# High resolution (3km) smoke forecasting for the US using satellite data

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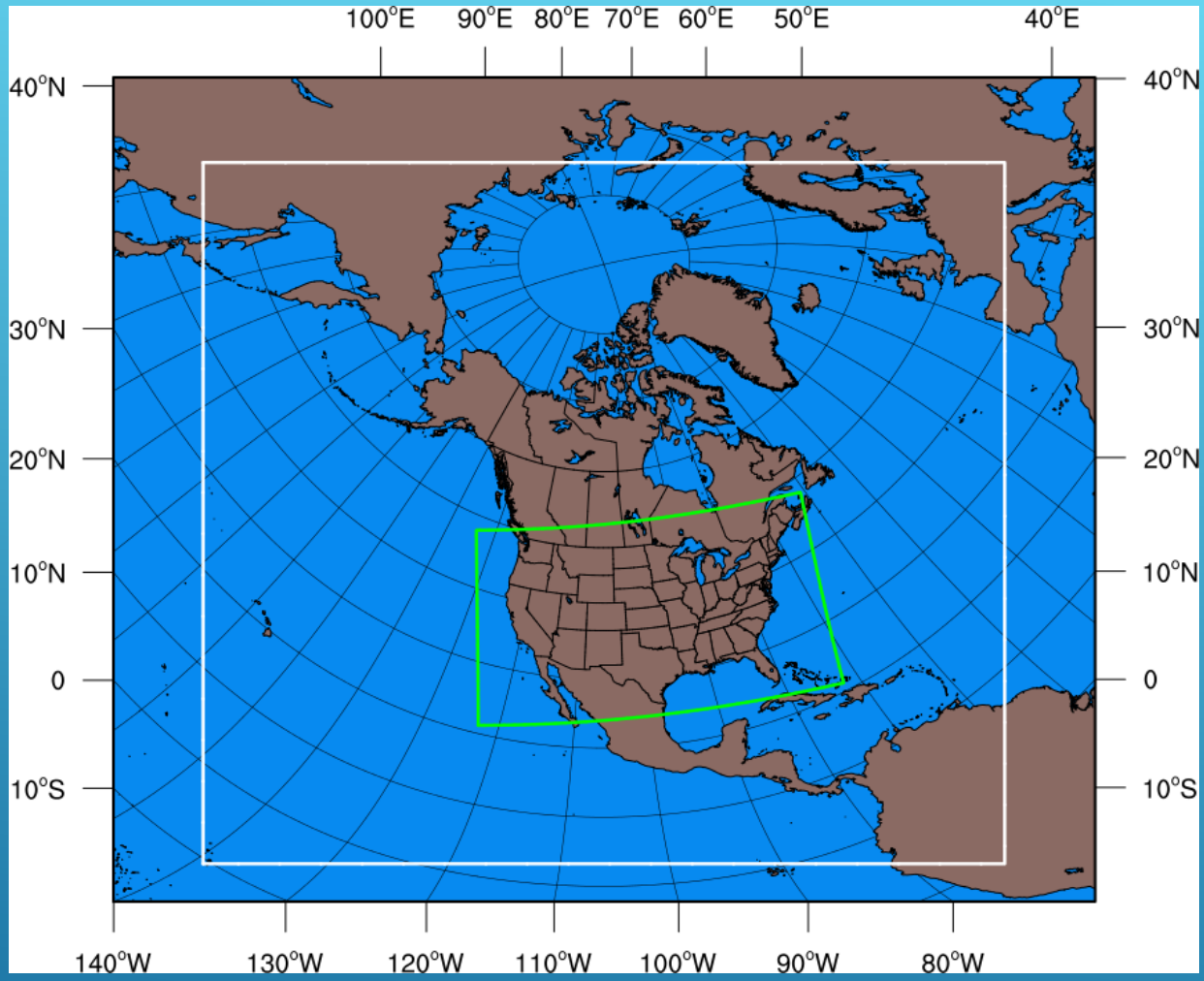
# HRRR-Smoke model

The primary advantages of the HRRR-Smoke modeling system:

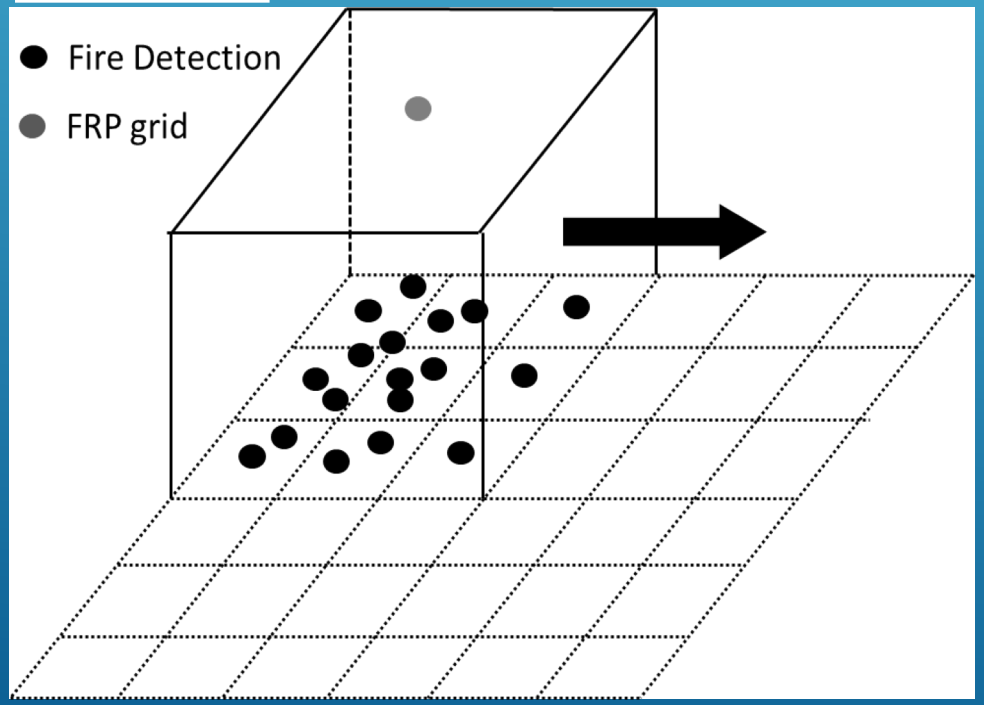
- High spatial resolution to allow simulation of mesoscale flows and smoke dispersion over complex terrain.
- Full coupling between meteorology and smoke: feedback of smoke on predicted radiation, cloudiness, and precipitation (using double moment microphysics).
- Biomass burning emissions and inline plume rise parameterization based on the satellite FRP data.
- A rapidly updating data assimilation cycle for meteorology;
- HRRR-Smoke uses meteorological input data prepared by the GSI data assimilation system and boundary conditions from another weather forecast model: Rapid Refresh (RAP).
- The forecast lead time is 36 hours. Four times a day (00, 06, 12 and 18UTC) a new forecast starts.



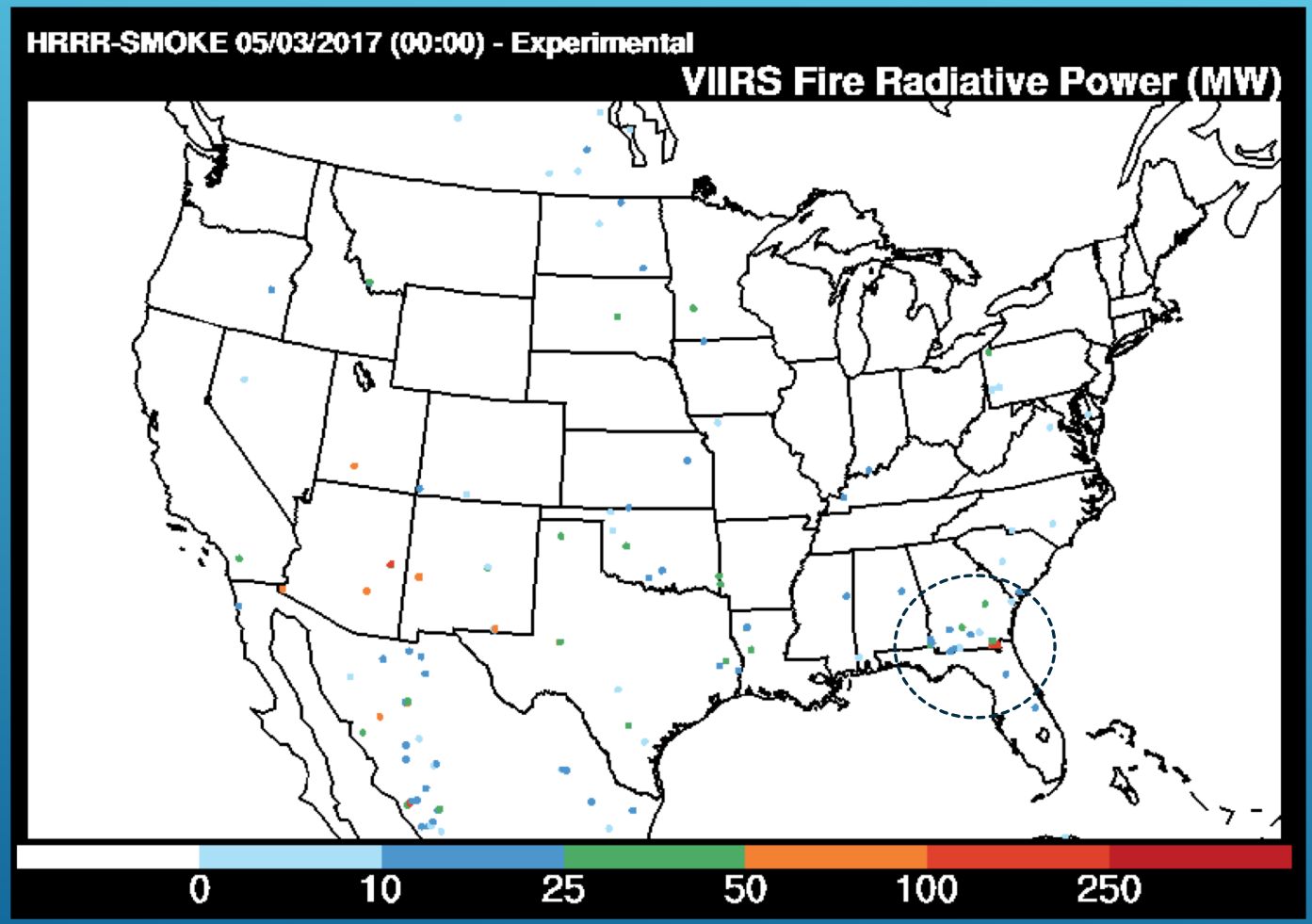

Operational weather forecast models at NWS:
RAP (white), 13km resolution
HRRR model domains (green), 3km resolution
(https://rapidrefresh.noaa.gov/)

# Mapping the VIIRS and MODIS FRP data to the HRRR-Smoke CONUS grid

The clustering procedure performs a combination of all detected fires from VIIRS according to the model spatial resolution and grid configuration.

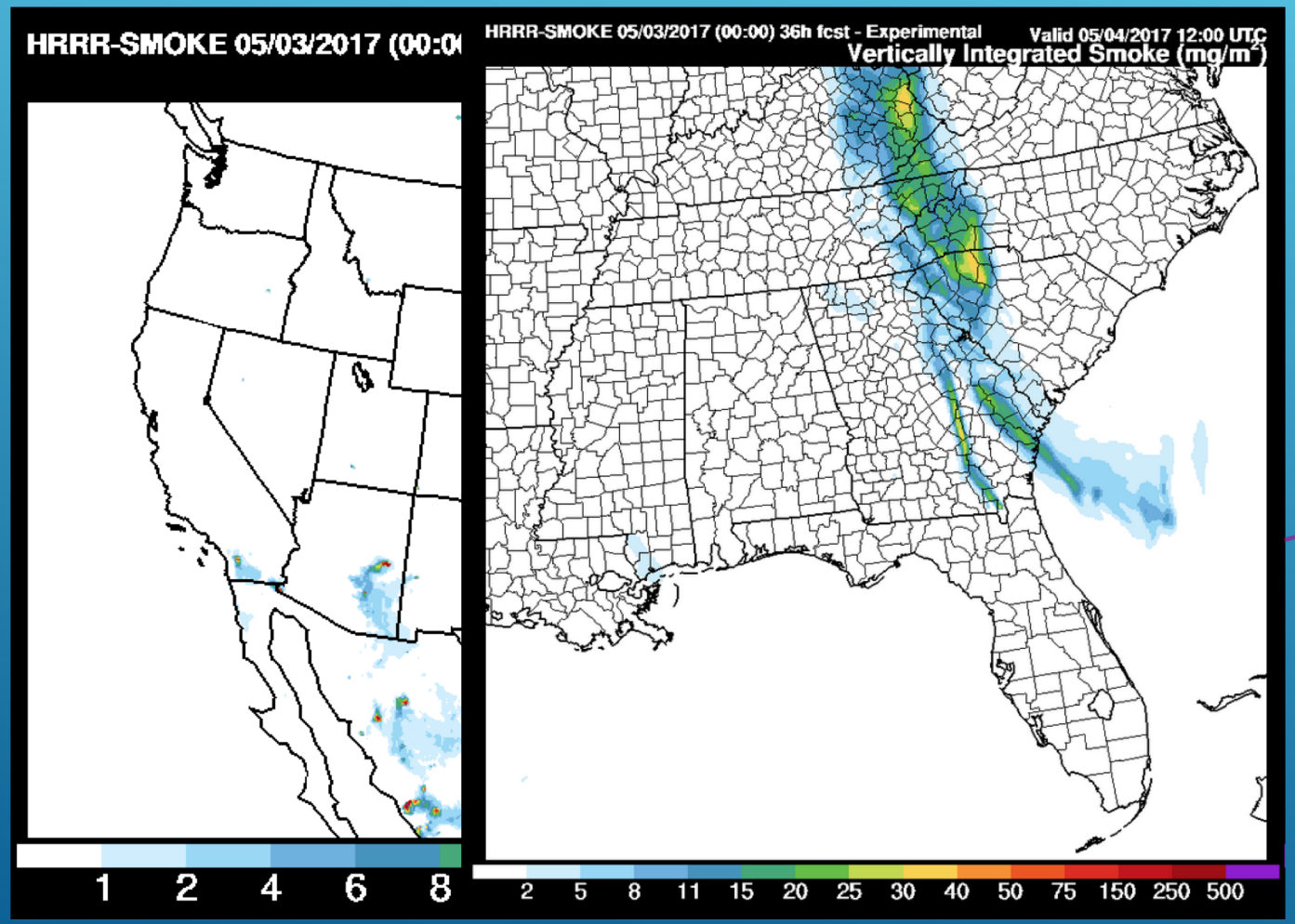




Averaged satellite FRP data mapped over 3x3km HRRR CONUS grid pixels for May 3, 2017



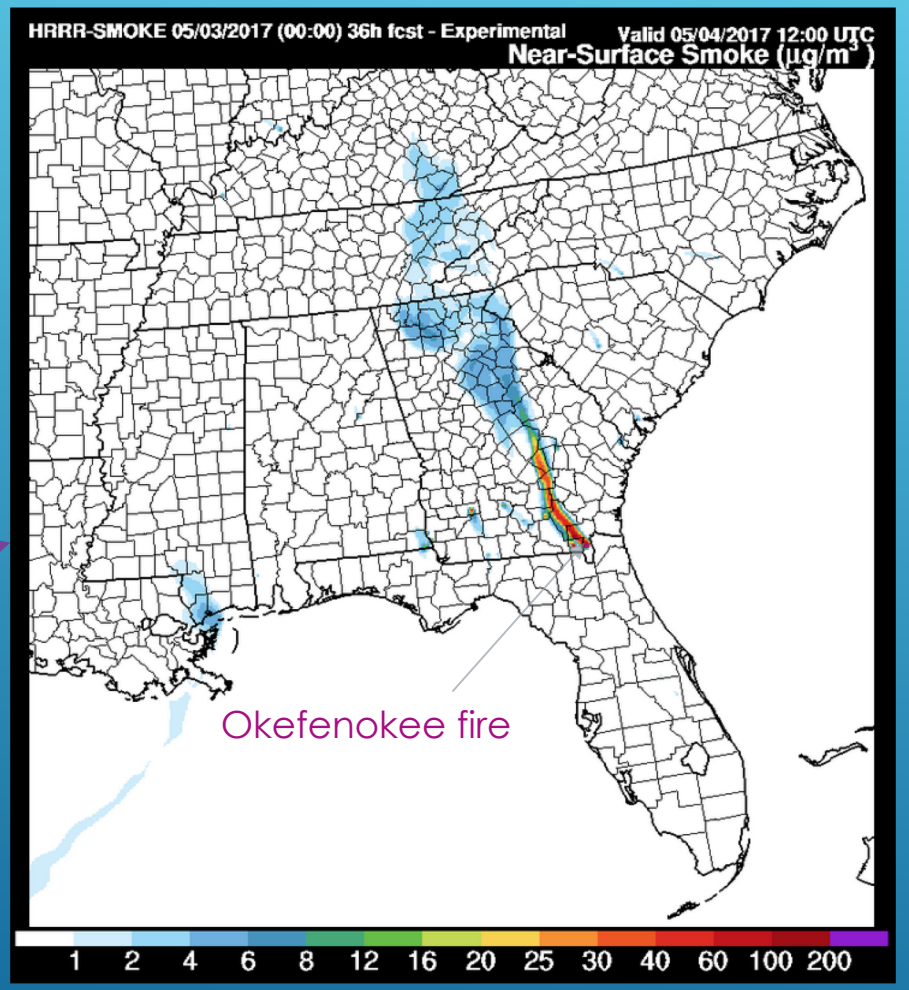
# Smoke forecast for May 4, 2017 (rapidrefresh.noaa.gov/hrrr/HRRRsmoke/)

This plot shows simulated fire emitted fine particulate matter (PM2.5 or fire smoke) concentrations at the first model level (~8m above ground). The following plot shows forecast of near-surface fire smoke for May 4, 8am EDT over the CONUS and its subdomain. This forecast is based on the model simulation of 36 hours from the model initialization time, which is 8pm EDT, May 2, 2017.

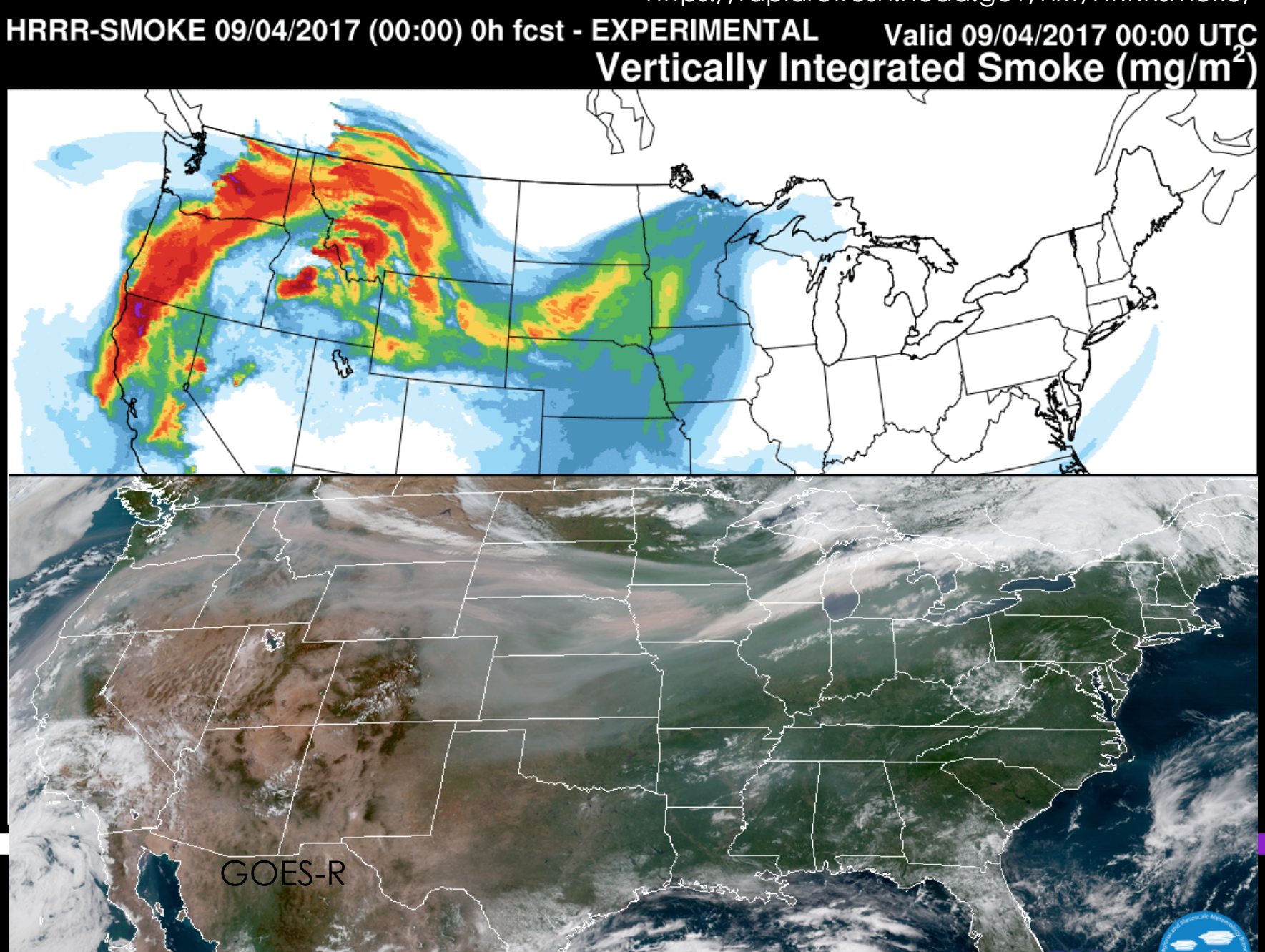




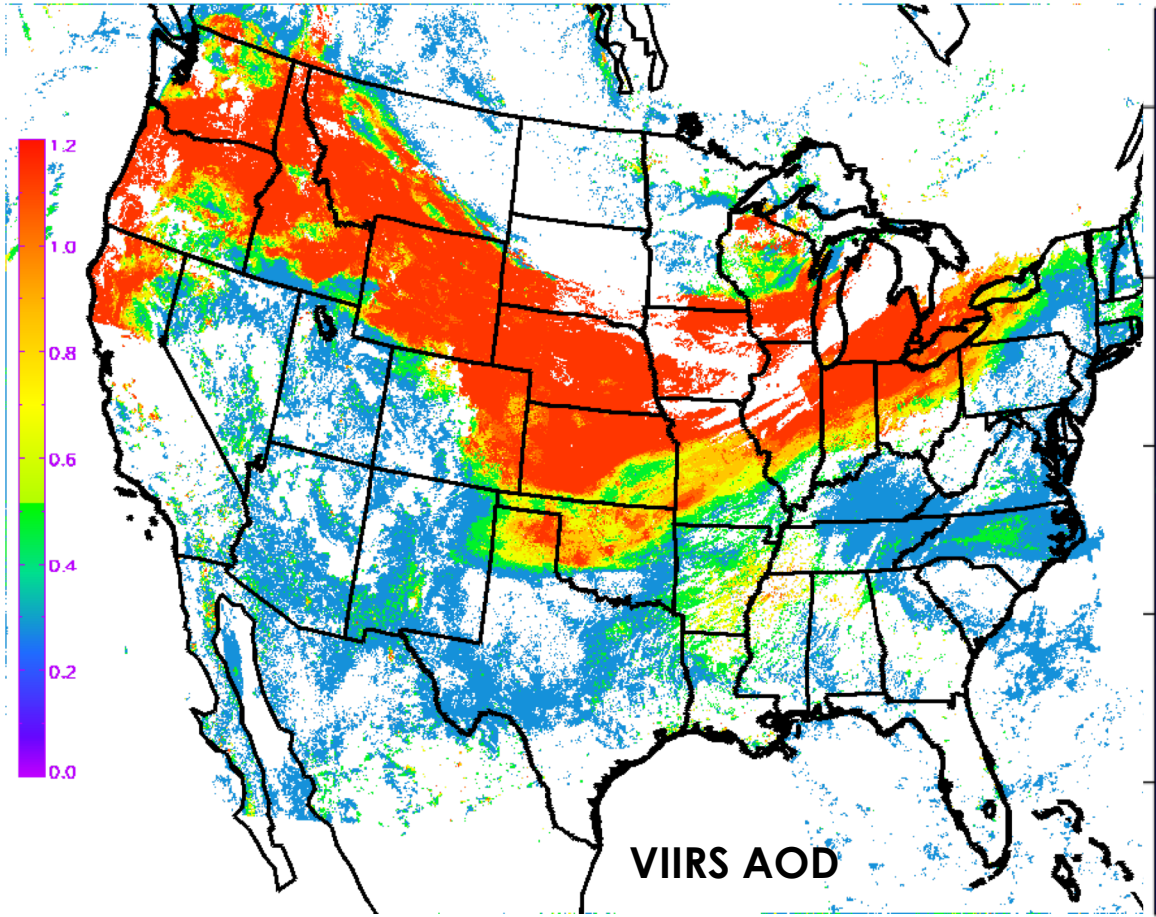


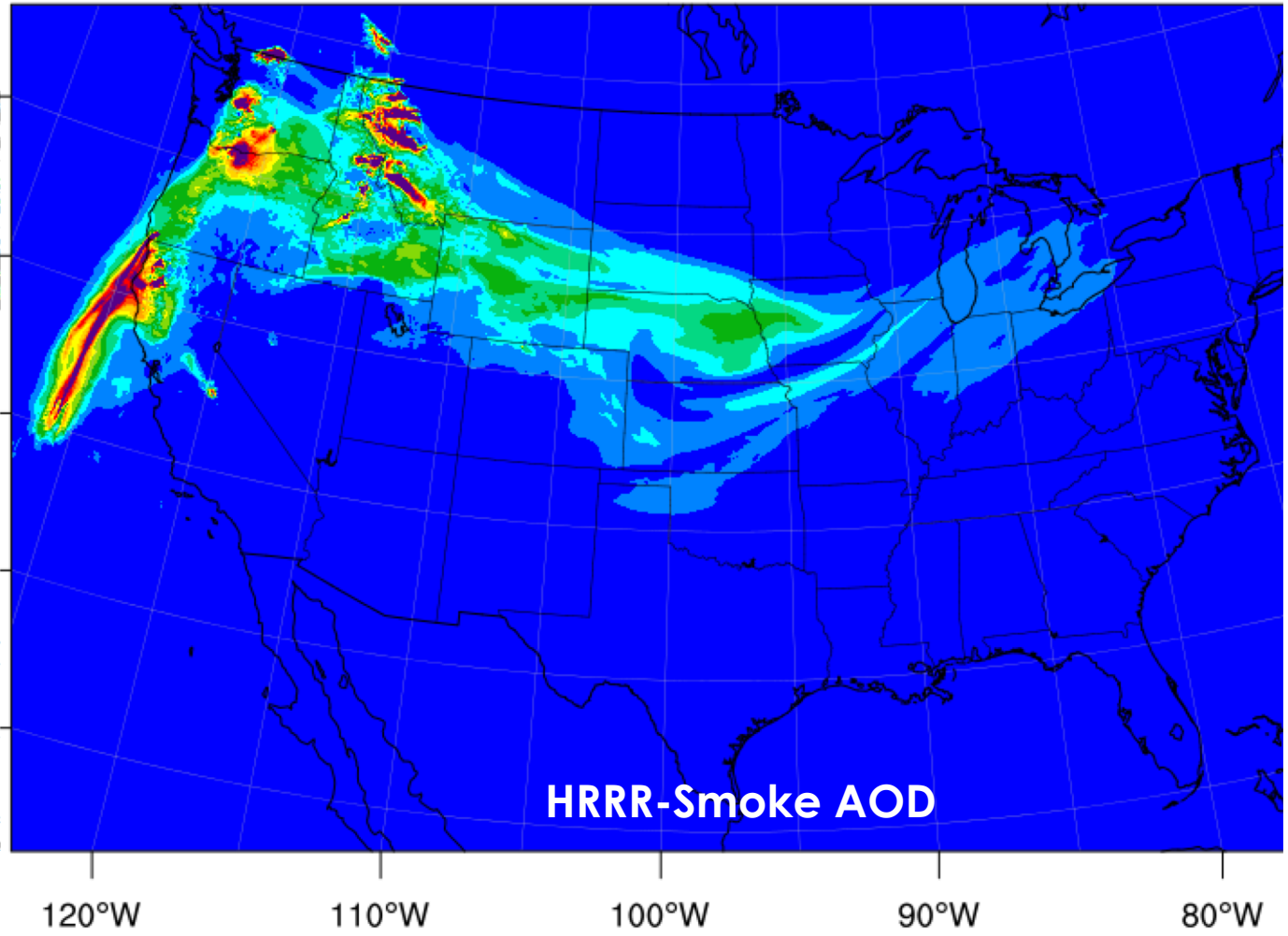


https://rapidrefresh.noaa.gov/hrrr/HRRRsmoke/

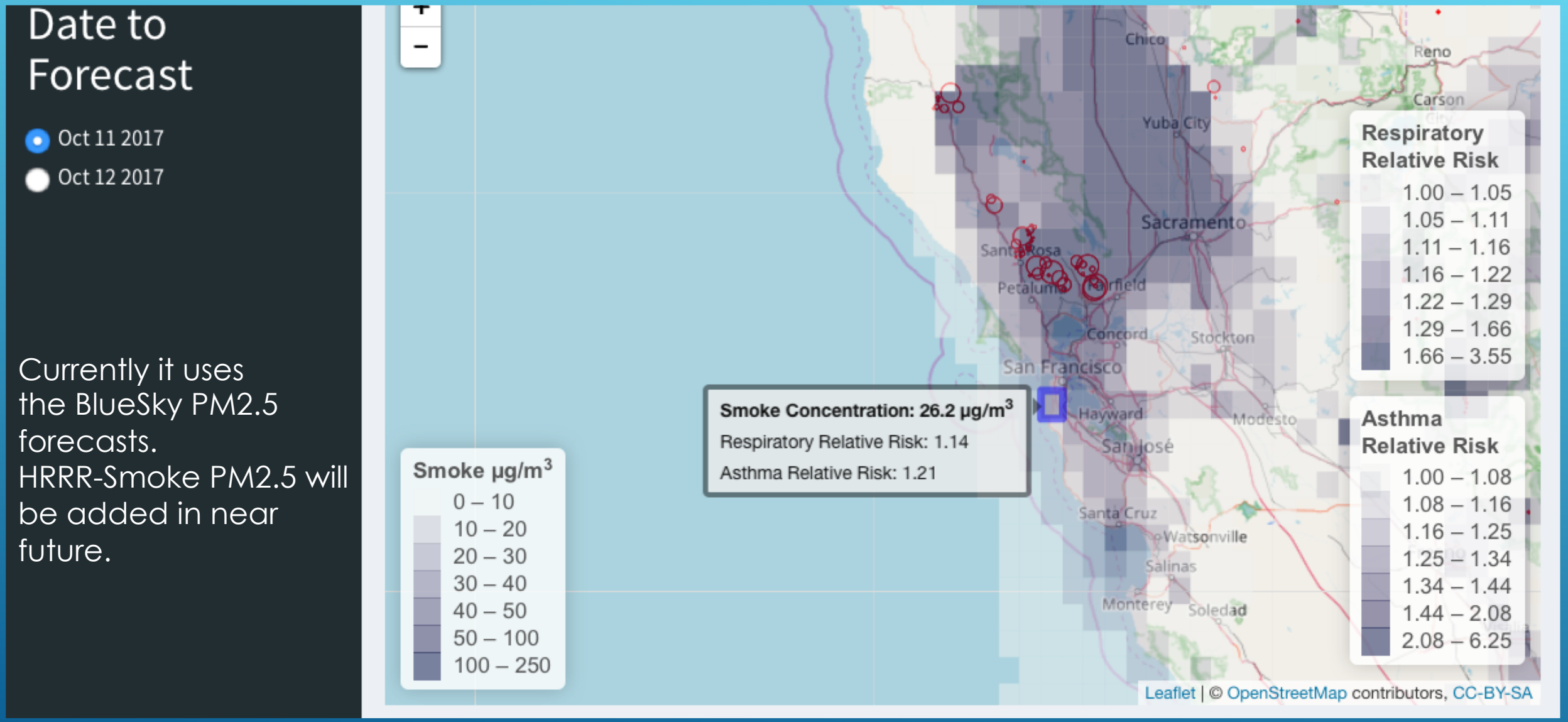


# AOD from HRRR-Smoke and VIIRS, September 4, 2017



# Health Impact Forecast Tool (developed by Gan et al., CSU)



A QUESTION FOR THE DISCUSSIONS: WHAT ARE THE UNCERTAINTIES ASSOCIATED WITH THE SATELLITE (MODIS, VIIRS, GEOSTATIONARY) FIRE RADIATIVE POWER DATA AND HOW BEST WE CAN USE THIS INFORMATION IN SMOKE MODELS?

# THANK YOU FOR YOUR ATTENTION