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# The Use of Satellite Data to Assist AQ Policy Development

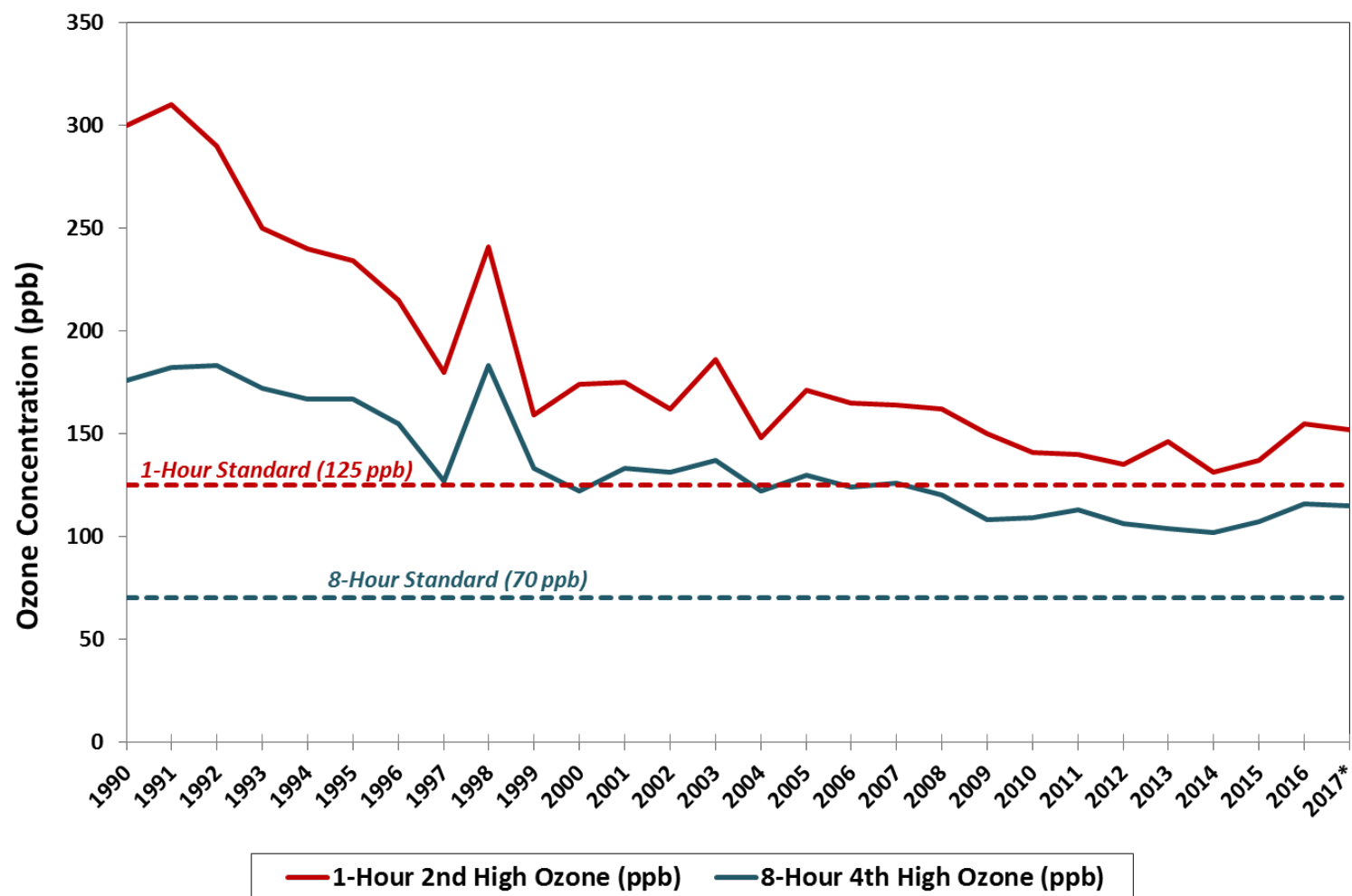
Sang-Mi Lee, Ph.D.

South Coast Air Quality Management District  
21865 Copley Dr, Diamond Bar, CA



# Ozone Concentration Trend

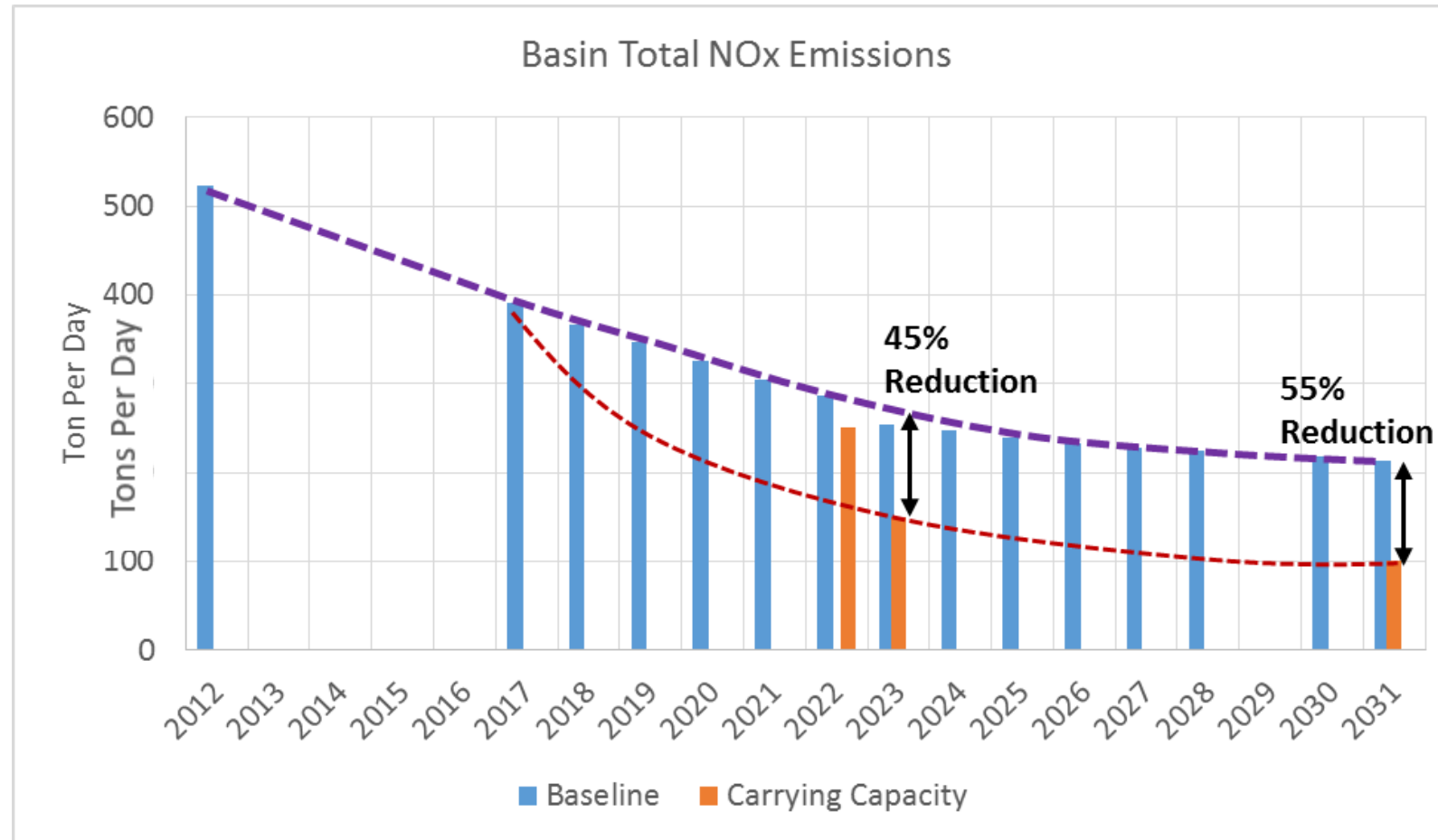
## 4<sup>th</sup> High 8-Hour and 2<sup>nd</sup> High 1-Hour, 1990-2017\*



\* Based on preliminary 2017 data

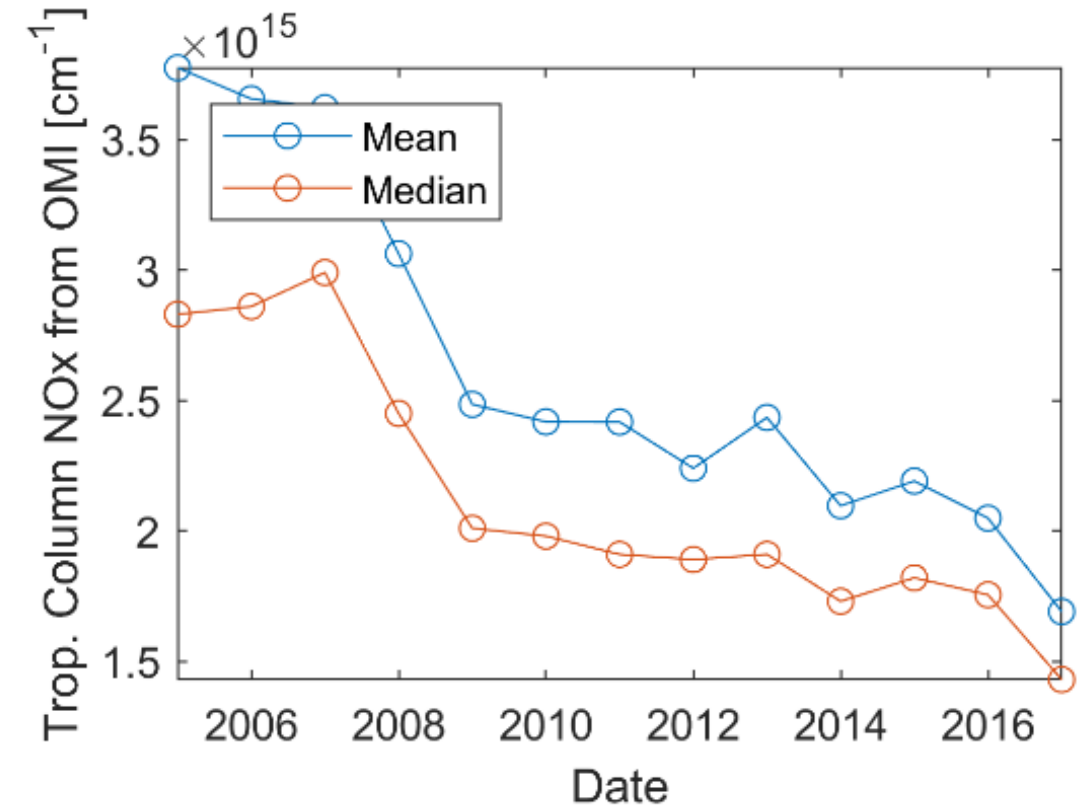
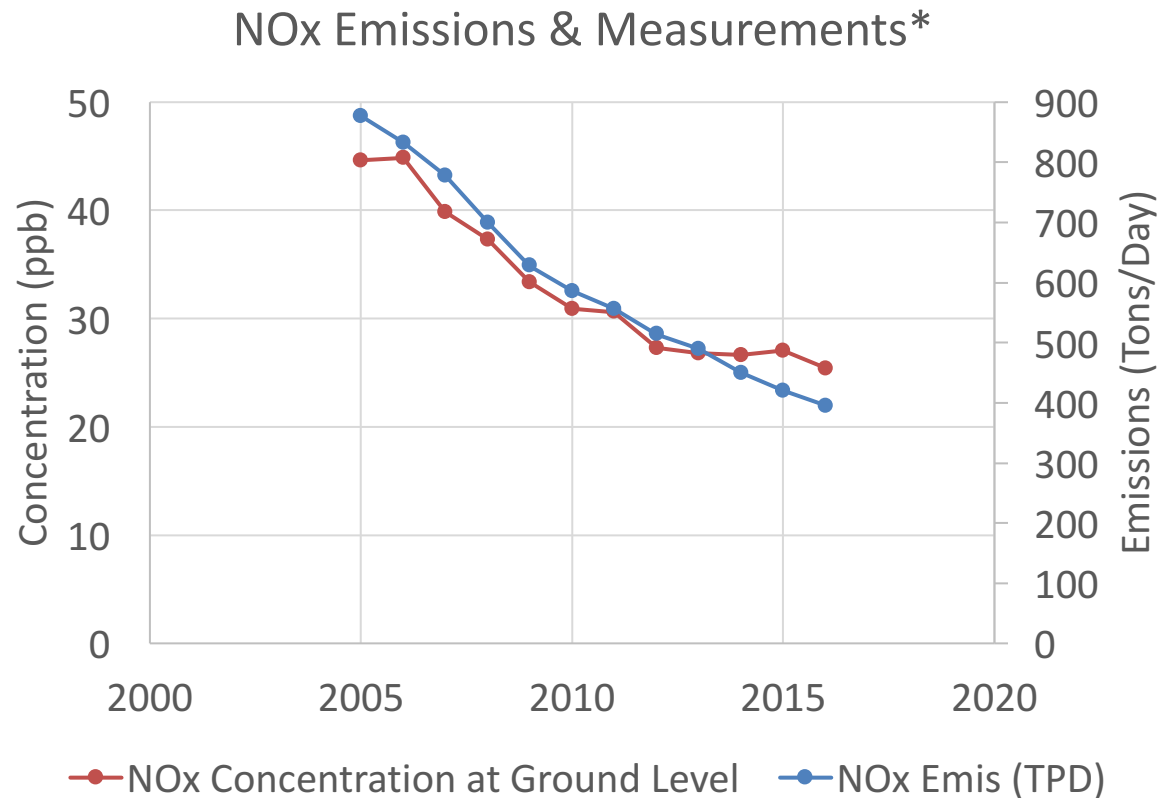


# Future NOx Emissions and Reduction Goals



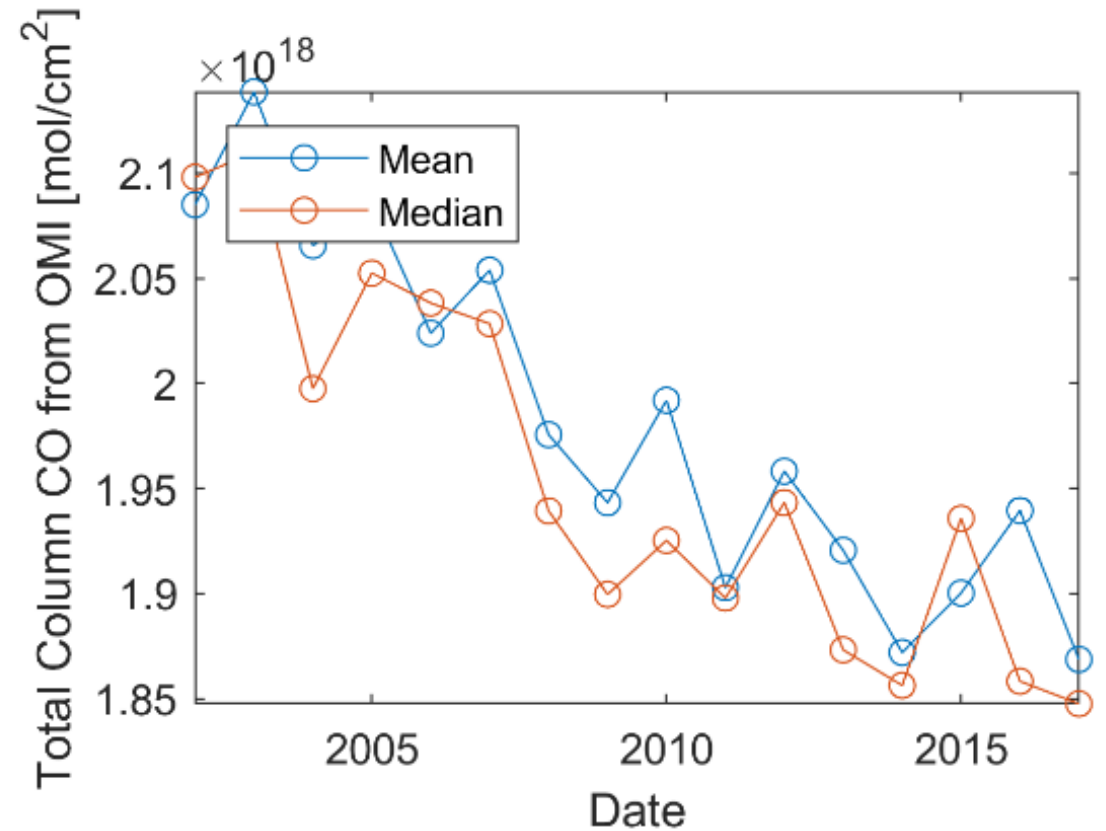
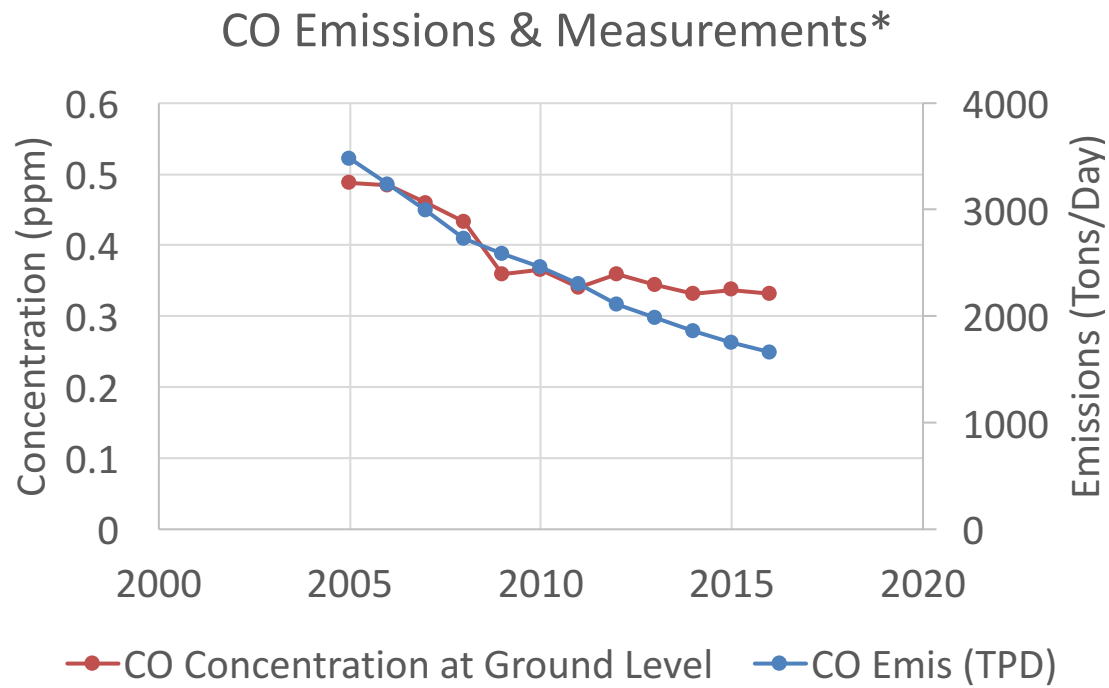
The future emission reduction goals were estimated from EKMA plots, which were developed with WRF-CMAQ-MEGAN and in-house Emissions Processing System

# Surface Concentrations, Emissions Inventory vs Satellite

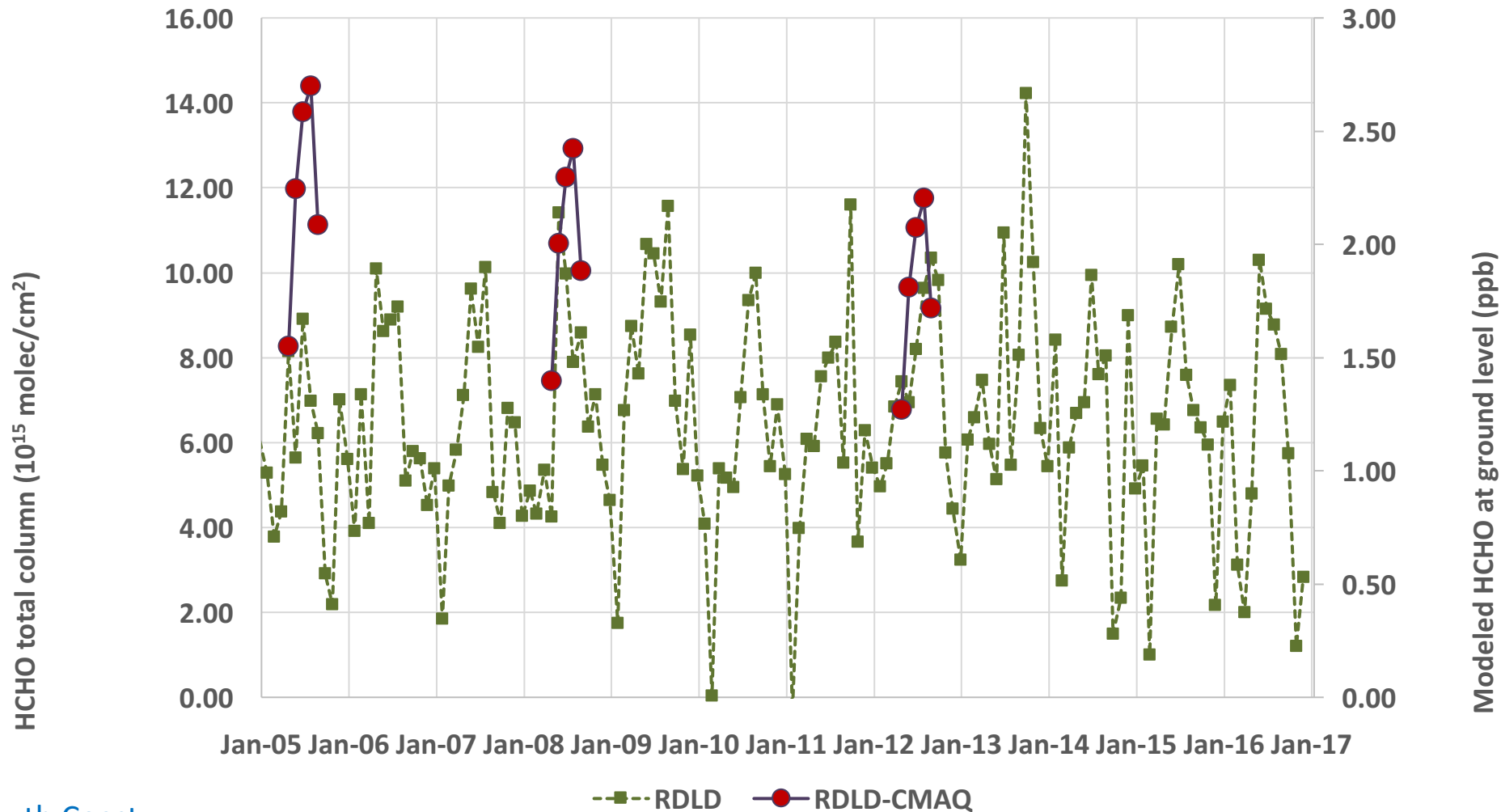


\*Annual Average of all the monitoring stations within the Basin

# Surface Concentrations, Emissions Inventory vs Satellite



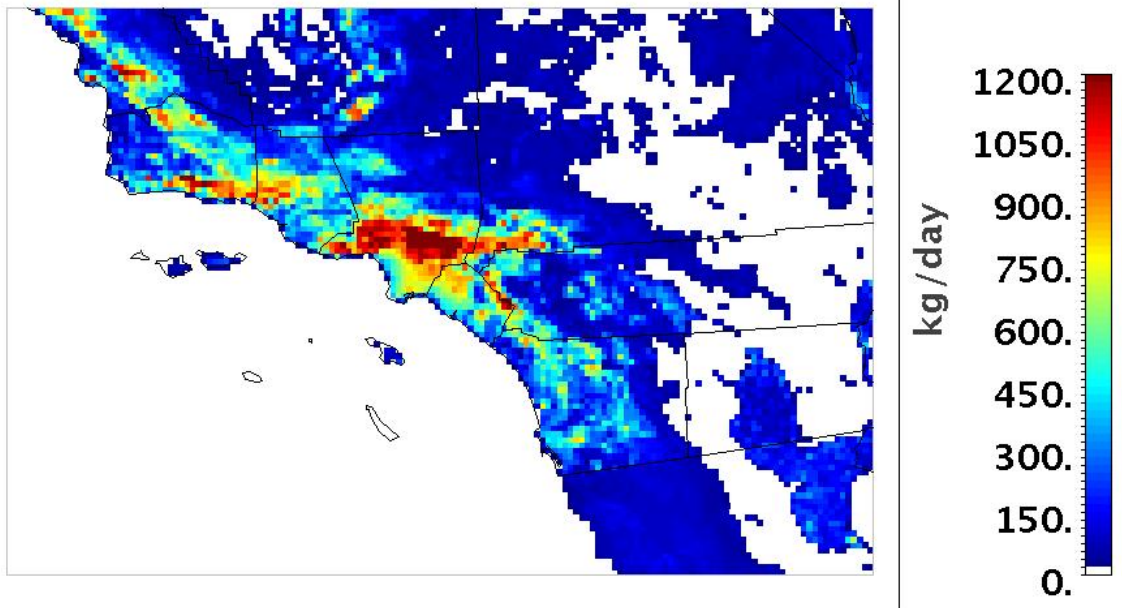
# HCHO from OMI & CMAQ prediction



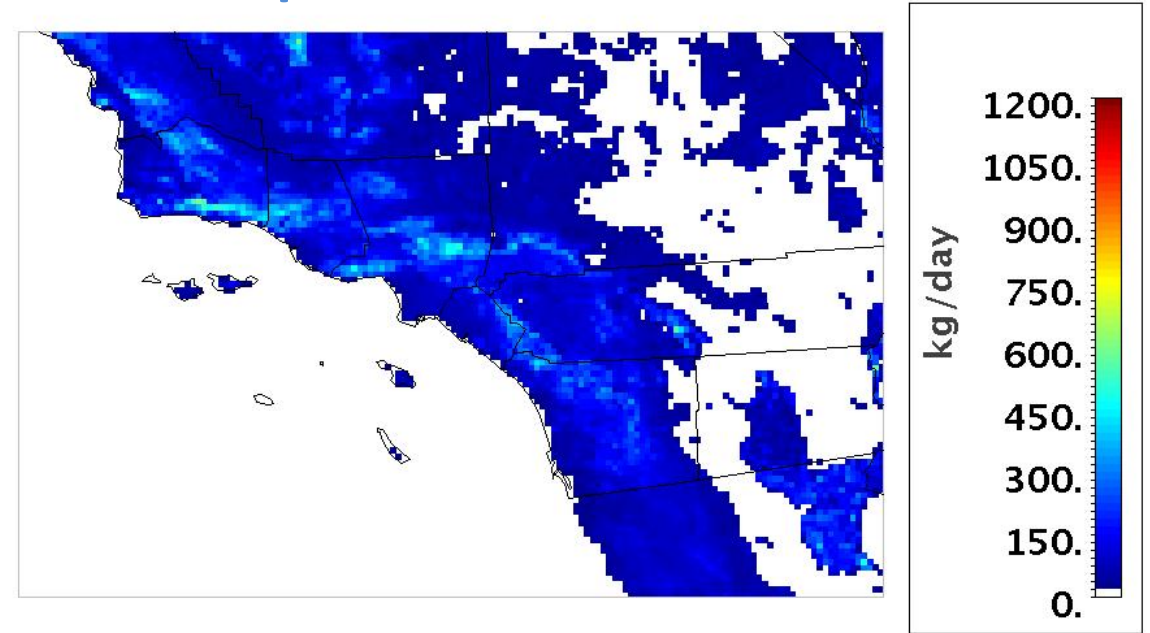
# Improvements in Biogenic Emissions

- Started analyzing a new version of the Model of Emissions of Gases and Aerosols from Nature (MEGAN 3.0)
  - MEGAN3.0 now include stress factors that limit biogenic emissions
  - MEGAN3.0 uses improved emission factors and vegetation species granularity
  - Preliminary results suggest that biogenic emissions estimated by MEGAN3.0 are lower than previously estimated by earlier versions

Isoprene – MEGAN 2.10



Isoprene – MEGAN 3



# Improvement in Urban Biogenic Emissions

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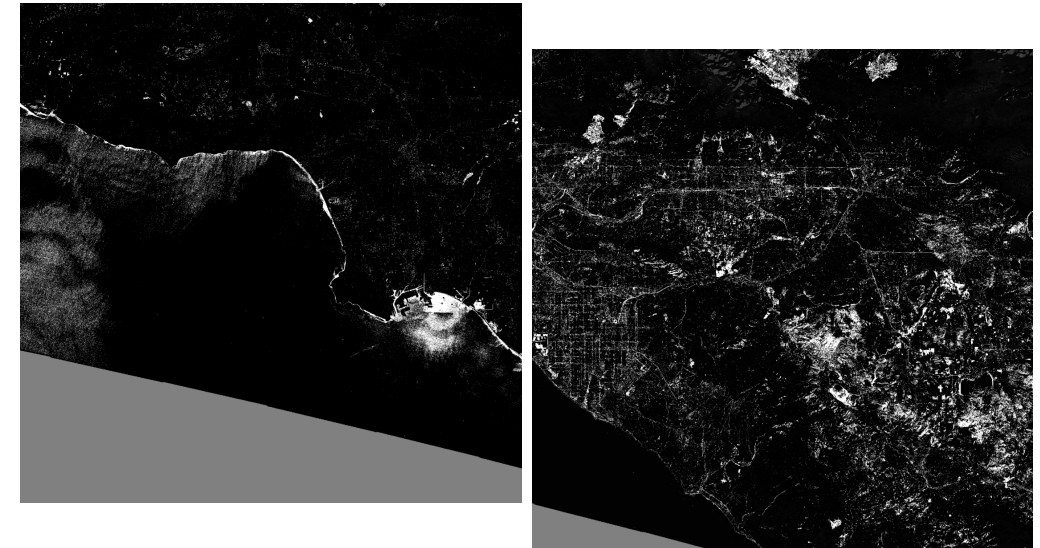
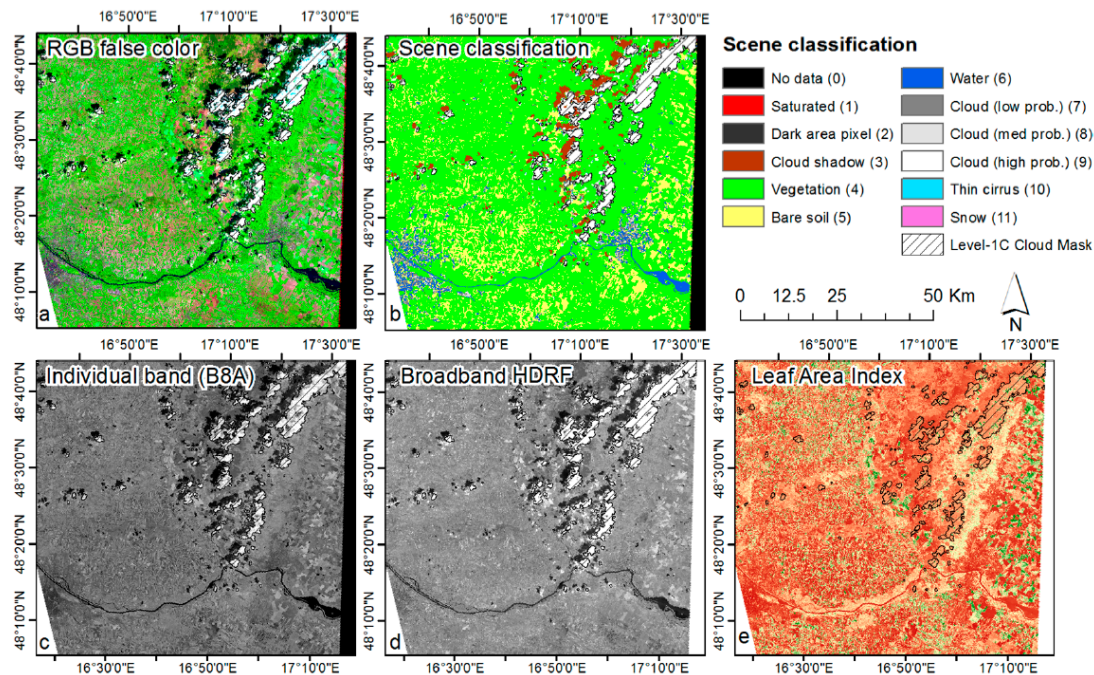
- Working on using high-resolution (10m) Sentinel Satellite data to obtain Leaf Area Index and vegetation cover to provide inputs for urban canopy emissions
  - There is no information on urban vegetation from standard resolution satellite product, so emissions from urban canopy are underestimated
  - Need to improve our understanding of vegetation species used in urban environments, and their specific emission factors



# High-Resolution Sentinel Satellite Image Processing

Vuolo et al, 2016, Remote Sens. 2016, 8, 938; doi:10.3390/rs8110938

## 10m Resolution Sentinel Images for South Coast Air Basin



**Figure 1.** Examples of a Sentinel-2 100 × 100 km<sup>2</sup> images (tile 33UXP, covering the region between Vienna and Bratislava, acquired on 6 May 2016) and value-added products available at the data service platform. Note that clouds extracted from the Level-1C cloud mask are displayed (as hashed symbol) in all other products. (a) RGB false color composite; (b) Scene classification; (c) Individual band; (d) Broadband hemispherical-directional reflectance factor (HDRF); (e) Leaf Area Index.

# Multiple Toxics Exposure Study V

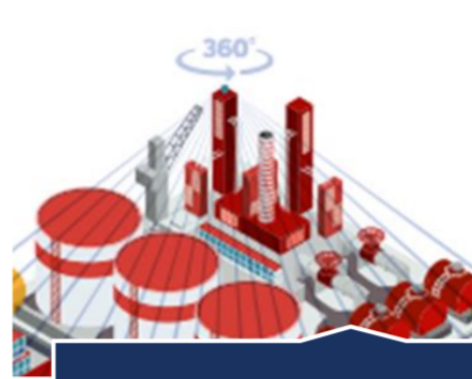
- Monitoring, Toxics Emissions Inventory and Exposure Modeling
- Apr 2018 – Mar 2019



Flight  
Measurements



Mobile Lab



Optical Tent



Sensor  
Networks

- Create detailed air toxics maps
- Evaluate monitoring technologies for leak detection capabilities
- Characterize cumulative impacts to communities
- Focus on refineries, as well as other industrial sources

# Summary

- SCAQMD's WRF-CMAQ-EPS-MEGAN modeling configuration simulated seasonal ozone trend reasonably well
- Historical trends of ambient NOx and CO concentrations agree well with the top-down approach the AQMP/SIP emissions inventory, however uncertainties in VOC measurements and emissions need further evaluation
- Satellite and Radar based data are being used to improve emissions from, for example, ships, aircrafts, and vegetation.
- MATES V will provide extensive data set collated from traditional fixed sites and advanced monitoring with remote sensing and community scale sensors

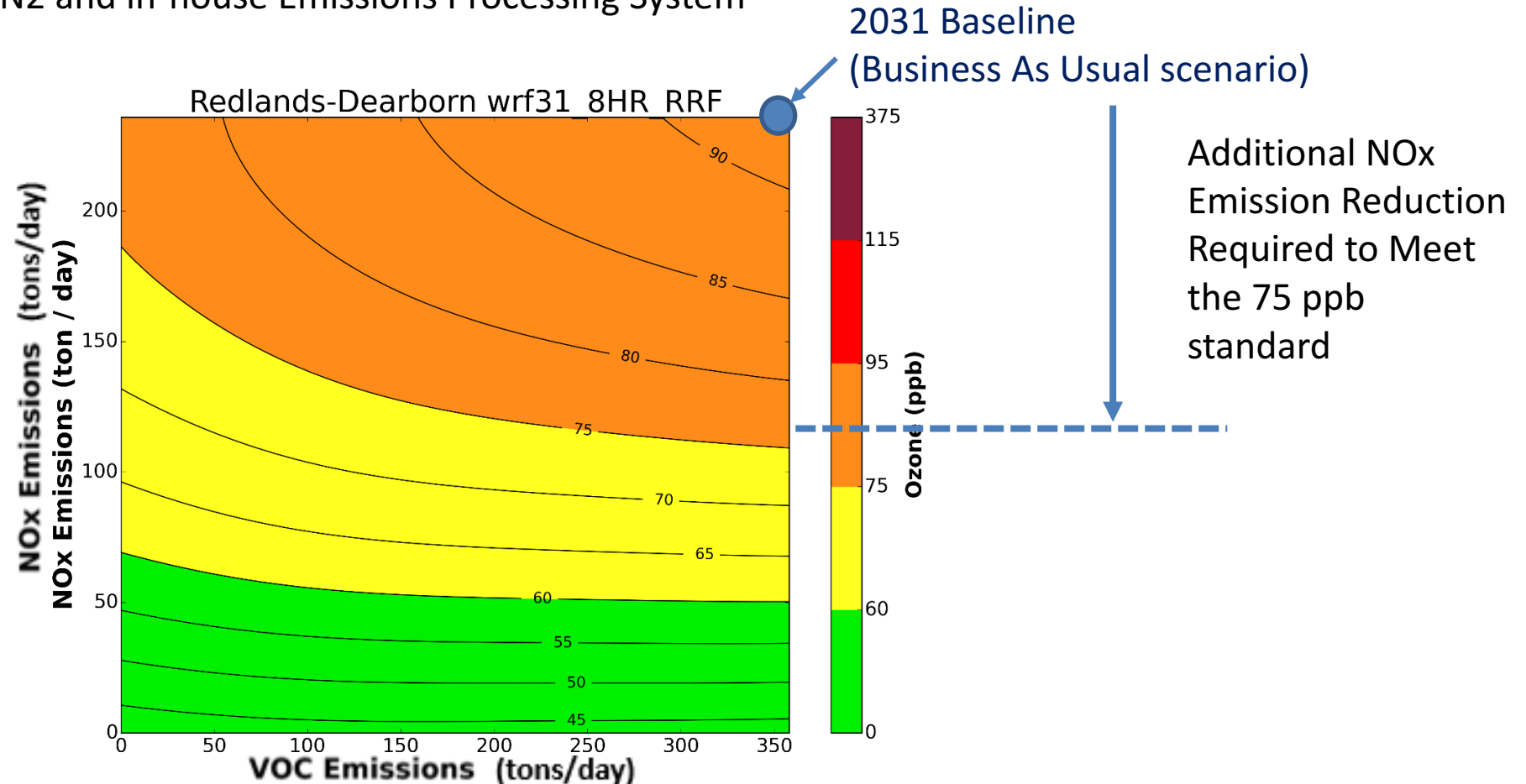
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# Extra Slides



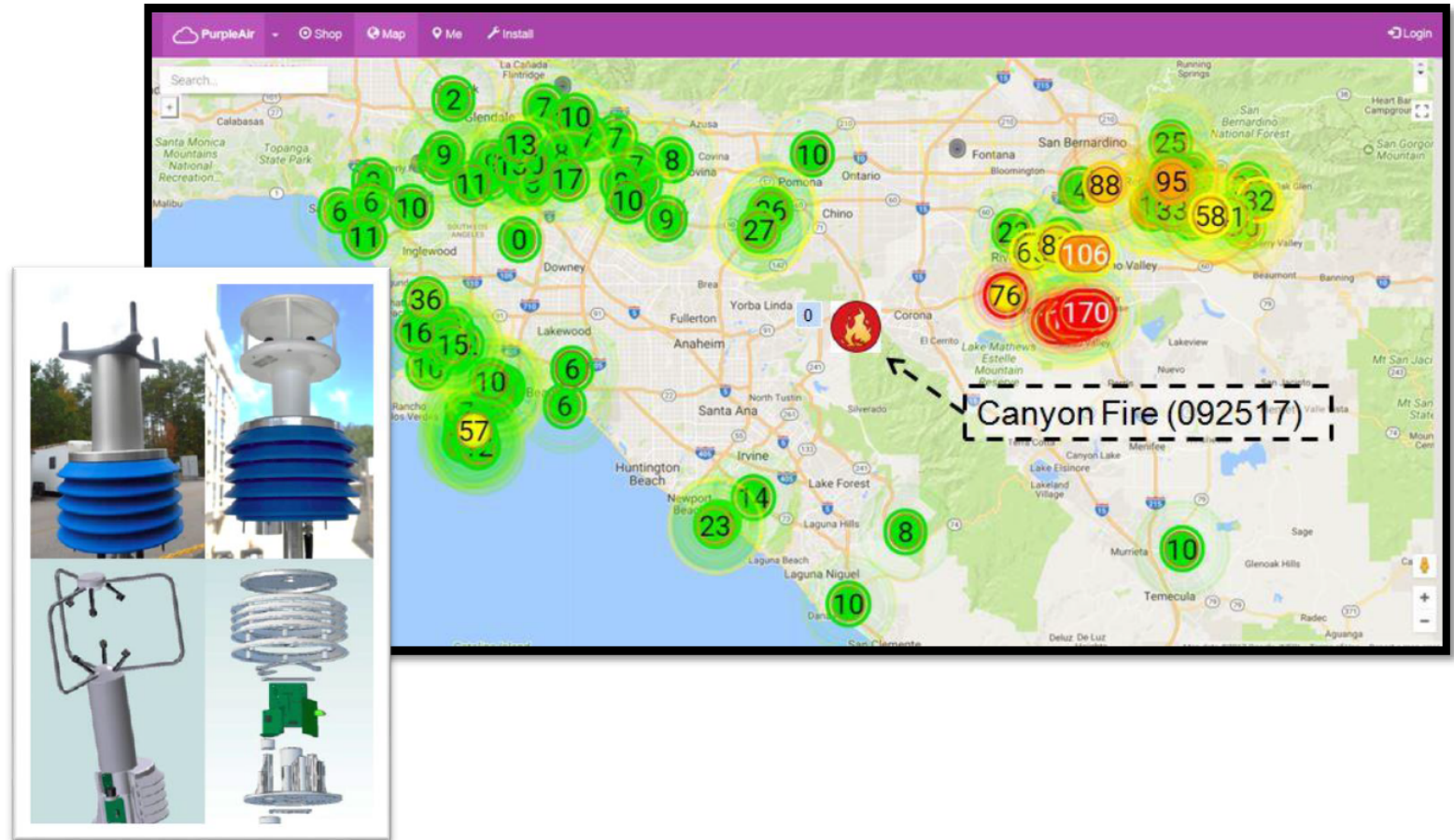
# 8-hour Ozone EKMA Plot

- WRF-CMAQ-MEGAN2 and in-house Emissions Processing System



# SENSOR NETWORKS & COMMUNITY ENGAGEMENT

- Detailed local data
  - PM: 2 communities
  - VOC: Near-refinery community
- Community engagement
  - Air quality & sensor training
  - Needs assessment
  - Inform air quality improvement projects



# NO<sub>x</sub>/VOC Ratio sensitive to O<sub>3</sub> chemistry

