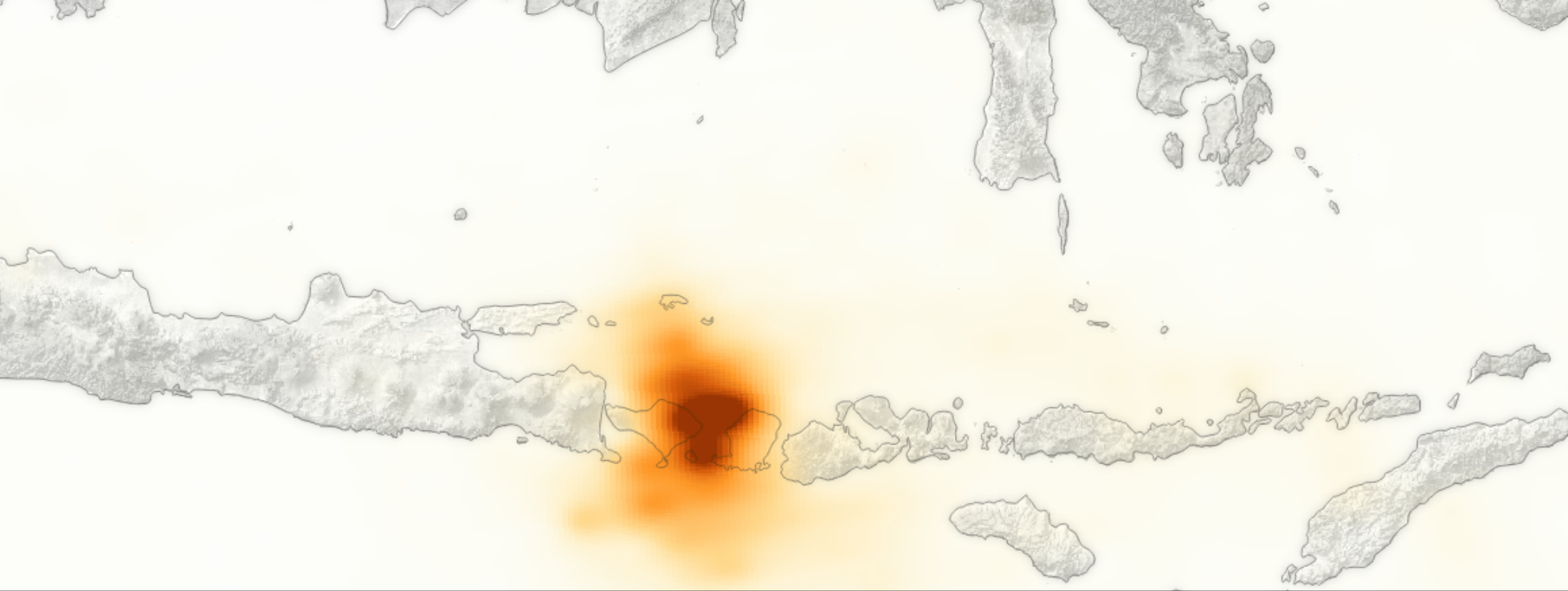


New and Upcoming Satellite Capabilities for Air Quality Monitoring

Data Analysis Tools for High Resolution Air Quality Satellite Datasets

Pawan Gupta & Melanie Follette-Cook, January 17-22, 2018





VIIRS

Visible Infrared Imaging Radiometer (VIIRS)

A multi-wavelength imager like MODIS with similar wavelength bands

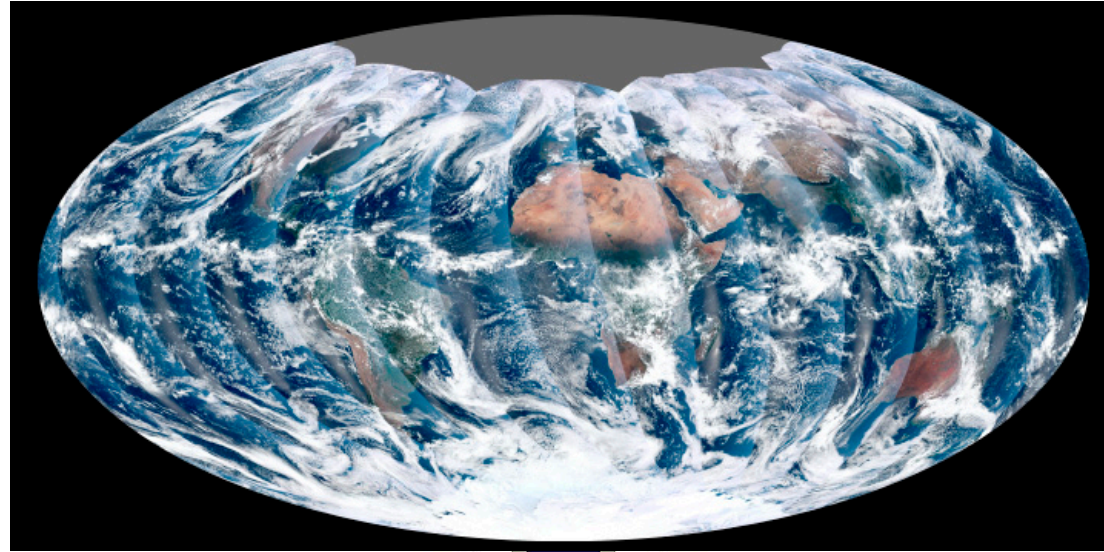
	MODIS	VIIRS
Orbit Altitude	690 km	824 km
Equator Crossing Time	13:30 LT	13:30 LT
Granule Size	5 min	86 sec
Swath	2,330 km	3,000 km
Pixel Nadir	0.5 km	0.75 km
Pixel Edge	2 km	1.5 km



VIIRS and MODIS

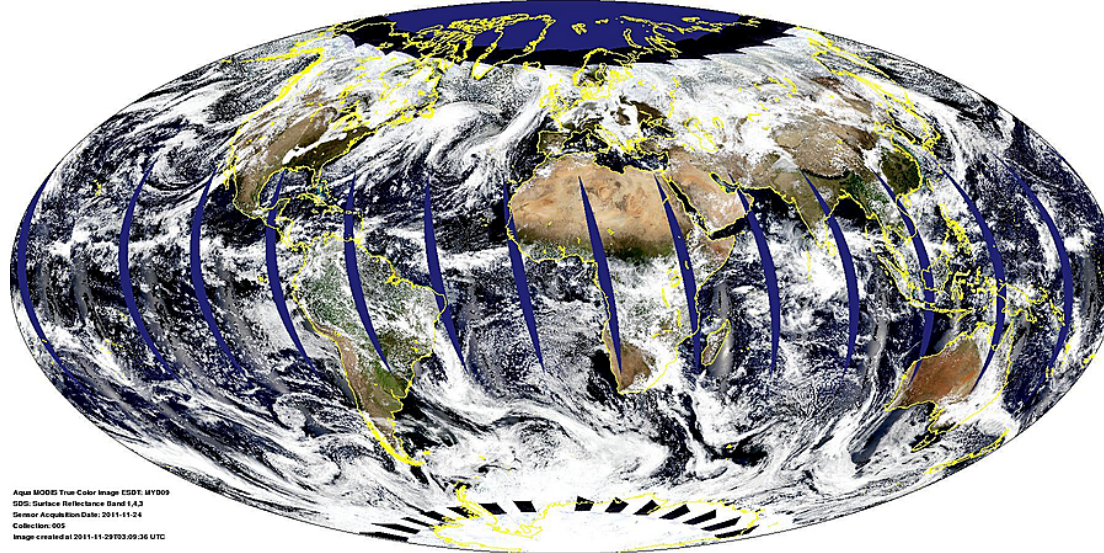
VIIRS

Nov 24, 2011



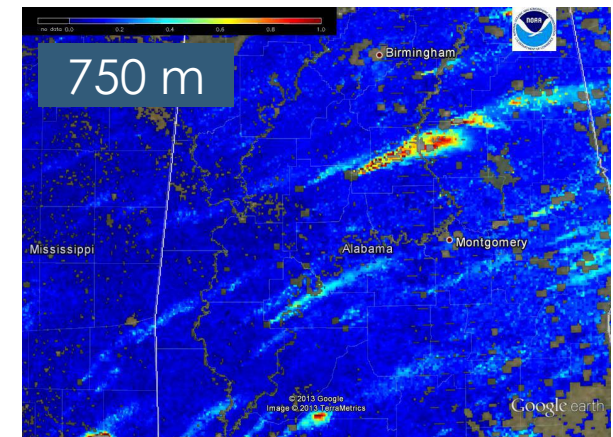
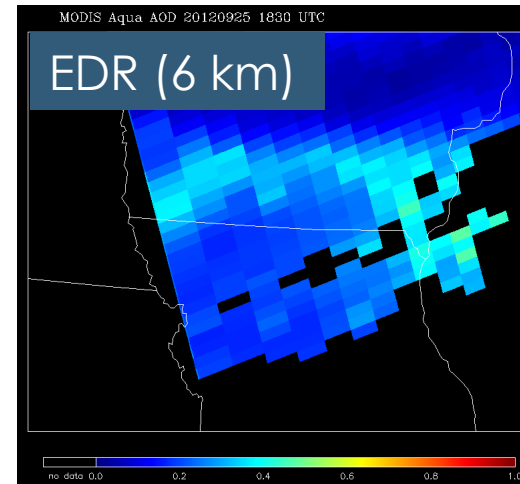
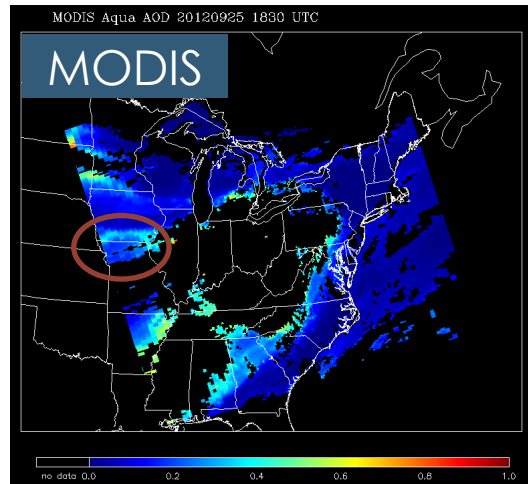
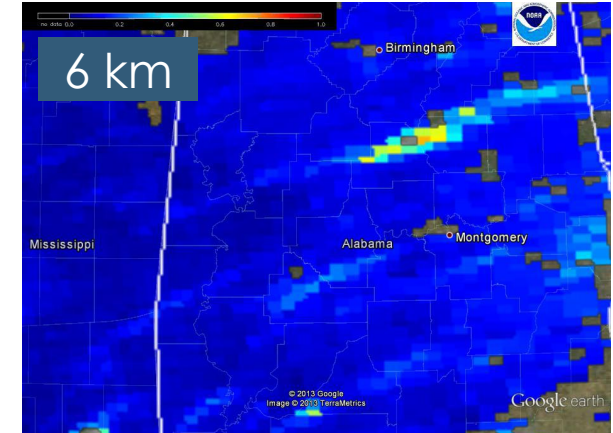
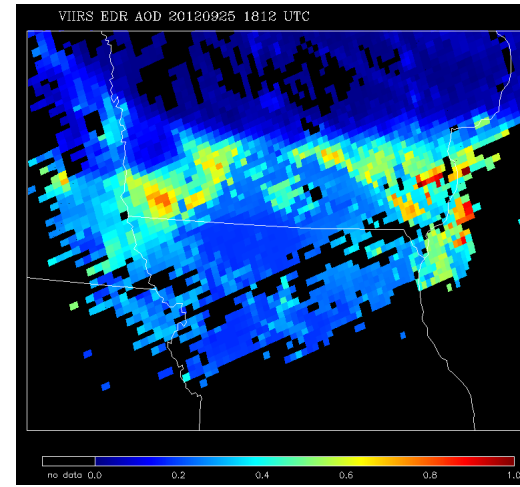
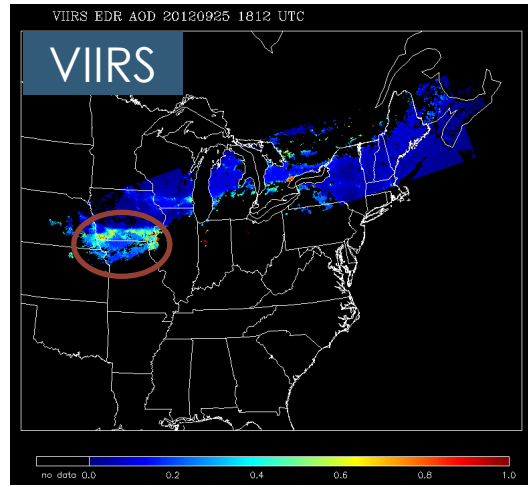
MODIS (Aqua)

Nov 24, 2011



SNPP VIIRS Advantages

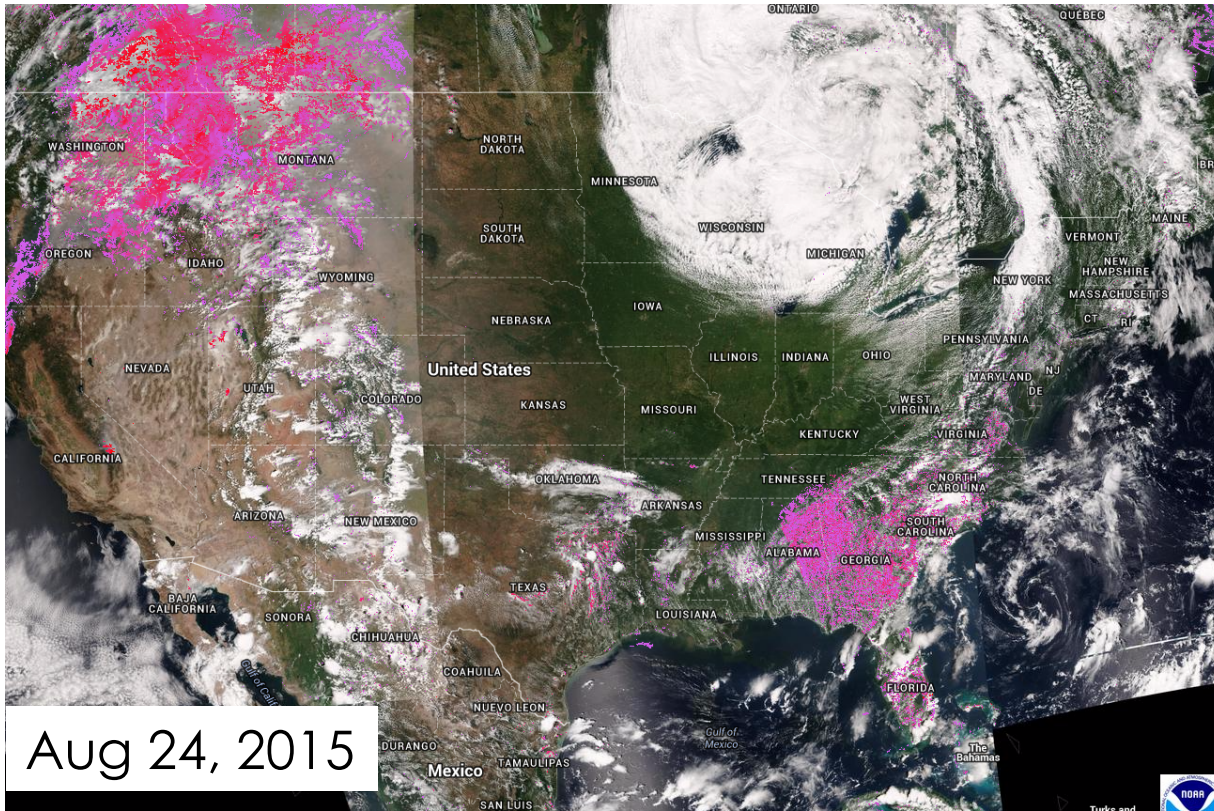
1. Pixels don't stretch at the edge of the scan
2. First 750 m resolution AOD product



Side Courtesy: Shobha Kondragunta



VIIRS: Smoke Mask

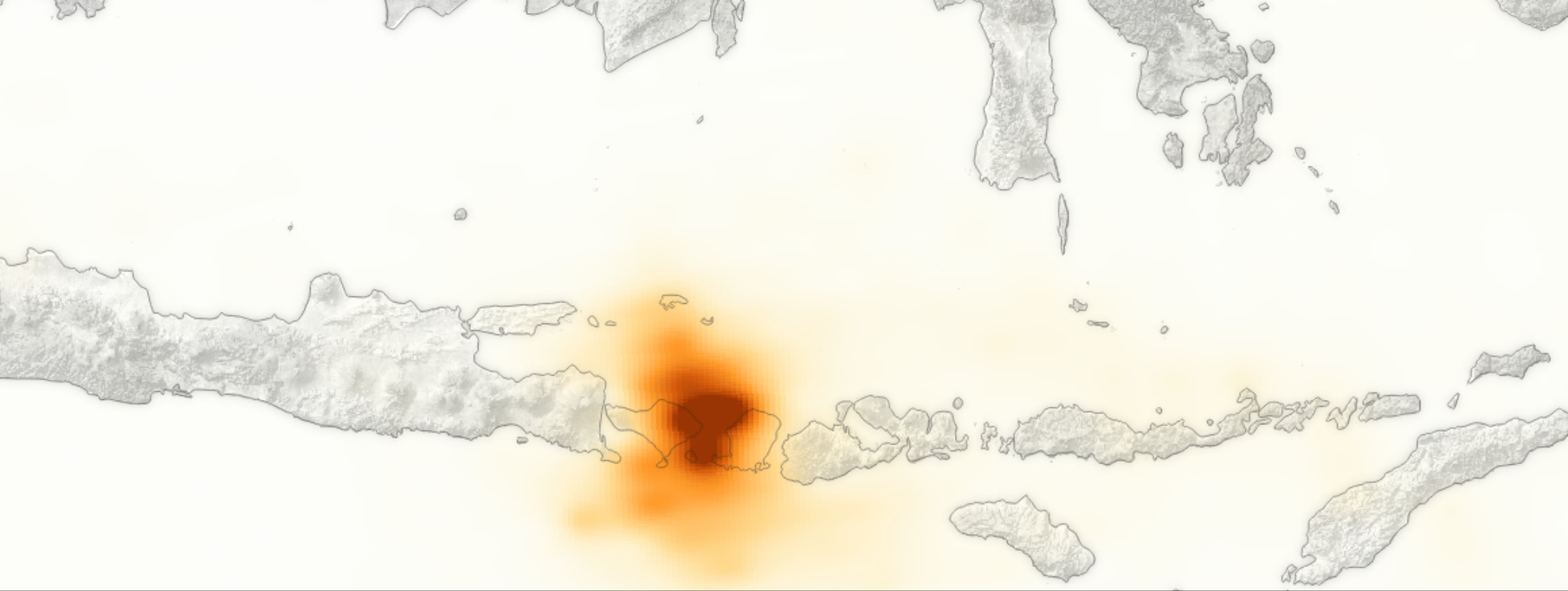


smoke mask



- Smoke mask: qualitative indicator of smoke
- Derived using spectral and spatial threshold tests based on VIIRS measurements in visible and IR
- **Useful for identifying local and transported smoke plumes**
- Colored in shades of pink
 - Light pink: thin smoke
 - Bright pink/magenta: thick smoke

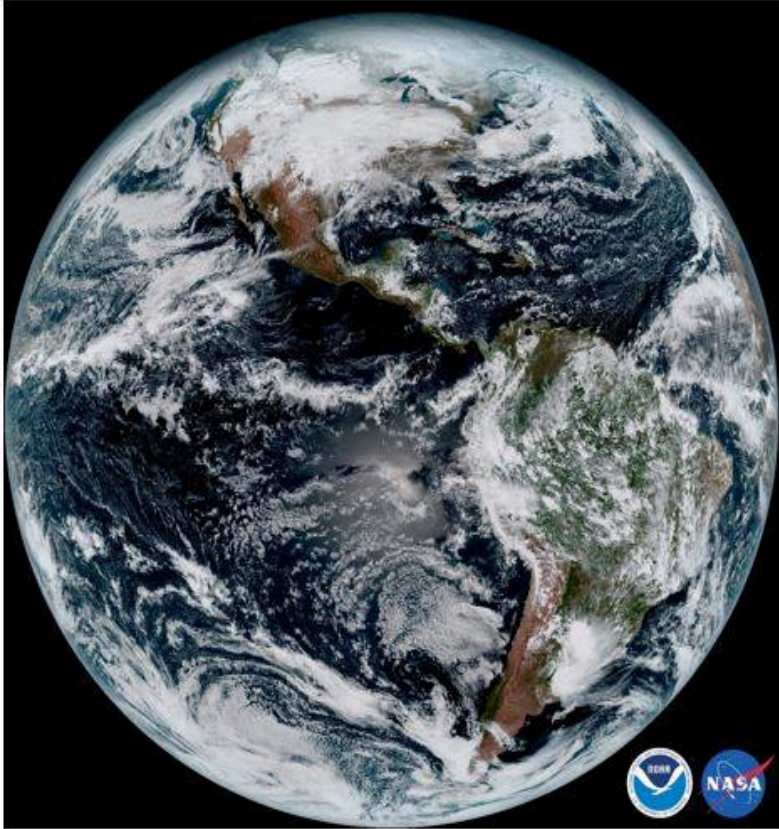
Side Courtesy: Shobha Kondragunta



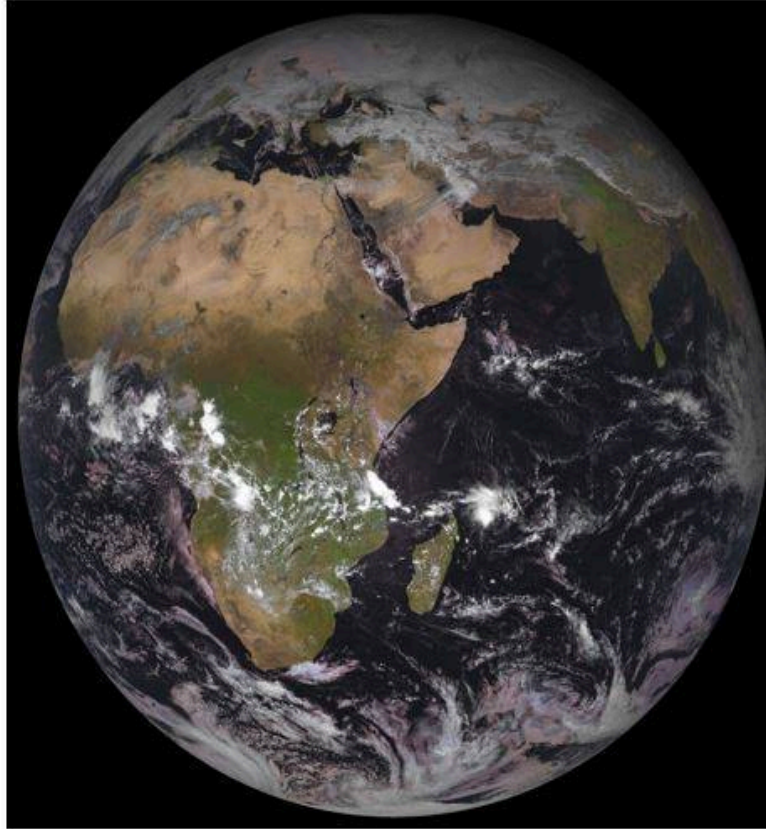
GEOS-16 & HIMAWARI-8

Breaking the Temporal Barrier

The beginning of a new era in satellite remote sensing of air quality



GOES-16



METEOSAT-8

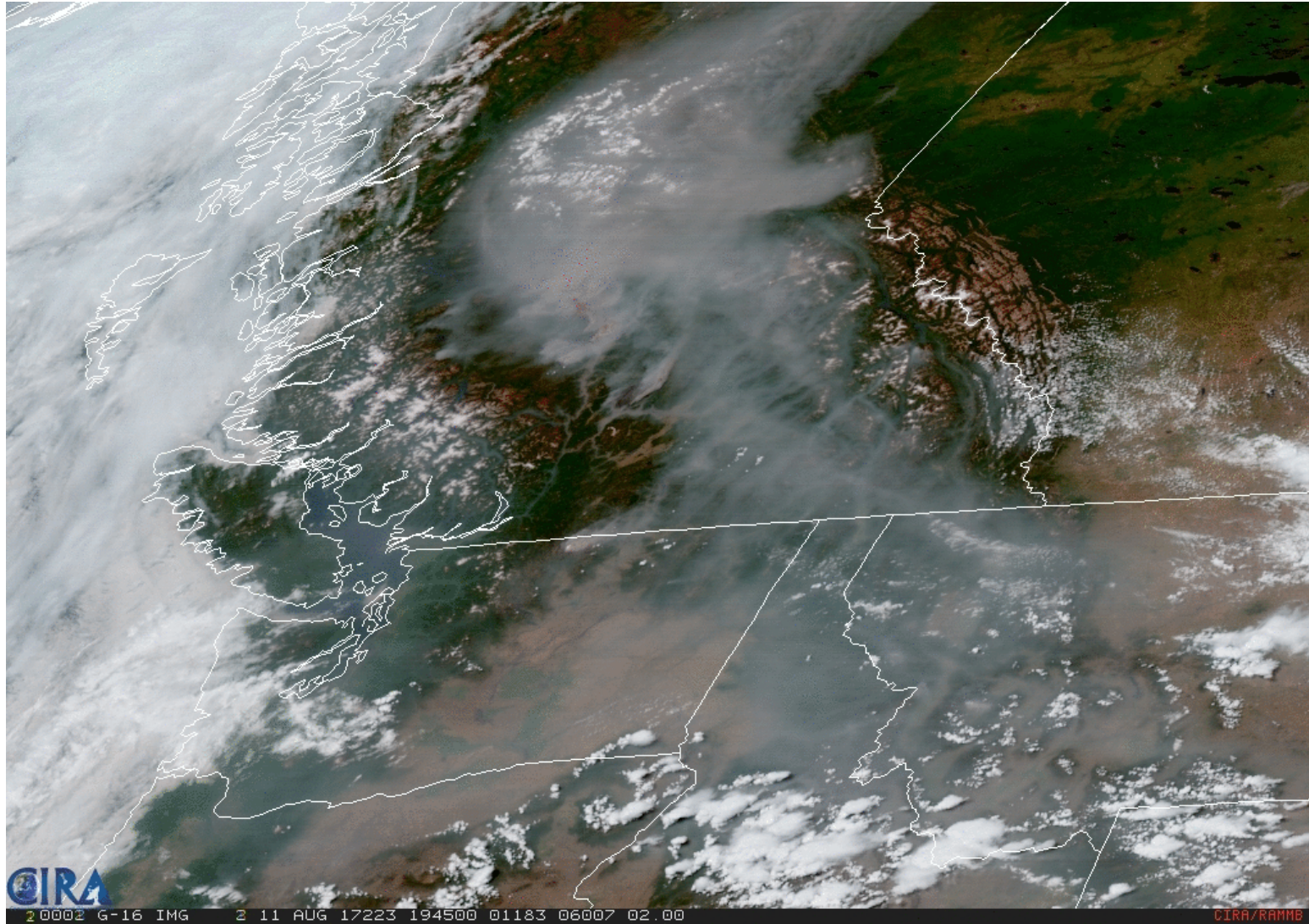


HIMAWARI-9

Source: NOAA NESDIS



GOES-R or GOES-16



HIMAWARI-8 Loop: Fog and Smog over India

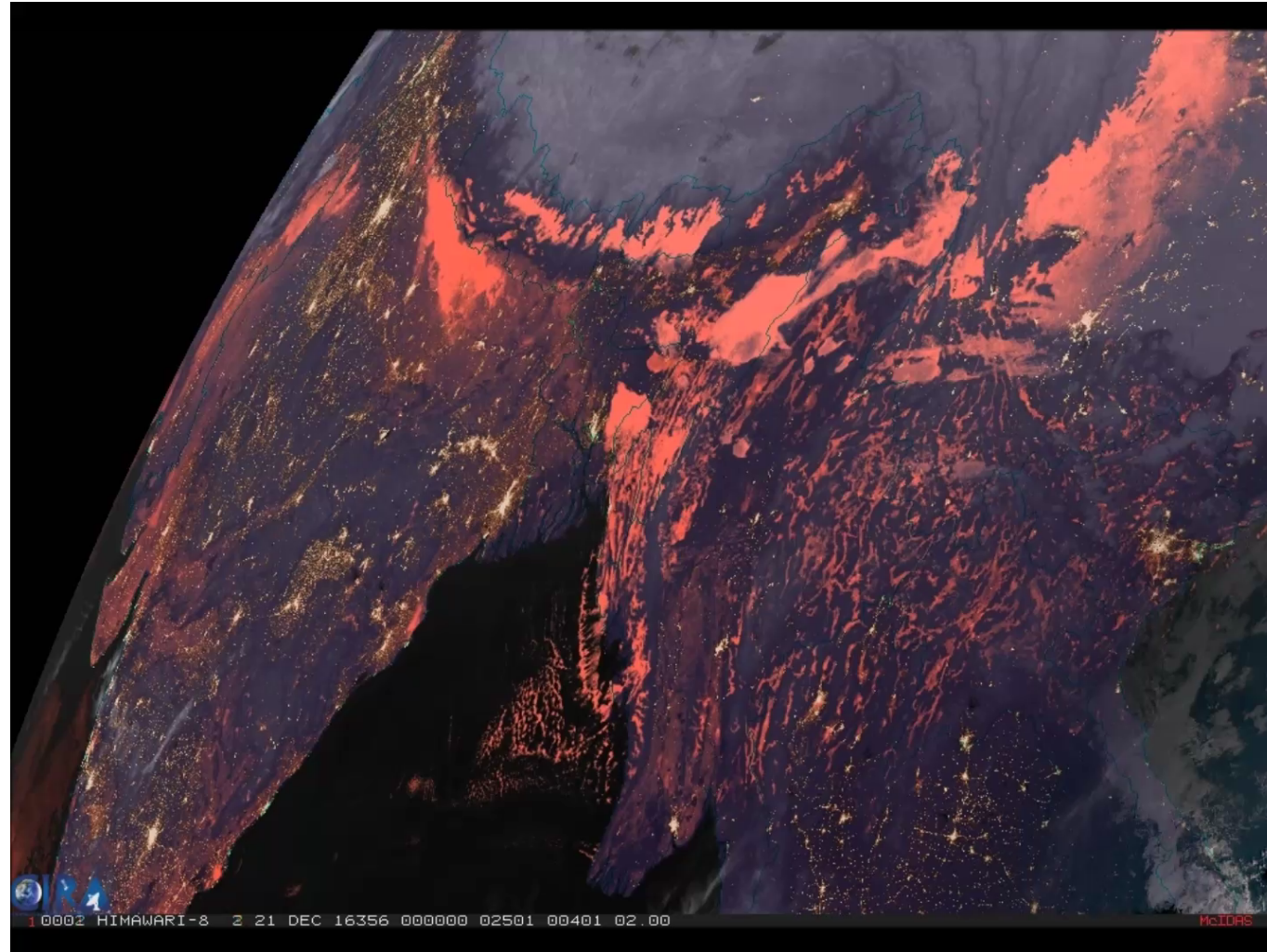
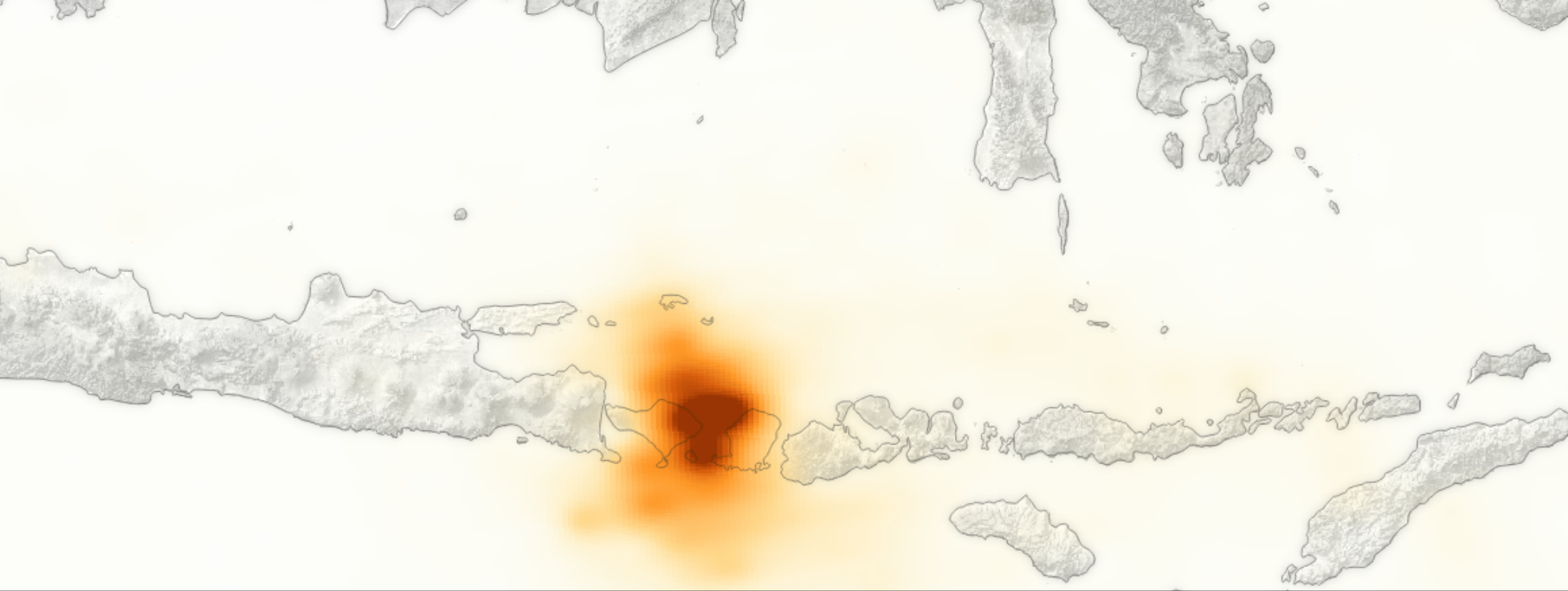


Image: NOAA CoRP, STAR: http://rammb.cira.colostate.edu/ramsdiss/online/loop_of_the_day/



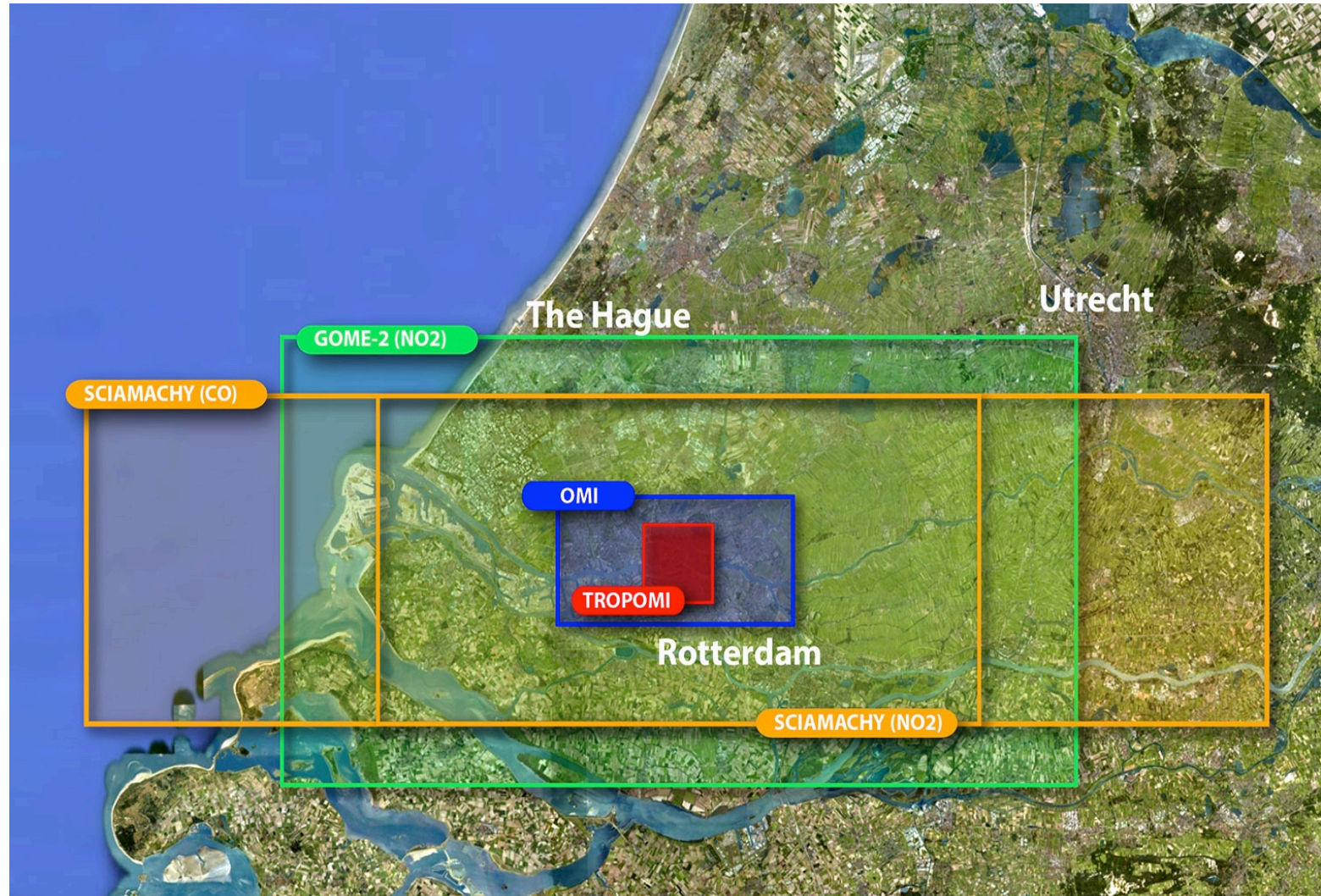


TROPOMI

TROPospheric Monitoring Instrument (TROPOMI)

TROPOMI Highlights

- Launched in Oct 2017 by the European Space Agency
- Global Coverage
- Sub-urban spatial resolution (7 km x 7 km)
- *1x/day*: NO₂, ozone (0-2 km vertical), aerosol, clouds, formaldehyde, glyoxal, SO₂, CO, methane

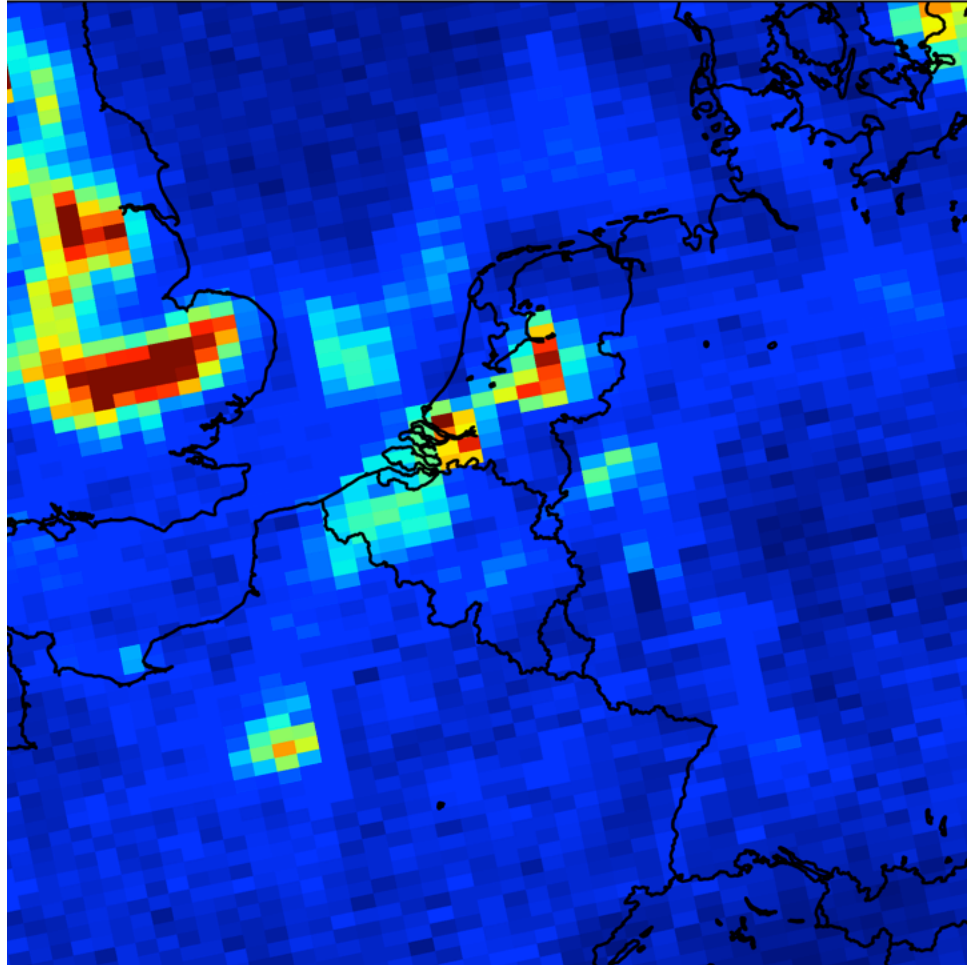


Slide Courtesy of Bryan Duncan

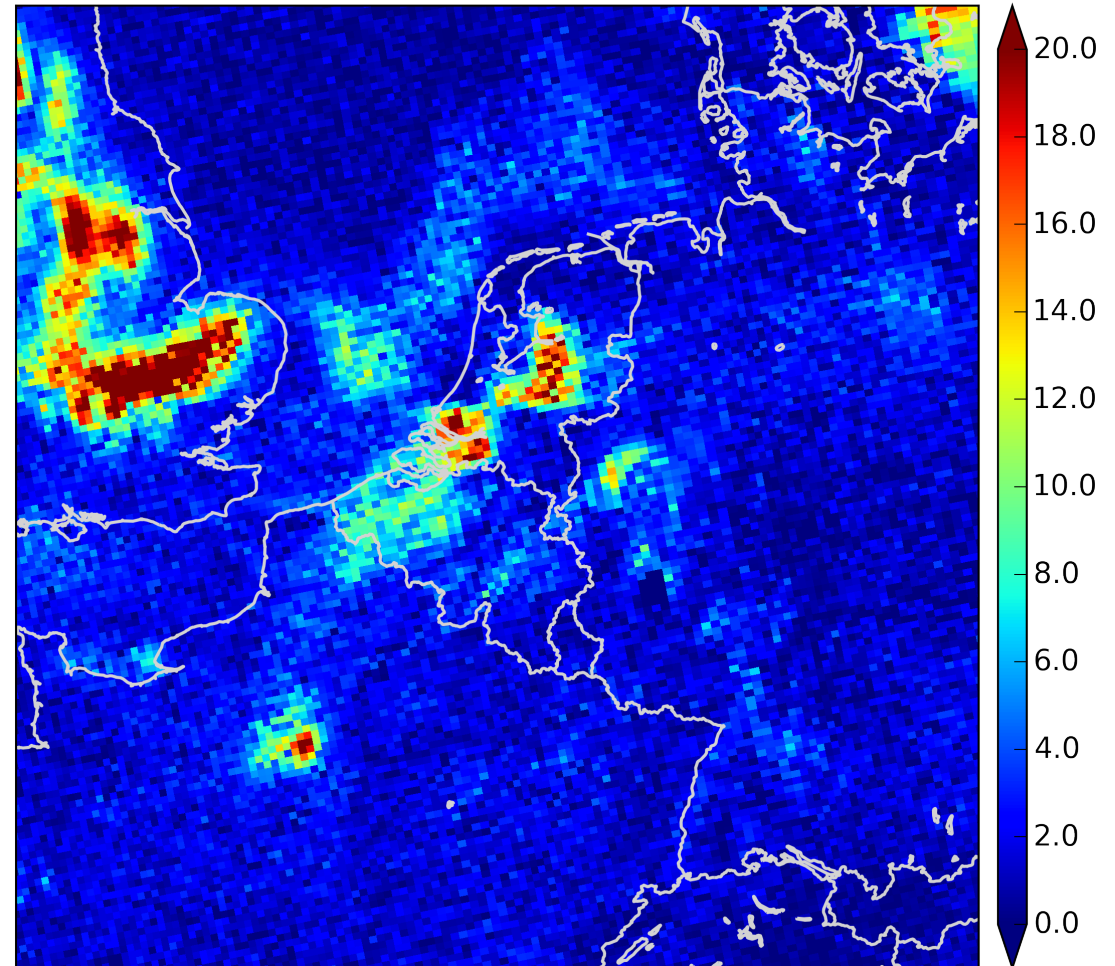


TROPOMI: Impact of Resolution

OMI (now)

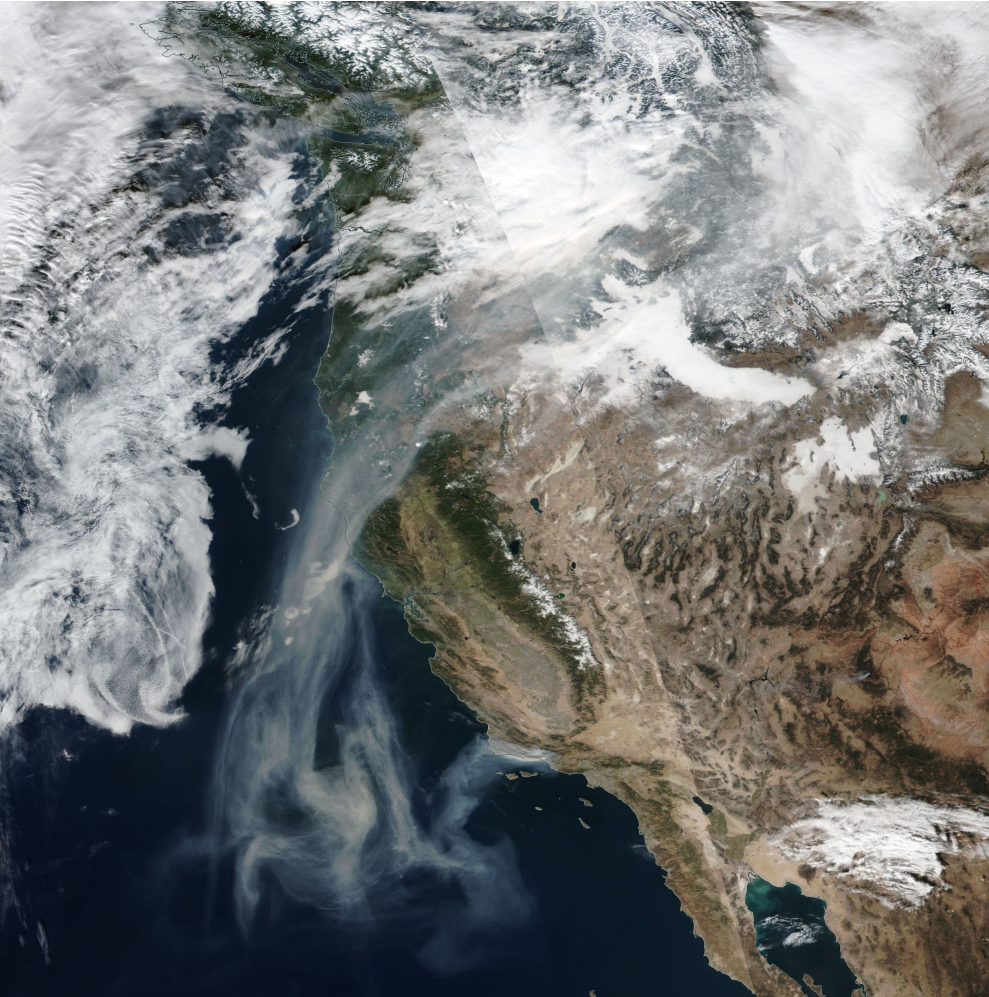


TROPOMI (Simulated data)

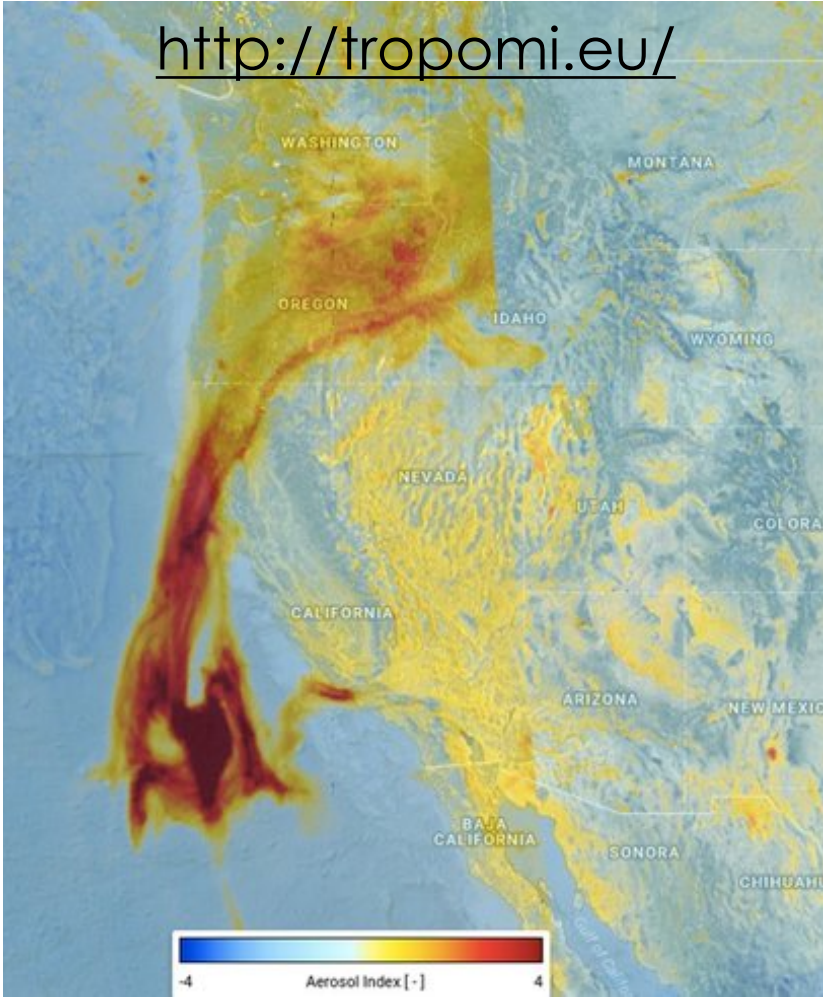


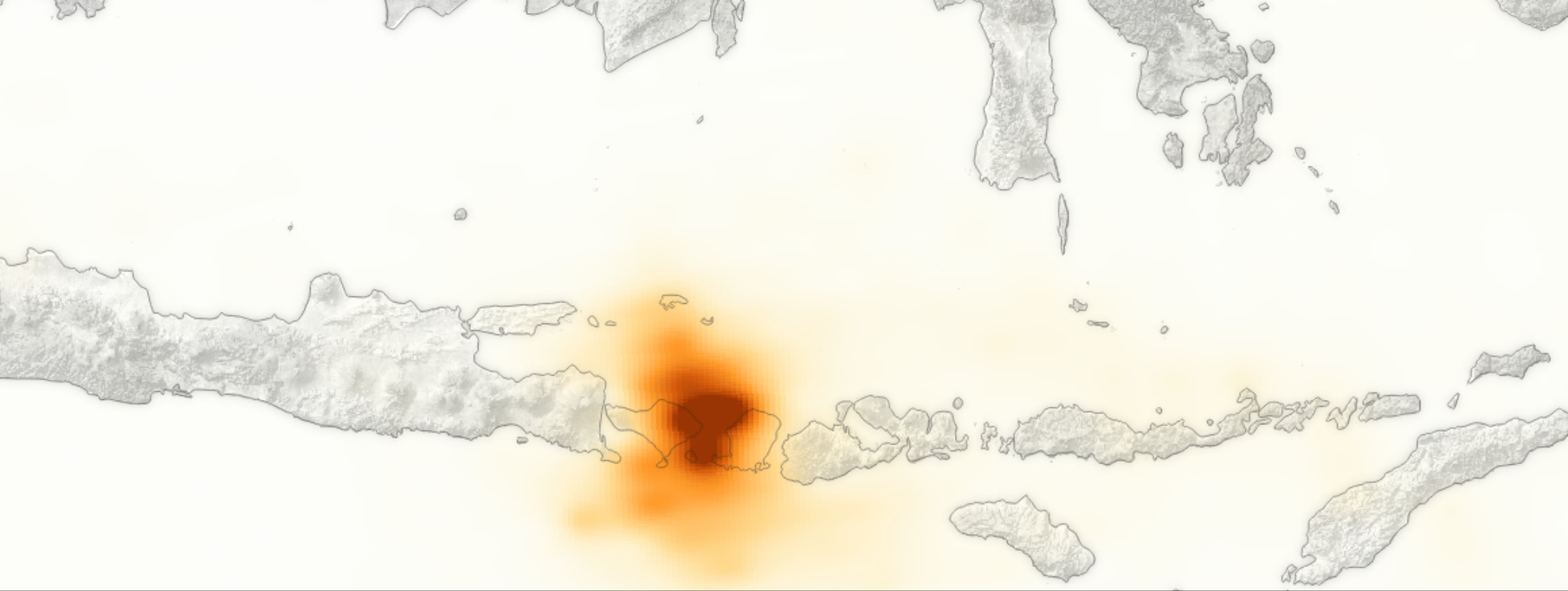
TROPOMI: California Fires - December 12, 2017

VIIRS



TROPOMI

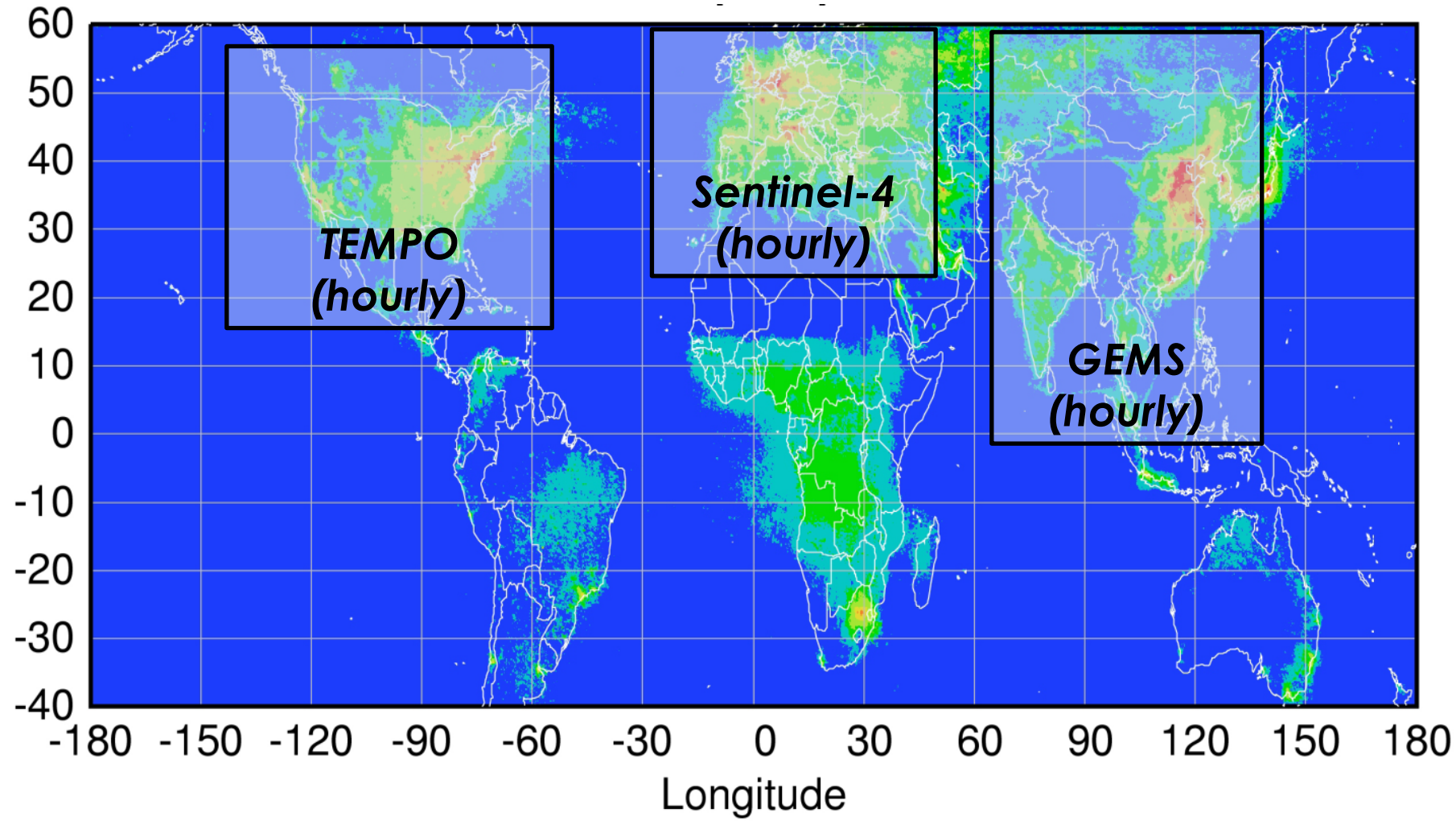




Future Satellite Capabilities for Air Quality Applications

Global Pollution Monitoring Constellation (2018-2020)

- Improved emissions, at common confidence levels, over industrialized Northern Hemisphere
- Improved air quality forecasts and assimilation systems
- Improved assessment, e.g., observations to support United Nations Convention on Long Range Transboundary Air Pollution

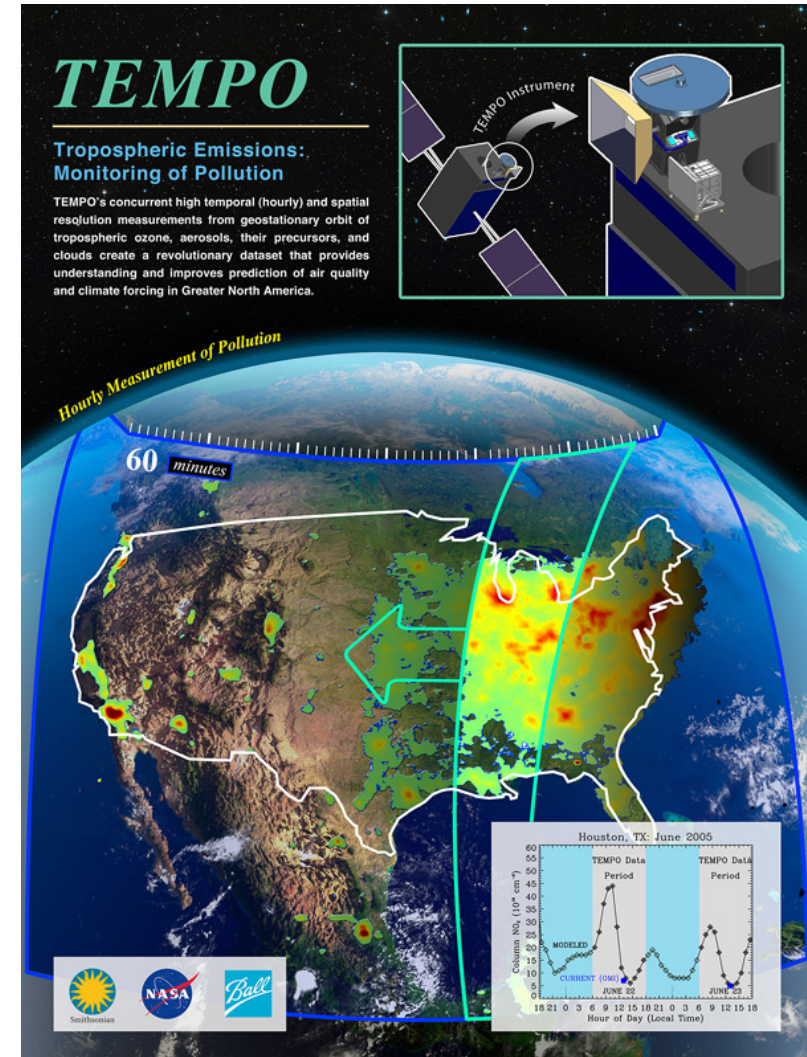


Image, courtesy of Jhoon Kim, Andreas Richter; text courtesy of K.Chance



TEMPO

- Geostationary over North America
- High Temporal Resolution
 - 1 hr
- High Spatial Resolution
 - 2.2 x 4.7 km
- Spectral Range
 - 290-740nm
- Data Products:
 - O₃, NO₂, C₂H₂O₂, aerosols, cloud parameters, & UVB radiation
- Expected Launch: 2021



Multi-Angle Imager for Aerosols (MAIA)

- Mission Goal: Assess linkages between different airborne particulate matter types and adverse birth outcomes, cardiovascular and respiratory disease, and premature deaths
- Sun synchronous orbit
- Spatial Resolution: 230 m
- Large Swath Width: 600 km
- Expected Launch: 2021

