

HAQAST Public Meeting Using Satellite Data for Operational Air Quality Decisions

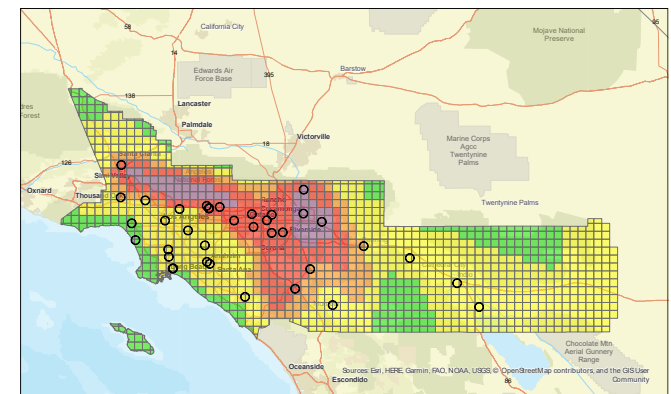
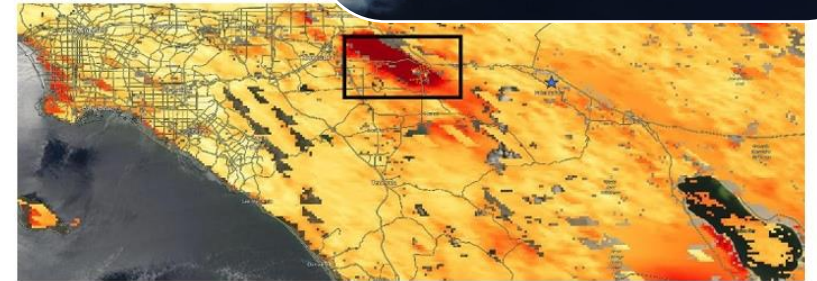
Madison, Wisconsin
May 13 - 14 2026



Nico Schulte, South Coast Air Quality Management District

How South Coast AQMD Air Quality Assessment Group uses Satellite Data

- Exceptional Event Demonstrations
 - Coachella Valley Ozone Exceptional Event due to wildfire
 - Hazard Mapping System (HMS) Smoke
 - TEMPO NO_x
- Air Quality Advisories for extreme air quality events
 - GOES visible imagery to identify satellite plumes in real time
- Analyzing PM₁₀ air quality impacts in the Coachella Valley
 - MAIAC, GOES Aerosol optical depth to estimate surface PM₁₀
- Evaluating TEMPO data for real-time air quality index applications



Exceptional Events

- Not all types of air pollution can be controlled through regulatory control
- Some events that cause violations of national ambient air quality standards or other regulatory impacts can be excluded from regulatory calculations
 - Naturally caused, or result of human activity and are unlikely to occur again at a particular location
 - Must demonstrate that event clearly caused high air pollutant concentrations
 - Event is not reasonably controllable or preventable
- Exceptional event demonstrations take months to years to prepare
- Exceptional Event Demonstration Tool R-Shiny App automates much of the process

Common Types of Exceptional Events (EE)



Exceptional Events Demonstration Tool

R-Shiny App

Exceptional Events Demonstration Development Tool

[General Information](#) [Event Description](#) [Time Sensitive](#) [Tier 1](#) [Tier 2](#) [Tier 3](#) [Compile Documents](#)

[This Tool](#) [Resources](#) [Example EEs](#) [For Potential Contributors](#) [For Code Contributors](#)

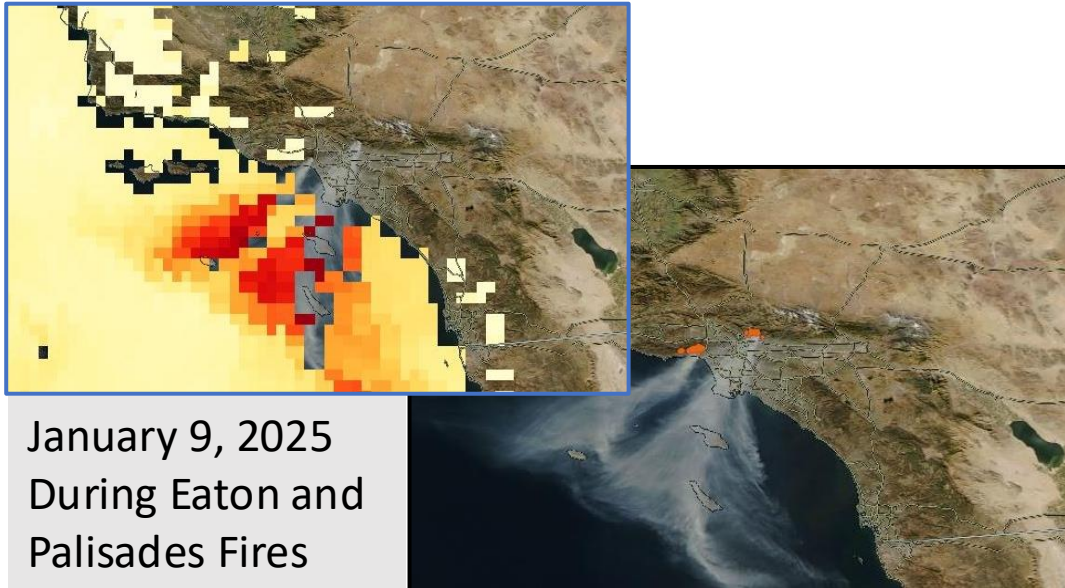
Purpose of Tool:

The purpose of this app is to quasi-automate some of the tasks involved in preparing an Exceptional Events (EE) Demonstration for submission to the EPA. Use of this app any EE demo submitted to the EPA. EE demos created using this app are subject to the same review process as EE demos that do not use this app. This interact

Satellite Capabilities for EE Demo Tool

- User inputs fire information
 - Dates, area of interest, reference (non-event) date
 - EE Demo tool downloads the relevant imagery for every day of fire and inputs it into Word files with template text

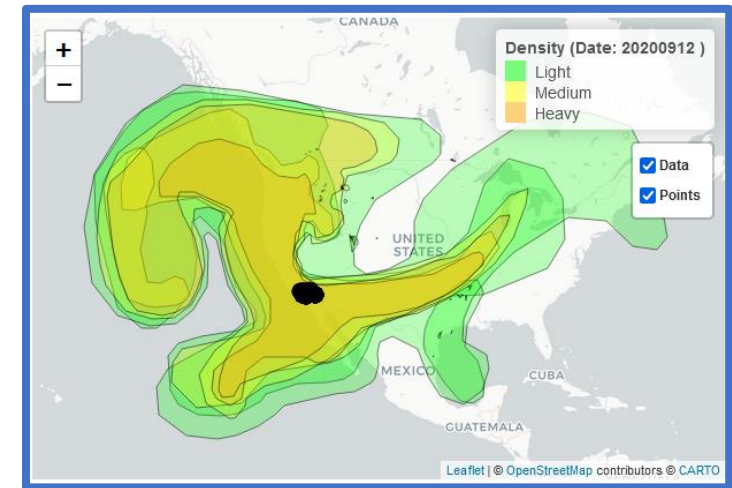
AOD and True Color MODIS



January 9, 2025
During Eaton and
Palisades Fires

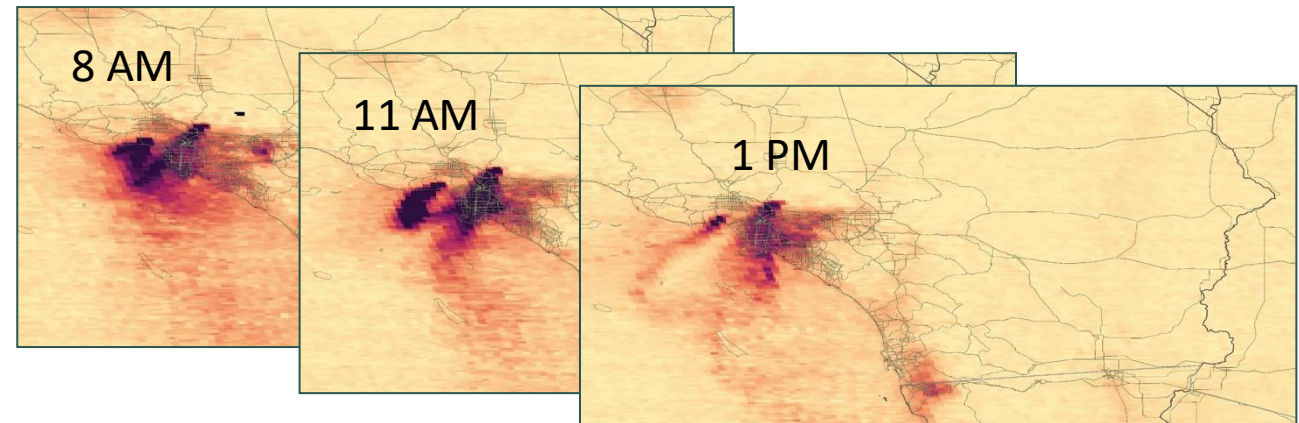
developed by Kristen Martin at Oregon DEQ

Hazard Mapping System (HMS)



Courtesy of former staff of OK DEQ

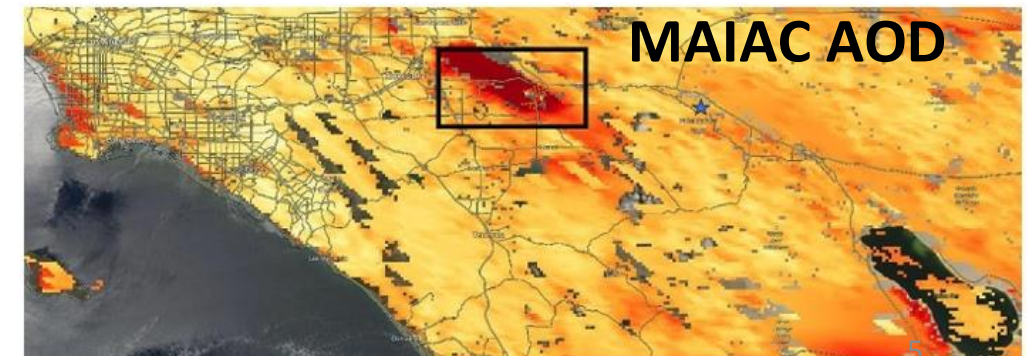
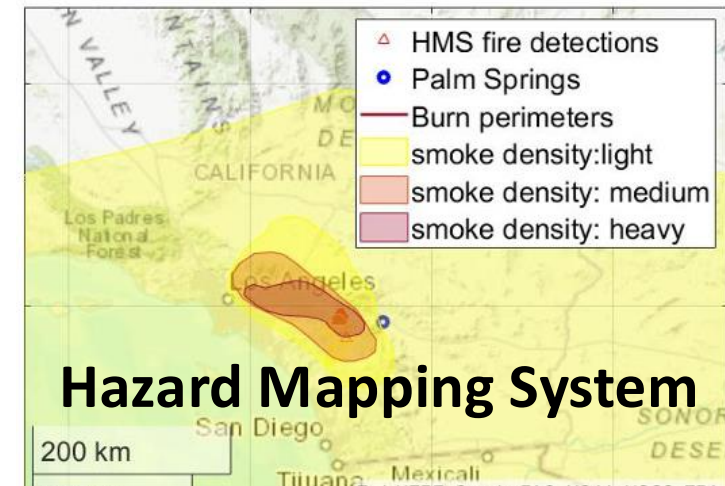
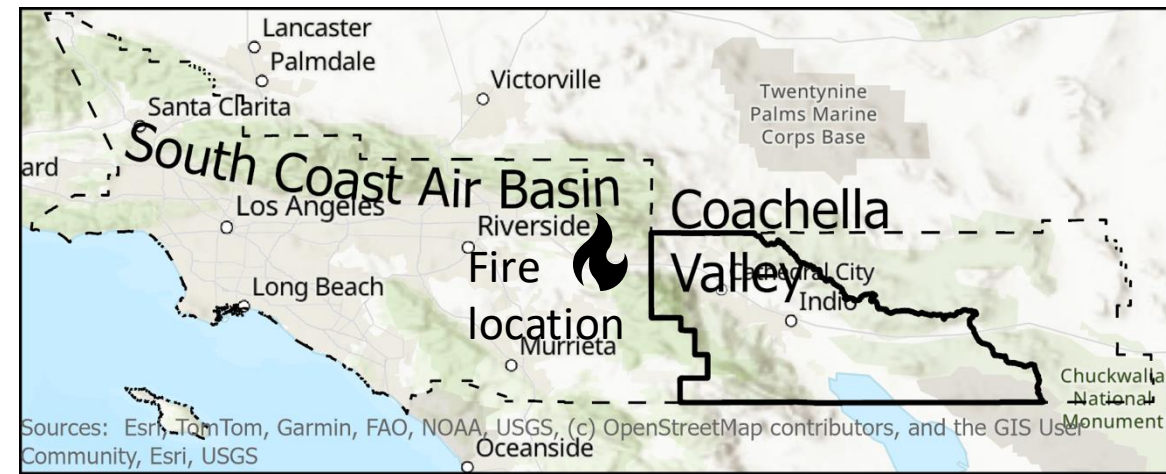
TEMPO NOx Data



Project of University of Utah undergraduate student Toby
Armstrong and Associate Professor Heather Holmes

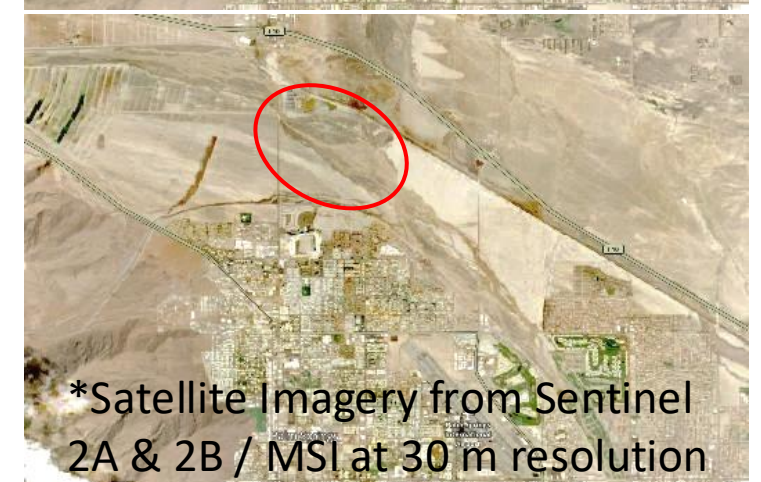
Ozone EE demo

- Rabbit, Reche, and Highland Fires caused ozone exceedance at Palm Springs on July 14 and 15, 2025
- EE demo tool provided HMS, AOD, and true color MODIS imagery to support clear causal relationship of the EE demo
 - Provided evidence of smoke transport from the fires to Palm Springs



Background on Recent Dust in Coachella Valley

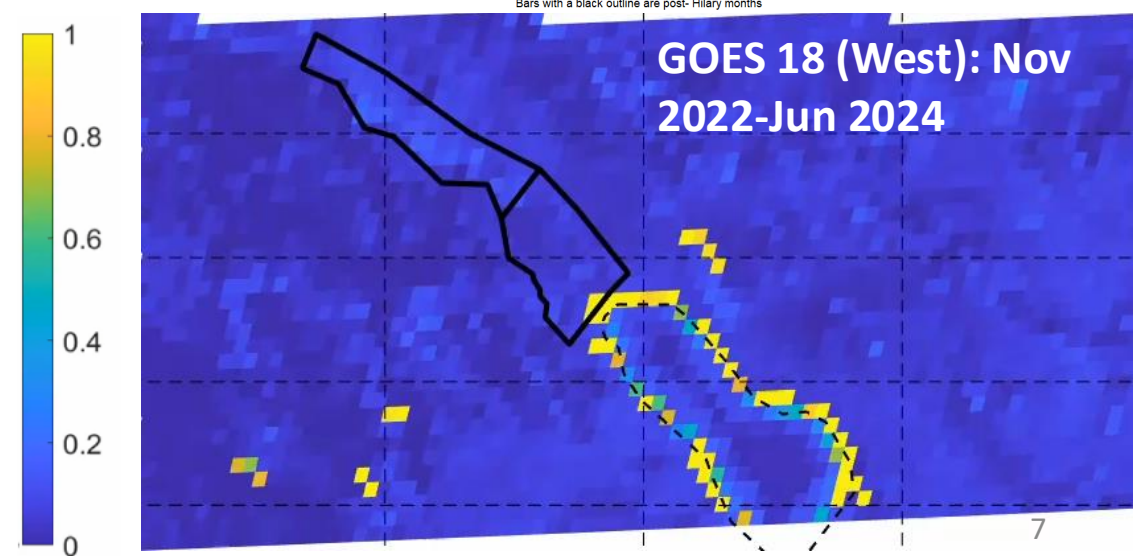
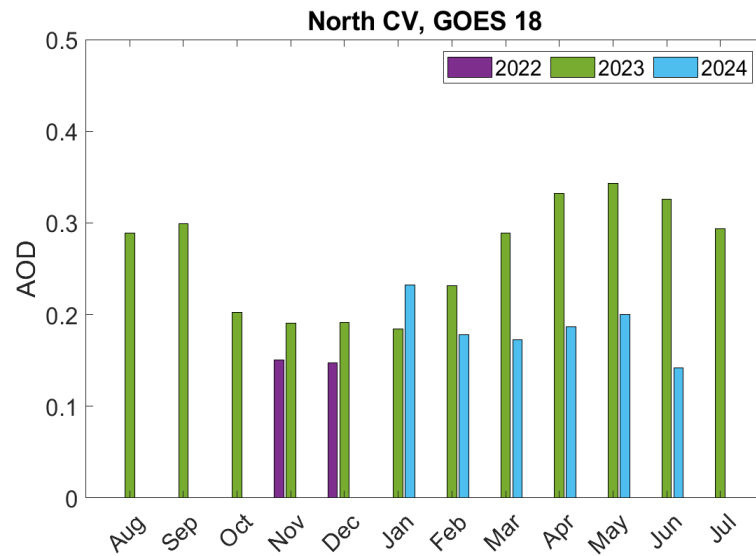
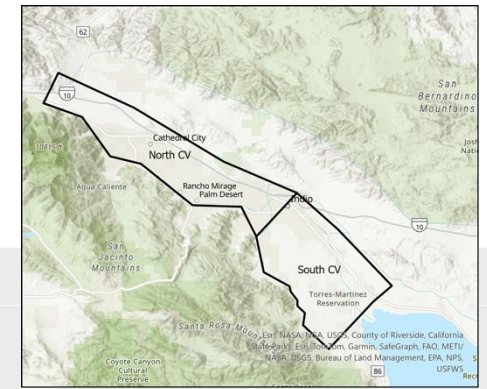
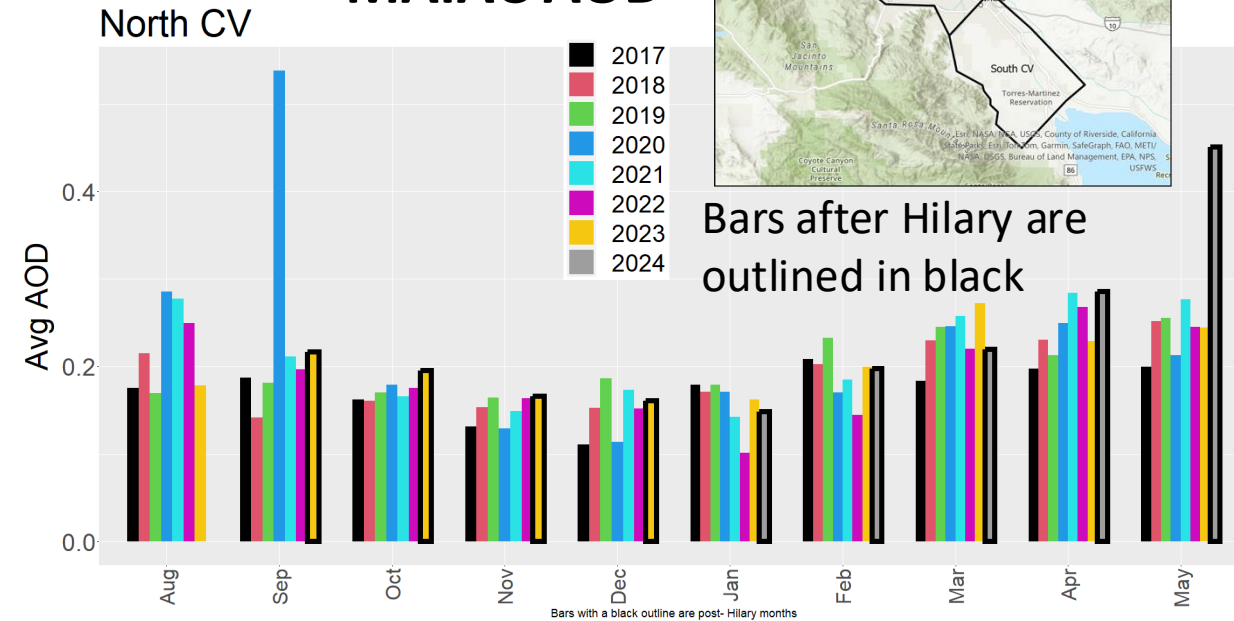
- Tropical Storm Hilary brought 3-4 inches of rain and subsequent mudflows on August 20-21, 2023
- Received reports from the community of increased levels of dust after tropical storm
- Is it indicated in satellite data? If so, where and when?
- Analyzed aerosol optical depth (AOD) from MODIS MAIAC and GOES to help answer questions for which surface measurements provide limited data:
 - Dust may have increased in locations far from regional monitors – satellite data's great spatial coverage addresses this limitation
 - Complaints about dust in Coachella Valley focus on visibility degradation rather than health impacts - AOD may capture a signal related to visibility



Selected Findings of AOD Analysis

- Monthly averaged AOD variation follows typical PM10 variation
- May 2024 was much higher than in past years
- AOD at North CV > AOD at South CV
- Similar pattern between GOES West and East
- High levels in Anza Borrego state park in May 2024, like MAIAC
- AOD from Feb-Jun 2024 in North CV is lower than in 2023 due to algorithm update (02/06/2024)

MAIAC AOD



Summary and Limitations of AOD Analysis

MAIAC MODIS Analysis

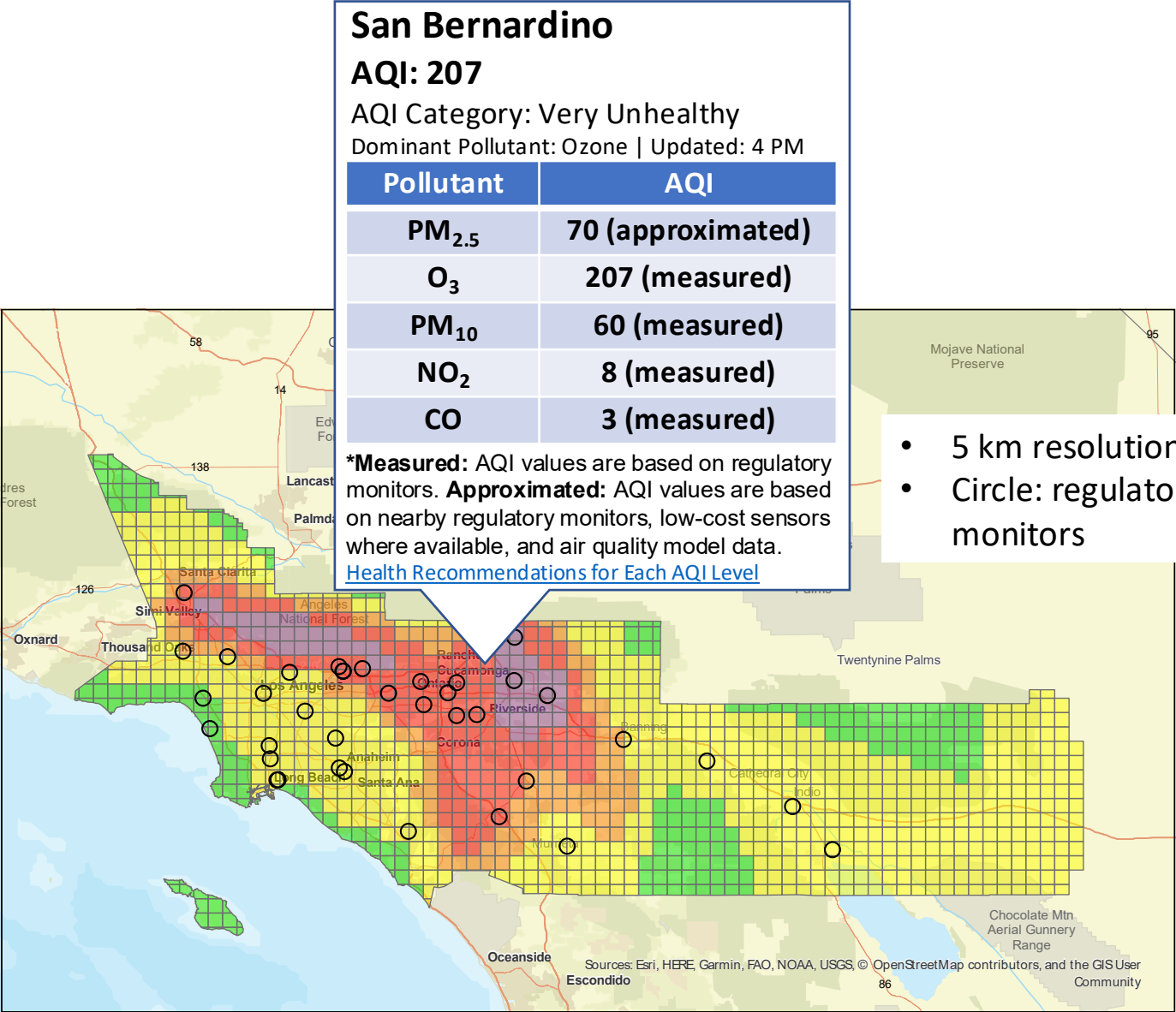
- There is evidence that AOD increased above typical levels seen in past years throughout Coachella Valley in May 2024
- Evidence that AOD increased to unusually high levels in Anza Borrego State Park in May 2024
- Limitations
 - AOD determined from at most two measurements (Aqua and Terra passes) per day around noon, so it doesn't capture the full diurnal variation
 - AOD sensitive to column of air, not same as surface PM
 - May be most sensitive to fine PM but community concerns may be more related to visibility which could be associated with TSP
 - AOD is noisy and so we need to use longer time periods to determine changes/trends
 - AOD doesn't capture the evening and overnight hours when winds (and dust) tend to peak

GOES Analysis

- AOD at North CV is higher than South CV; however, inconsistent with MAIAC
- No conclusive annual trend is observed due to algorithm change of land surface
- AOD shows no correlation with surface PM either in South Coast Air Basin or Coachella Valley
- Limitations:
 - Changes in retrieval algorithms can affect the analysis of long-term trends
 - Influence of bright surface reflectance on our analysis
 - It is challenging to directly relate satellite-retrieved AOD to surface-level PM₁₀
 - We could not identify impacts of tropical storm Hilary on AOD from GOES or MAIAC

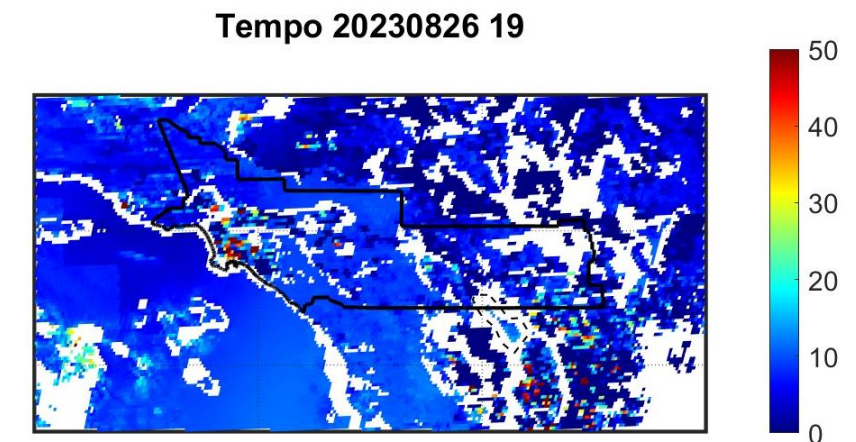
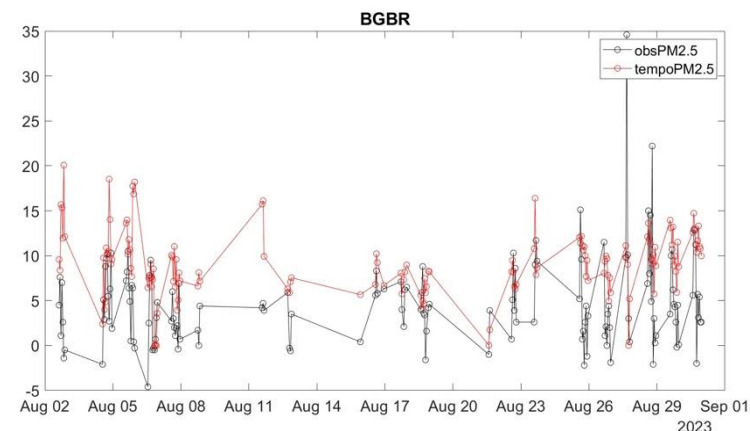
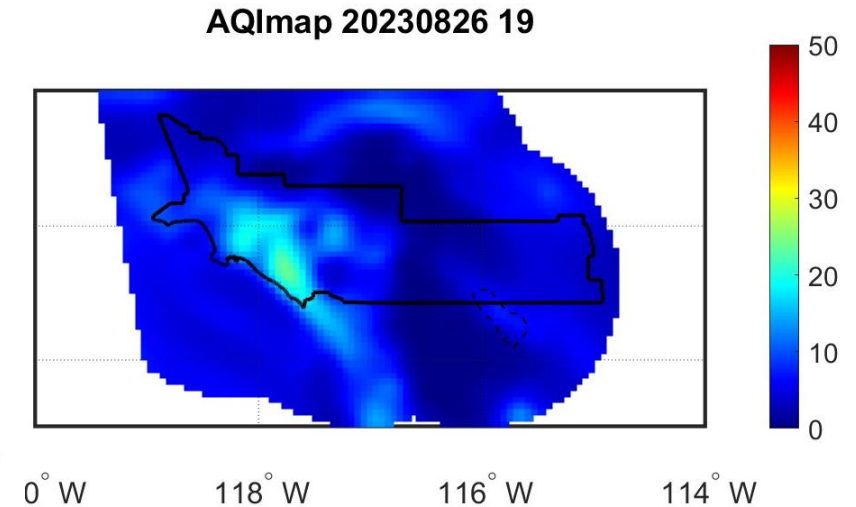
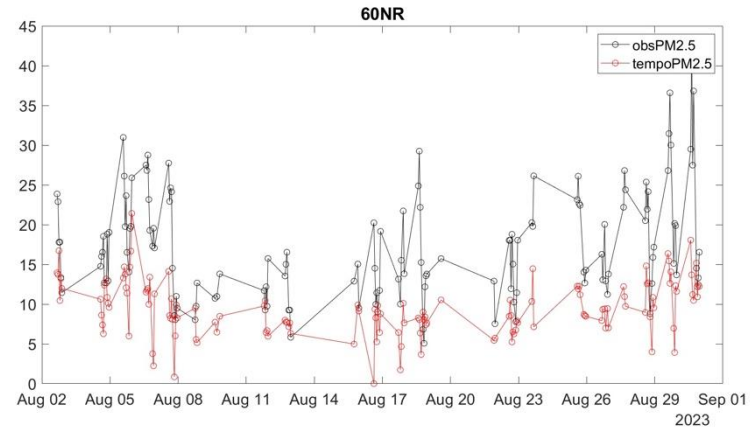
Evaluation of TEMPO PM2.5 for Real-Time Air Quality Index Map

- South Coast AQMD Real-time AQI map: Data fusion of National Air Quality Forecast Capability model and real time regulatory monitors and sensor data (PurpleAir and Clarity)
- Evaluated TEMPO data over the South Coast AQMD region to improve accuracy far from monitors



PM2.5 from South Coast AQMD AQI map vs TEMPO PM2.5

- Overall similar PM2.5 levels
- Uncertain if PM2.5 spikes from TEMPO are real
- TEMPO PM2.5 captured the magnitude of PM2.5 observation for most of the monitors
 - Underestimate near-road, overestimate high-altitude site



Summary

- Air Quality Assessment Group uses satellite data for several applications
 - Exceptional Event demonstrations
 - Advisories for Extreme Air Quality Events
 - Air Quality Analysis to evaluate
 - Evaluation of new data sets for use in real-time air quality index map to provide data in areas without existing monitors
- Challenges with using satellite data
 - Relating column data with surface concentrations
 - Limited overpass times
 - Algorithm changes impact temporal trends analysis
 - Noise in AOD data products requires long averaging times to reduce statistical uncertainty
 - Difficulty estimating PM10 from satellite measurements
 - Varying surface reflectance impacts spatial patterns

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