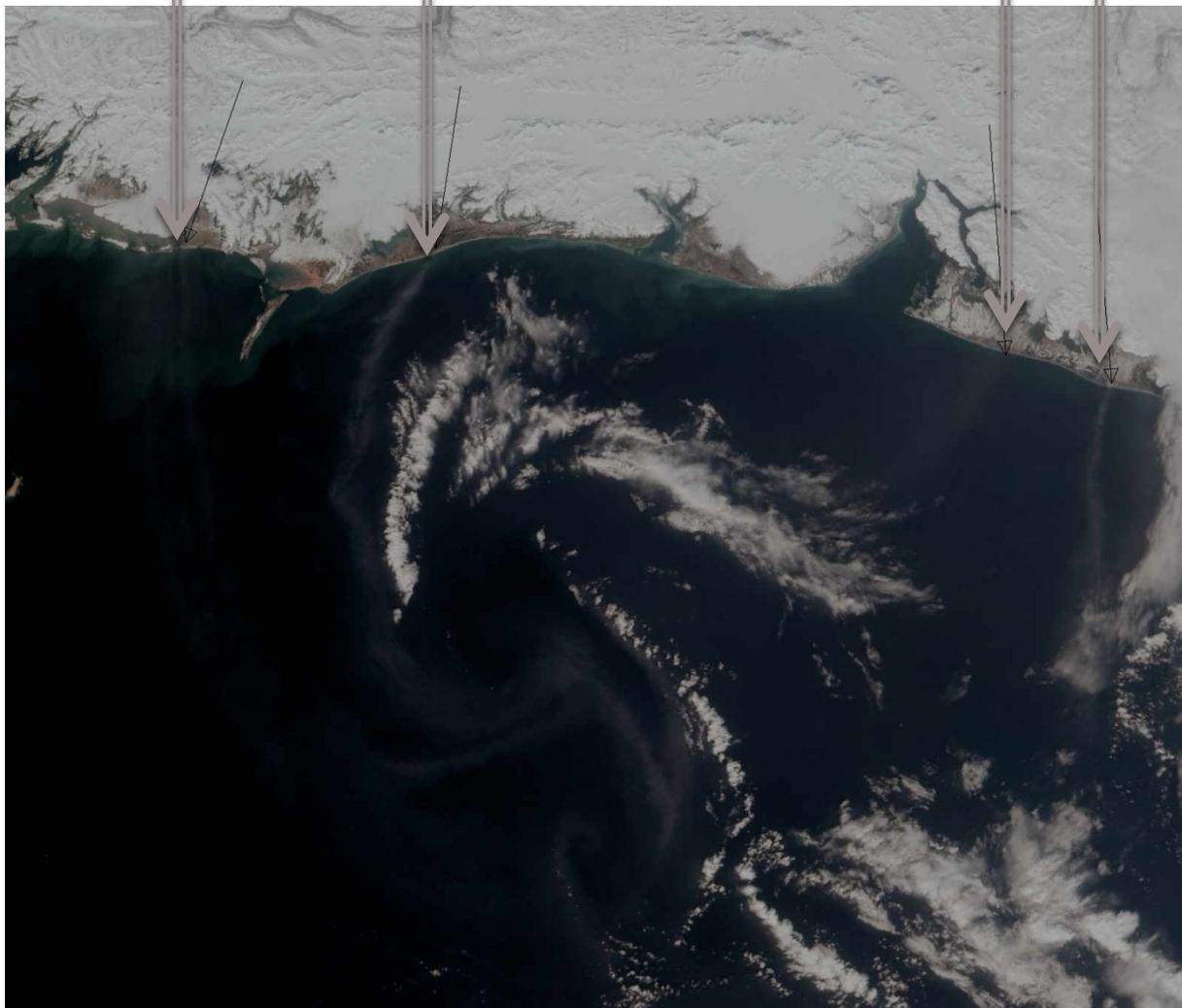
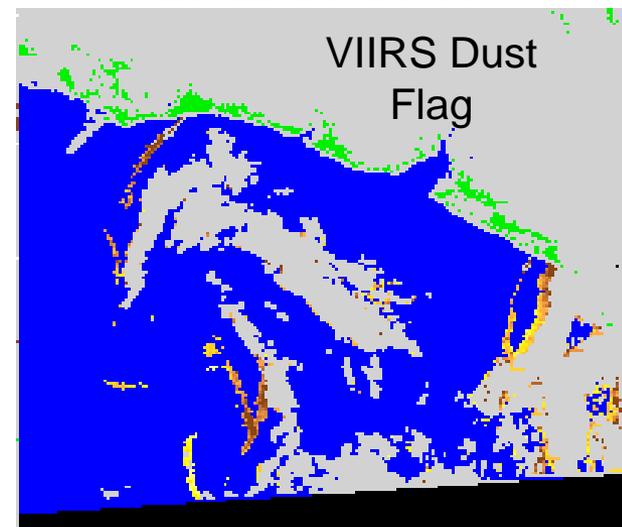
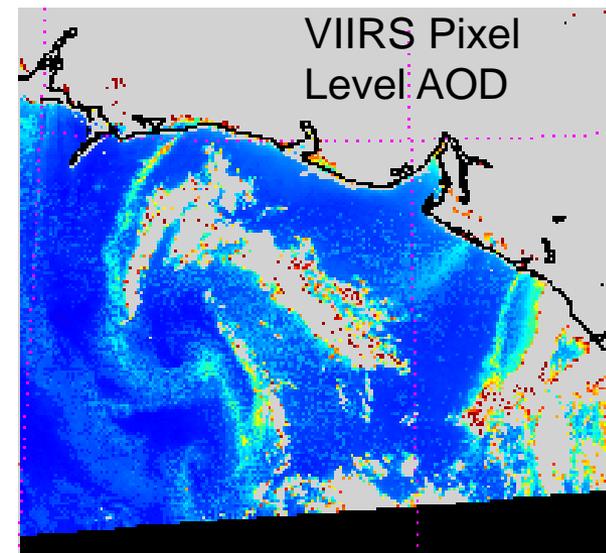


Smoke visible in the RGB image is detected nicely in the VIIRS AOT product



VIIRS smoke detection algorithm (research version) applied to VIIRS granules identifies most of the smoke plumes associated with fires.

VIIRS true color image of blowing dust from different sources in Alaska on April 28, 2013



IDEA Infusing satellite Data into Environmental Applications

We value your feedback! Please send any comments, problems and suggestions to the IDEA Team.

NASA NOAA NASA-ESA CIMSS

MODIS AIR NOW WFABRA

VIIRS Satellite Natural Color and AOT Images (Alaska)

SELECT PLOT PREVIOUS FORECAST DAY NEXT FORECAST DAY

2013 June 17 Go
Valid date ranges (20080101 to 20130617)

VIIRS 2013-06-17 2210 UTC

labels Map black

Animation Controls

NCI Opacity

AOD Opacity

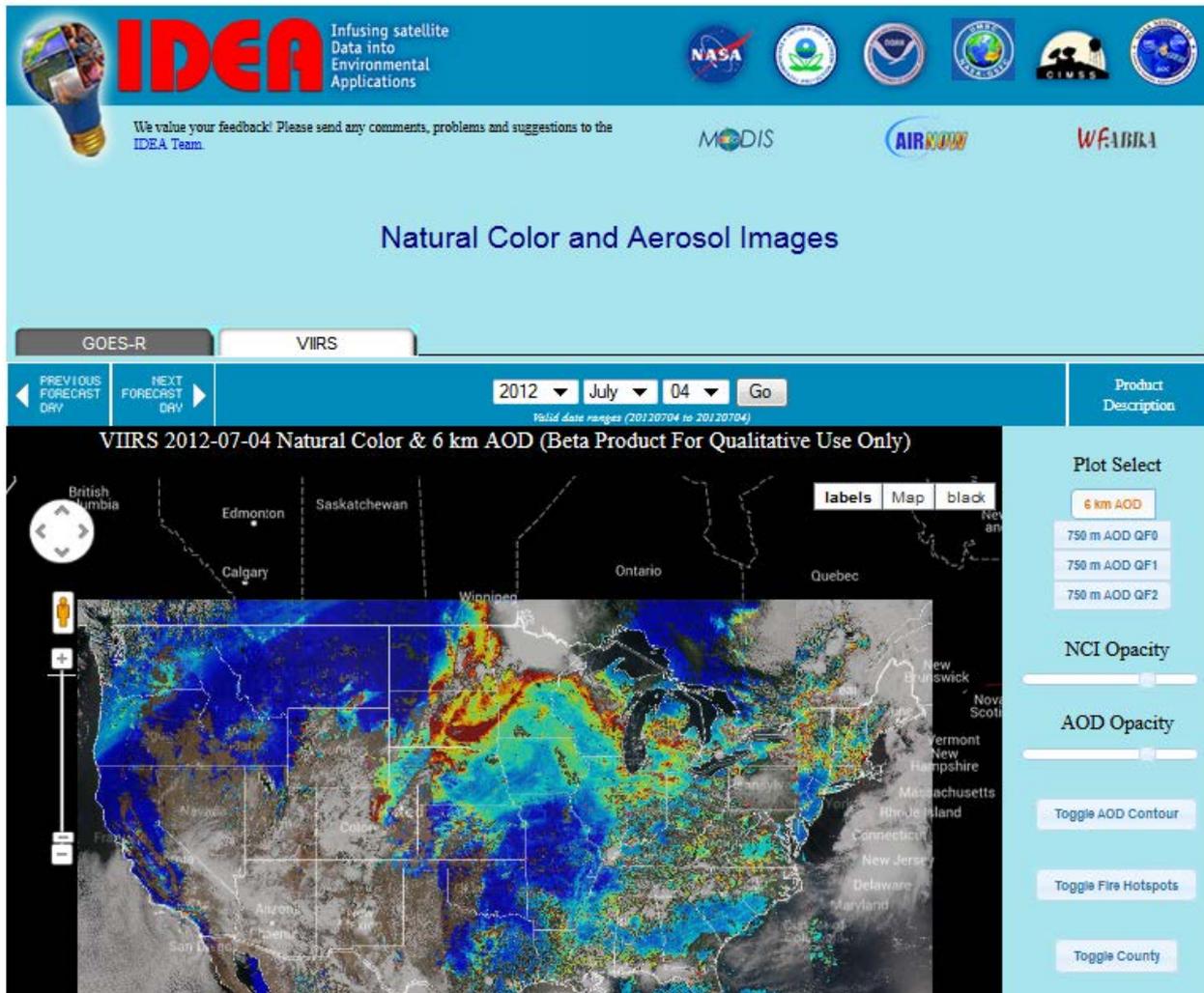
AOT Quality Select

- High Quality
- Medium/High Quality
- All Quality

Toggle Fire Hotspots

Toggle County

http://www.star.nesdis.noaa.gov/smcd/spb/aq/index_viirs_AL.php?product_id=5



http://www.star.nesdis.noaa.gov/smcd/spb/aq/aqpg_v3/index.php?plot_type=goesr_aod&product_date=20120704&product_gmt=1000&product_id=1

Conclusions

13

- After CSPP VIIRS EDR package V1.1 is implemented at UF, AOT and ASDA images for Alaska region will be generated routinely on STAR computers;
- Algorithm performance will be evaluated by comparing the smoke AOT product with other satellite observations (e.g., CALIPSO);
- Will coordinate with UF and CIMSS on how to transition the algorithm