STATE OF CALIFORNIA
AIR RESOURCES BOARD

Heavy-Duty Engine and Vehicle	**)**	
Omnibus Regulation and Associated	**)**	**Hearing Date:**
Amendments; Proposed Rulemaking;	**)**	**August 27, 2020**
Initial Statement of Reasons	**)**	

SUPPLEMENT TO THE COMMENTS OF THE TRUCK AND ENGINE MANUFACTURERS ASSOCIATION

August 21, 2020

Timothy A. French
Steve Berry
Truck and Engine Manufacturers Association
333 West Wacker Drive, Suite 810
Chicago, IL 60606

STATE OF CALIFORNIA
AIR RESOURCES BOARD

Heavy-Duty Engine and Vehicle	**)**	
Omnibus Regulation and Associated	**)**	**Hearing Date:**
Amendments; Proposed Rulemaking;	**)**	**August 27, 2020**
Initial Statement of Reasons	**)**	

1. Introduction

The Truck and Engine Manufacturers Association ("EMA") hereby submits this supplement to EMA's comments in opposition to the proposed Heavy-Duty Engine and Vehicle Omnibus Regulations and Associated Amendments (the "Omnibus Regulations" or "Low-NO_x Regulations") that the California Air Resources Board ("CARB") has proposed to adopt at a Board hearing scheduled for August 27, 2020. This supplement adds to the point, discussed at pages 29-30 of EMA's comments, that CARB has done nothing to assess the efficacy of its proposed Omnibus Low-NO_x Regulations.

2. CARB Has Done Nothing To Assess Or Establish The Efficacy Of Its Proposed Low-NO_x Regulations

EMA's comments point out that CARB has taken no steps and has provided no evidence in the rulemaking record to demonstrate that its proposed Low-NO_x Regulations will be effective at reducing ozone levels in the South Coast Air Basin (SoCAB). In that regard, EMA submitted a report prepared by the Ramboll Group (Exhibit "F" to EMA's comments) confirming that a "NO_x-disbenefit" phenomenon still exists in portions of the SoCAB. The NO_x-disbenefit phenomenon refers to the fact that NO_x reductions actually can lead to increases in ozone in "VOC-limited" regions of the SoCAB, such as the more heavily-populated areas near downtown Los Angeles. Ramboll's report (Exhibit "F") documents the continuing persistence of NO_x-disbenefits in the central and western portions of the SoCAB, including Los Angeles.

More recently, Ramboll has assessed whether the recent significant COVID-related reductions in ozone-precursor emissions, specifically NO_x, have led to actual corresponding reductions in ozone. As detailed in Ramboll's supplemental report (attached hereto as Exhibit "F.1",) notwithstanding NO_x reductions of approximately 20% when comparing June 2019 with June 2020 (months that had similar meteorology), ozone levels were similar at the key "design-value" monitoring in the SoCAB (and actually were slightly higher in downtown Los Angeles). Ramboll's supplemental analysis confirms that ozone levels in the SoCAB are, at best, currently unresponsive even to significant 20% reductions in ambient NO_x levels, reductions that are well beyond those that could be achieved through implementation of the proposed Low-NO_x Regulations.

Ramboll's analysis and findings confirm that the proposed Low-NO_x Regulations likely will not be effective in reducing ozone levels in the SoCAB. Just as important, CARB has done nothing to establish any different conclusion. The complete lack of evidence of the actual efficacy of CARB's proposed Low-NO_x Regulations is another factor establishing their invalidity.

Respectfully Submitted,

TRUCK AND ENGINE
MANUFACTURERS ASSOCIATION

Effects of 2020 COVID-19 NOx Reductions on Ozone in the SoCAB

Preliminary Analysis of 2019 & 2020 Met and Ozone Changes; Top Down NOx Emissions; Ozone Isopleth Analysis

Ralph Morris and Lynsey Parker

August 17, 2020

RAMBOLL

Outline

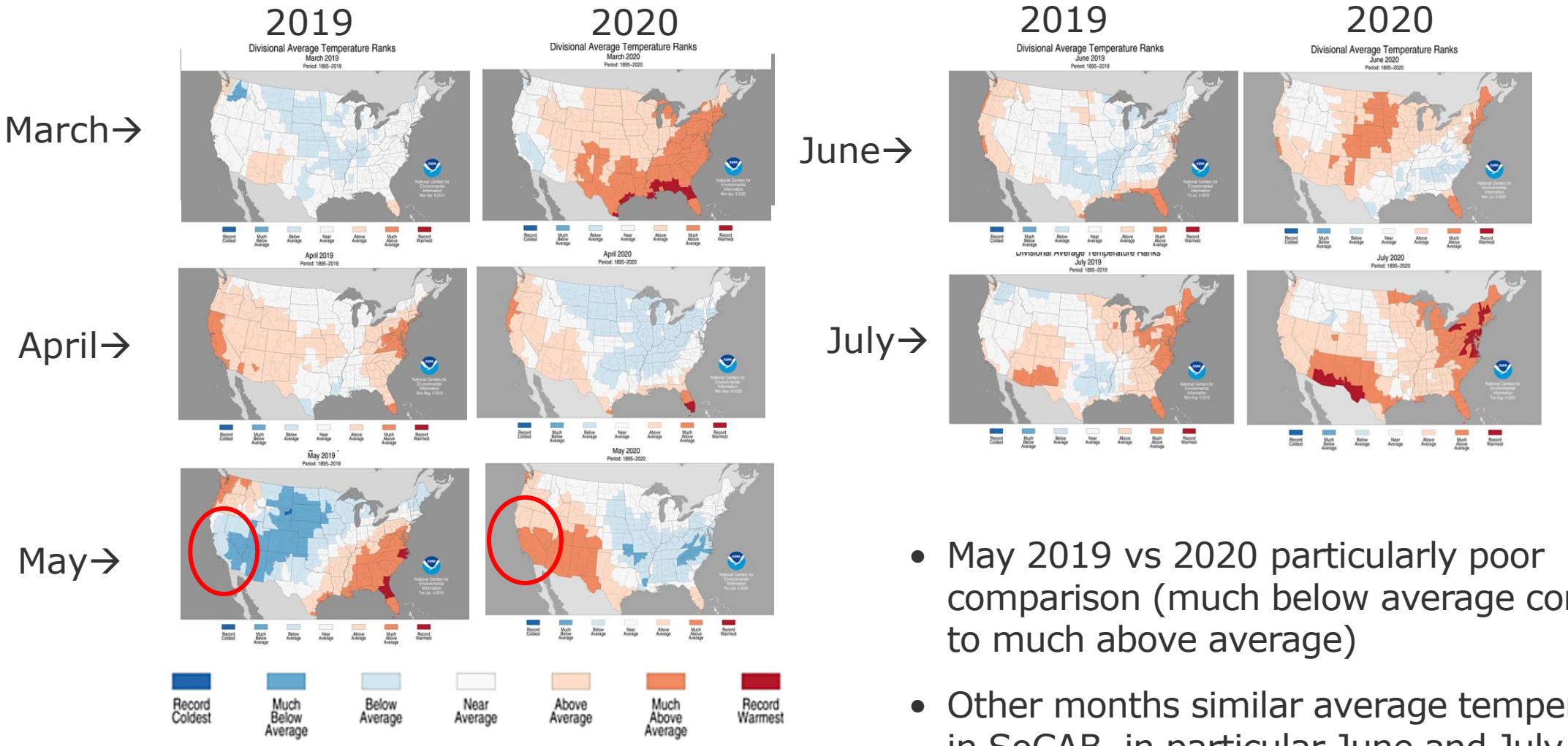
- Overview of Proposed Work
- Meteorological Characterization
- Top Down Emissions Characterization
- Observed Ozone Changes
- Isopleth Discussion
- Recommendations

Testing Hypothesis

- The current chemical regimes in some locations of the South Coast Air Basin (SoCAB) may be VOC-limited such that NOx emissions reductions due to the COVID Shelter-in-Place (SiP) orders may cause ozone increases or at least no changes in ozone.
- Do modeled ozone estimates respond in the same fashion as ozone observations in response to the COVID NOx emission reductions?
- Phase I Technical Approach
  - Analyze observed and modeled changes in ozone between 2019 and 2020
  - First determine whether 2019 and 2020 meteorological conditions have similar ozone formation conditions such that the signal of the COVID NOx emissions reduction can be detected through variations in meteorology.
  - Analyze changes in NOx concentrations to develop top-down adjustment factors for adjusting 2020 NOx emissions to account for COVID
  - Model 2019 and 2020 to see whether models respond to the changes in NOx emissions in the same fashion as observed ozone changes.
  - Develop plan for bottoms-up adjustment of emissions to account for COVID.

RAMBOLL

Meteorological Characterization: Average Temperatures

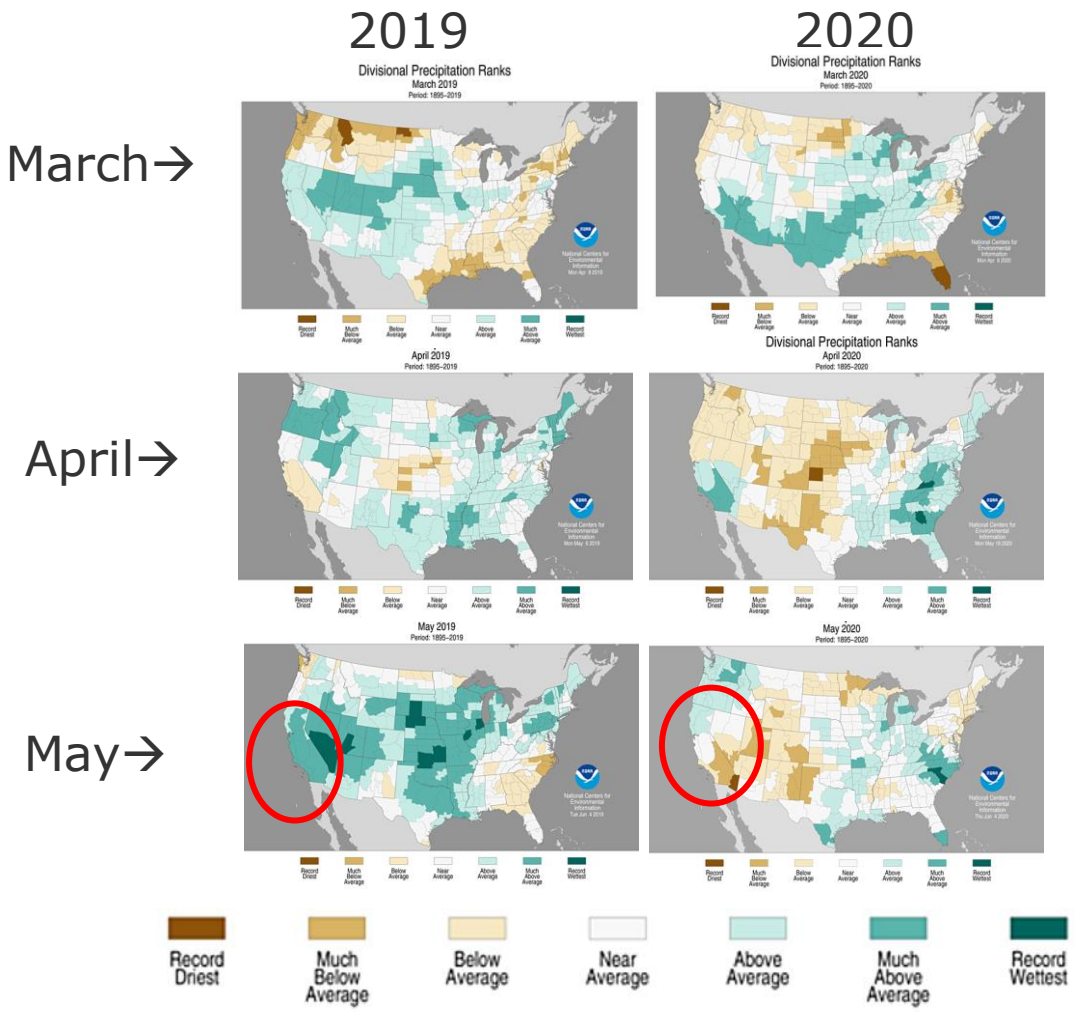


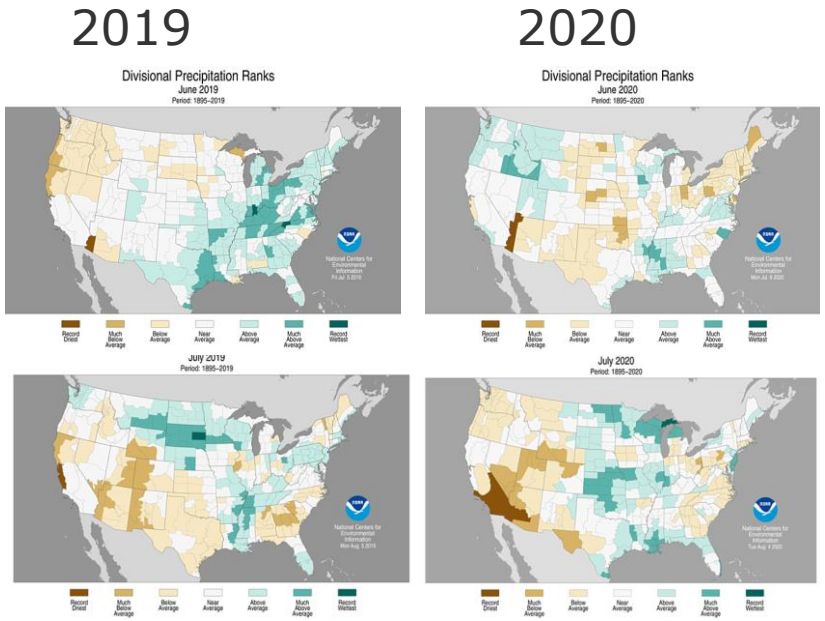
- May 2019 vs 2020 particularly poor comparison (much below average compared to much above average)
- Other months similar average temperatures in SoCAB, in particular June and July comparable

Period: 1895 – 20xx

https://www.ncdc.noaa.gov/temp-and-precip/us-maps/

Meteorological Characterization: Precipitation



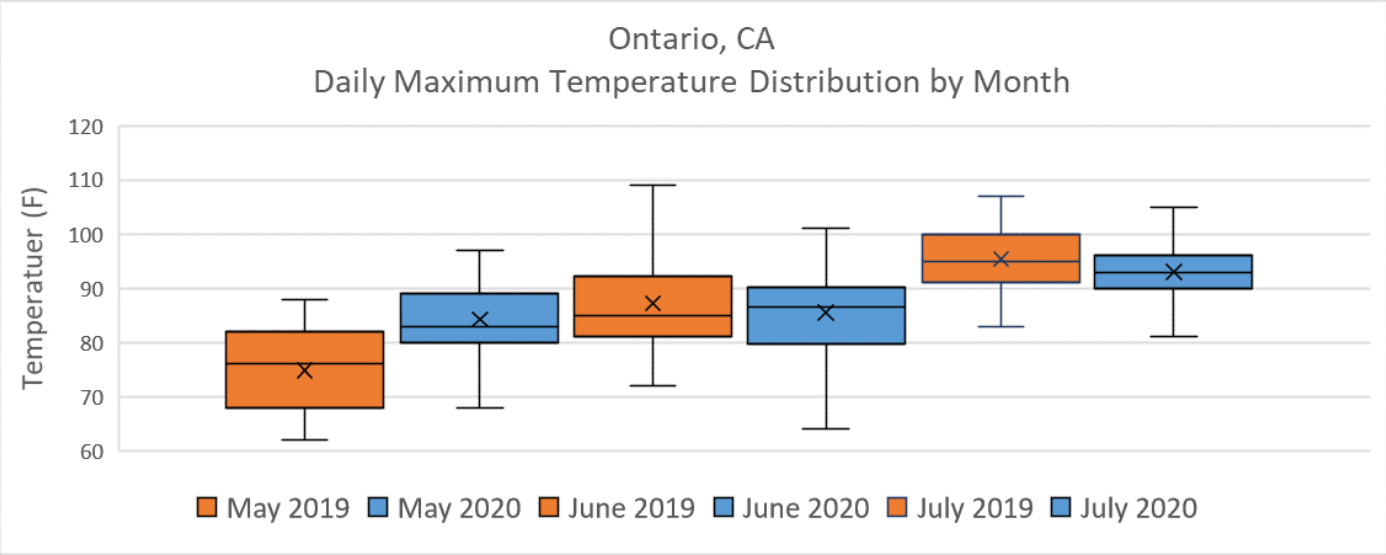


- May 2019 vs 2020 particularly poor comparison, May 2019 much above average precipitation
- Other months reasonably similar average temperatures in SoCAB
  - July 2020 record driest

RAMBOLL

Period: 1895 – 20xx

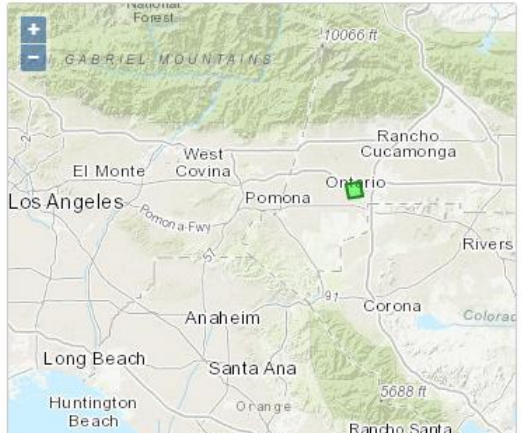
Meteorological Characterization: Local meteorological site



Non-coastal site: Ontario International Airport (KONT)

Temperature Distribution Plots:

- Whiskers = Max/min
- Boxes = 25 – 75 %
- Mid bars = medians
- Crosses = means



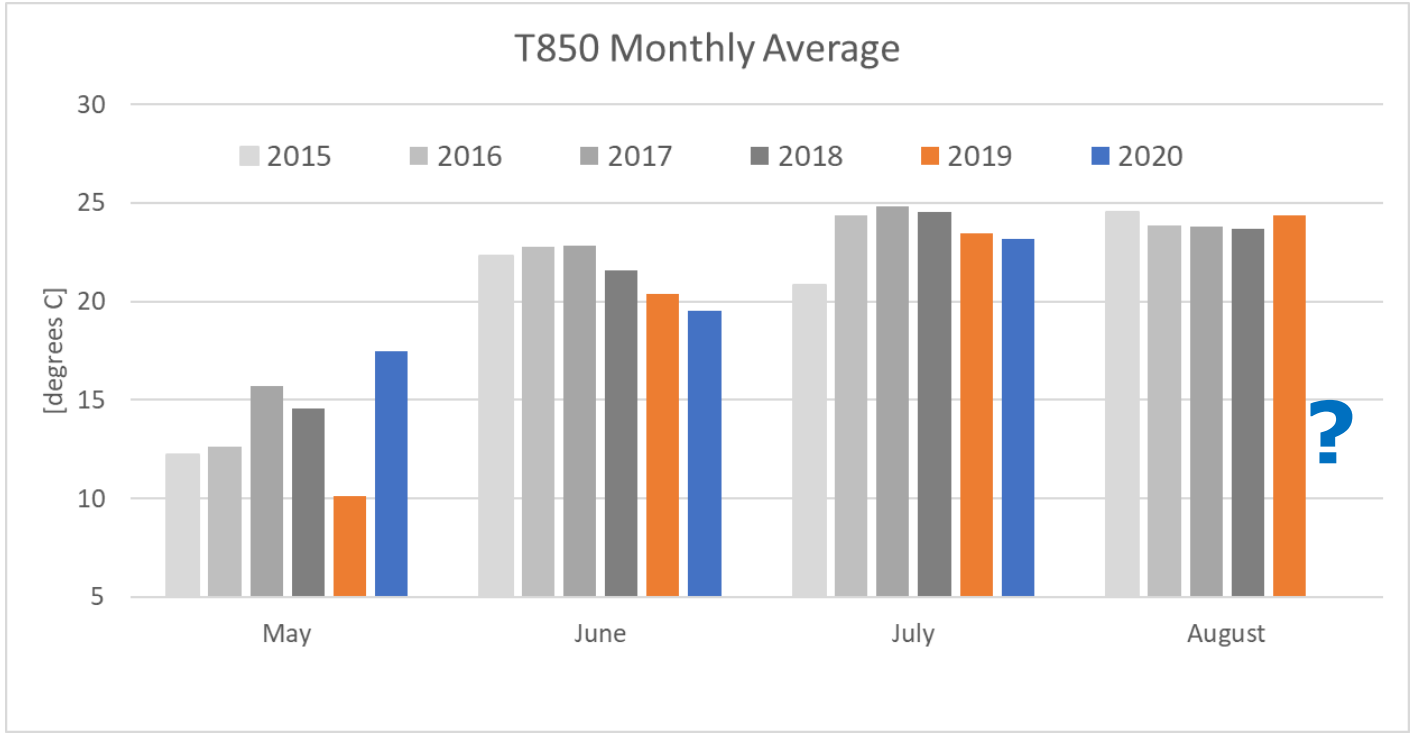
Ontario International Airport (KONT)

Lat: 34.05316°NLon: 117.57685°WElev: 906ft.

- May 2019 much cooler than May 2020
- June and July reasonably similar temps

Meteorological Characterization: "T850" metric

- T850 is the temperature at 850 mb (~ 1,500 meters) an indicator of inversion strength
  - Stronger inversion -> higher pollution in SoCAB
  - Correlates with surface temperatures
  - High ozone at Crestline (i.e. ~design value monitor) occurs when T850 (San Diego) is high
  - 2017 high ozone in SoCAB was due (in large part) to high T850



- Additional years (2015-2018) added for context:
  - May 2019/2020 anomalously low and high
  - June 2019 and 2020 similar, both low
  - July 2019 and 2020 similar and within range of other years

RAMBOLL

https://ruc.noaa.gov/raobs/

Meteorological Characterization: Summary

- May 2019 and 2020 are anomalous compared to recent years, and very different from each other
  - ➢ May 2020 is much more conducive to ozone formation than May 2019
- June and July 2019 and 2020 are reasonably similar in terms of surface temperatures and T850 therefore similar in terms of ozone formation potential
  - ➢ Performing AQ modeling and comparing June/July 2019 and 2020 years is reasonable

Top Down Emissions Characterization: Overview

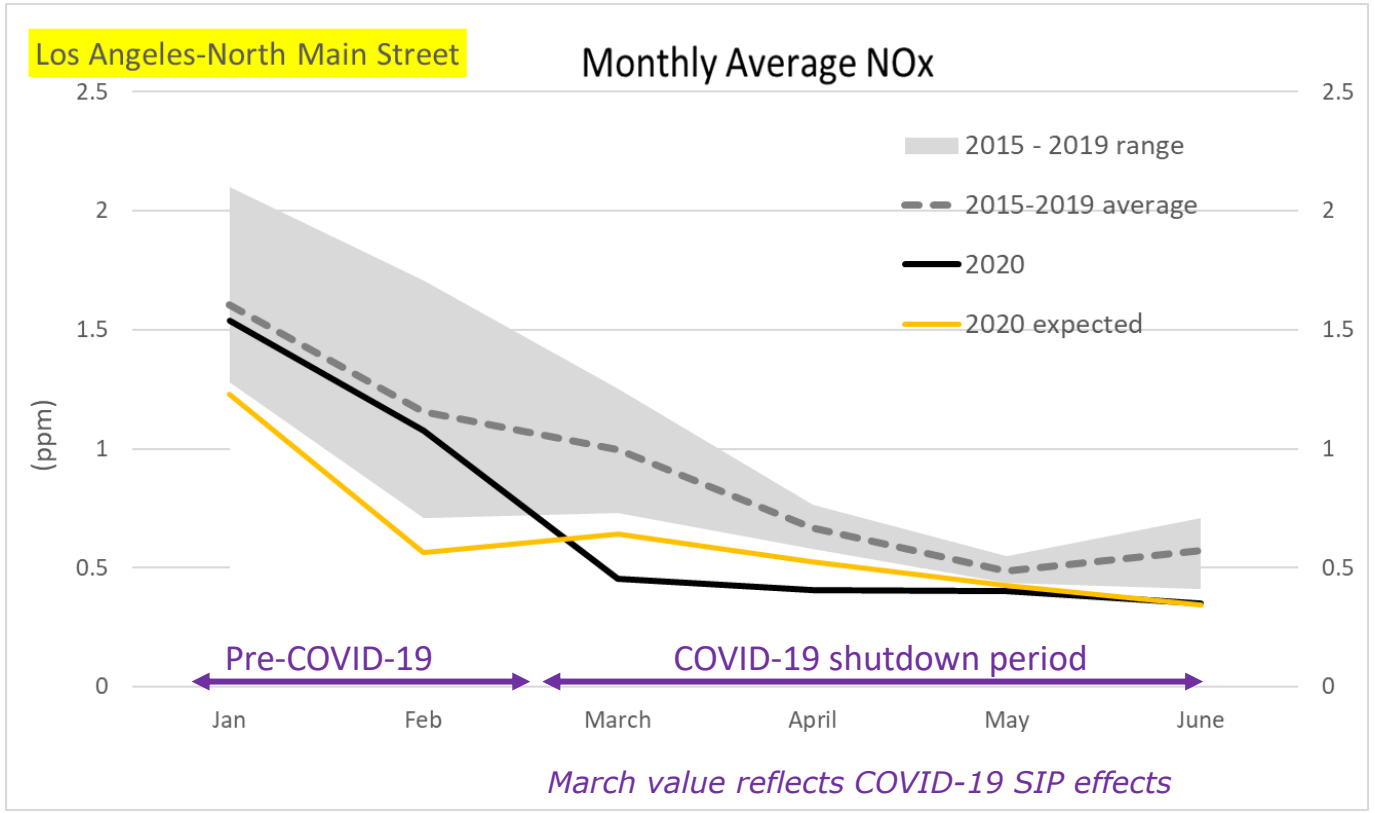
Goal:

Quantify COVID-19 response NOx emissions reductions and account for recent trends

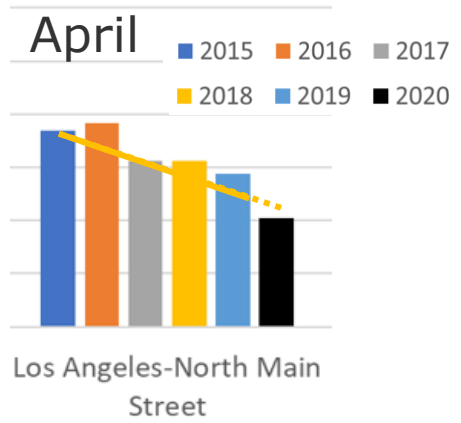
Two Methods:

1. Surface NOx concentrations (7 sites in SoCAB, spanning basin)
   - Two near road sites (Long Beach and Anaheim)
   - Monthly average metric
   - Compare with 2015-2019 baseline period
2. Satellite NO_2 columns

Top Down Emissions Characterization: Surface NOx Methodology



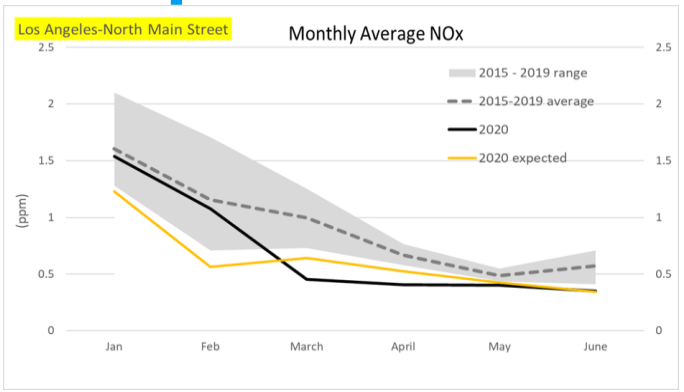
Example extrapolation to calculate "2020 expected"

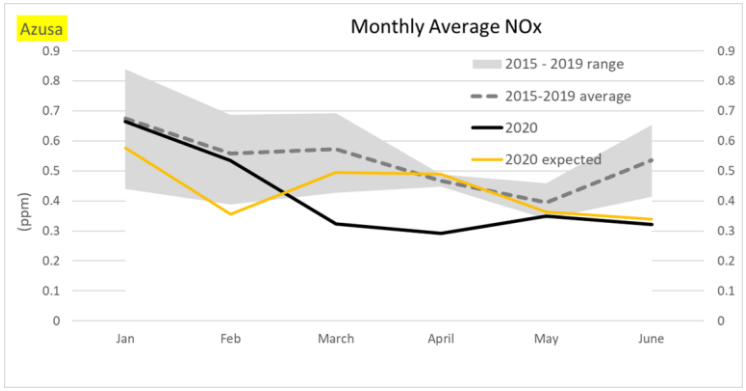


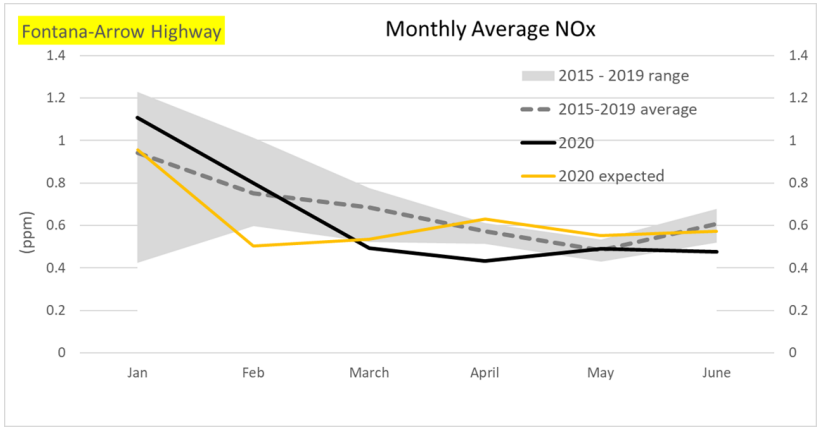
- "2020 expected" is based on monthly linear extrapolation of 2015-2019
- Shutdown occurred mid-March (impacts March concentrations)

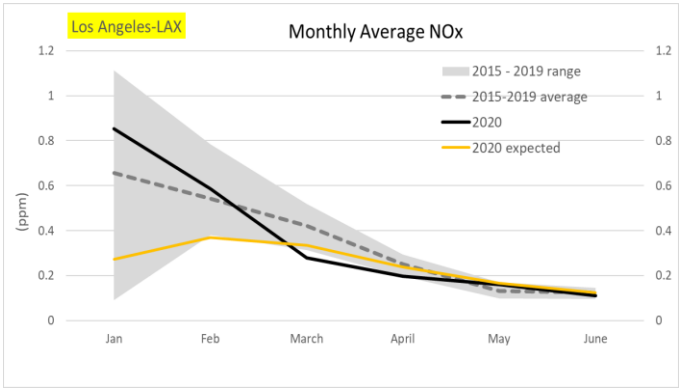
RAMBOLL

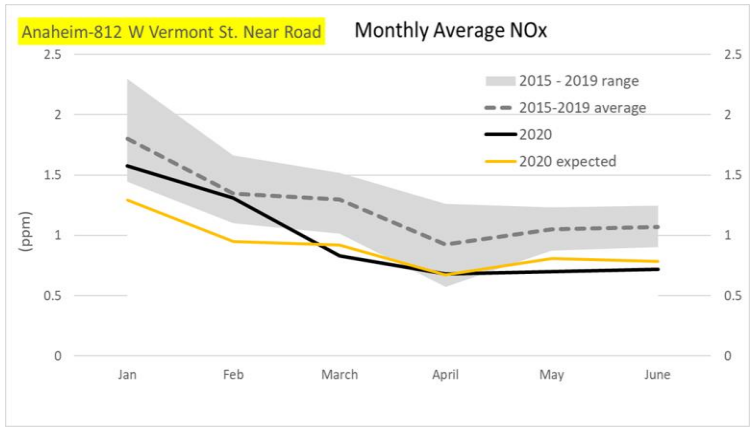
Top Down Emissions Characterization: NOx at Seven Sites

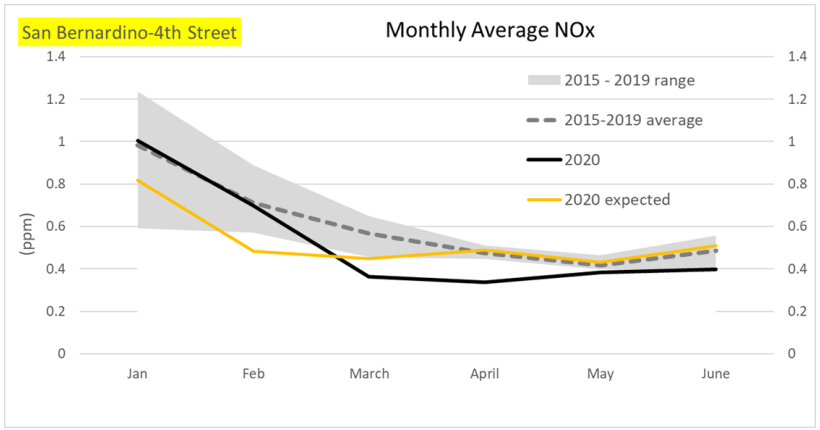


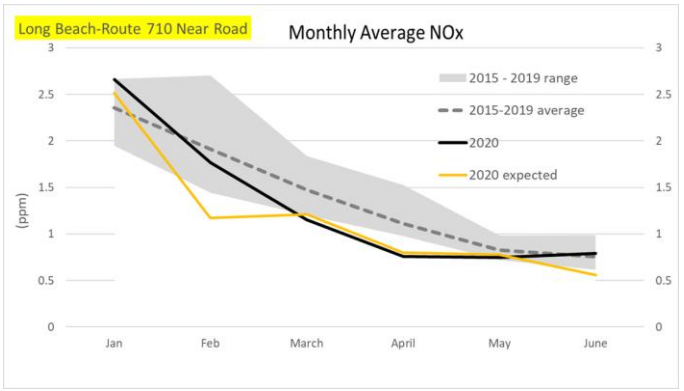


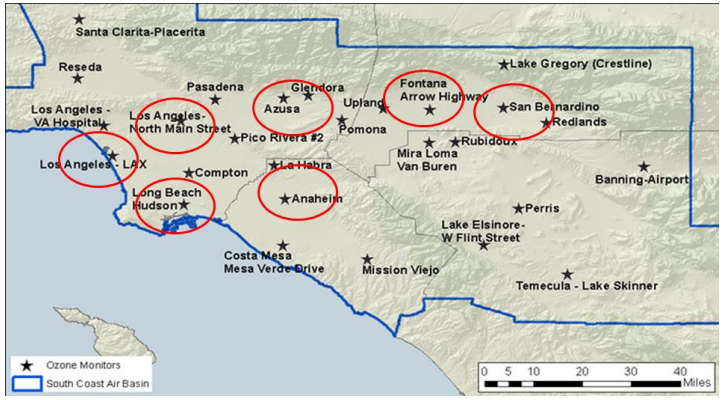






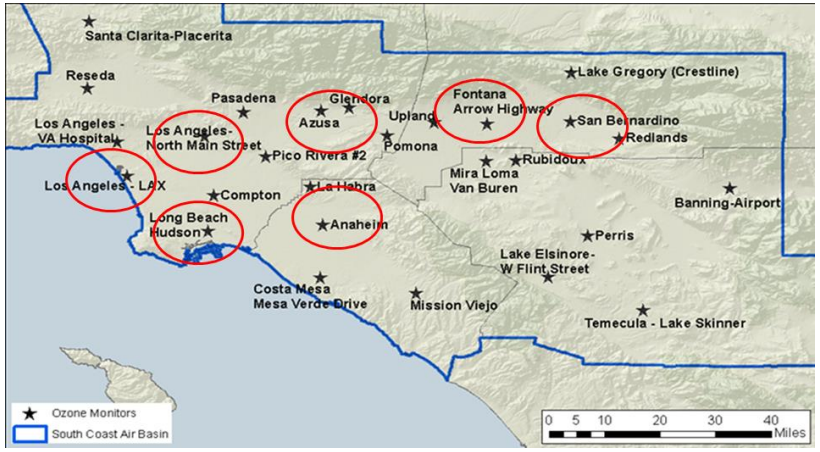






- 2020 Jan/Feb within 2015-2019 range
- 2020 March/April generally below range and below expected
- 2020 May/June below at interior sites

Top Down Emissions Characterization: NOx Seven Sites Statistics



April-June difference from expected	
Los Angeles-LAX	-12%
Long Beach-Route 710 Near Road	8%
Los Angeles-North Main Street	-11%
Anaheim-812 W Vermont St. Near Road	-7%
Azusa	-19%
Fontana-Arrow Highway	-20%
San Bernardino-4th Street	-22%

- "2020 actual" compared against "2020 expected" April – June average show decreases at all sites except Long Beach
- "2020 actual" compared against 2015-2019 baseline both show substantial decreases since COVID-19 shelter in place orders in SoCAB during March and April and continuing in May and June at most sites

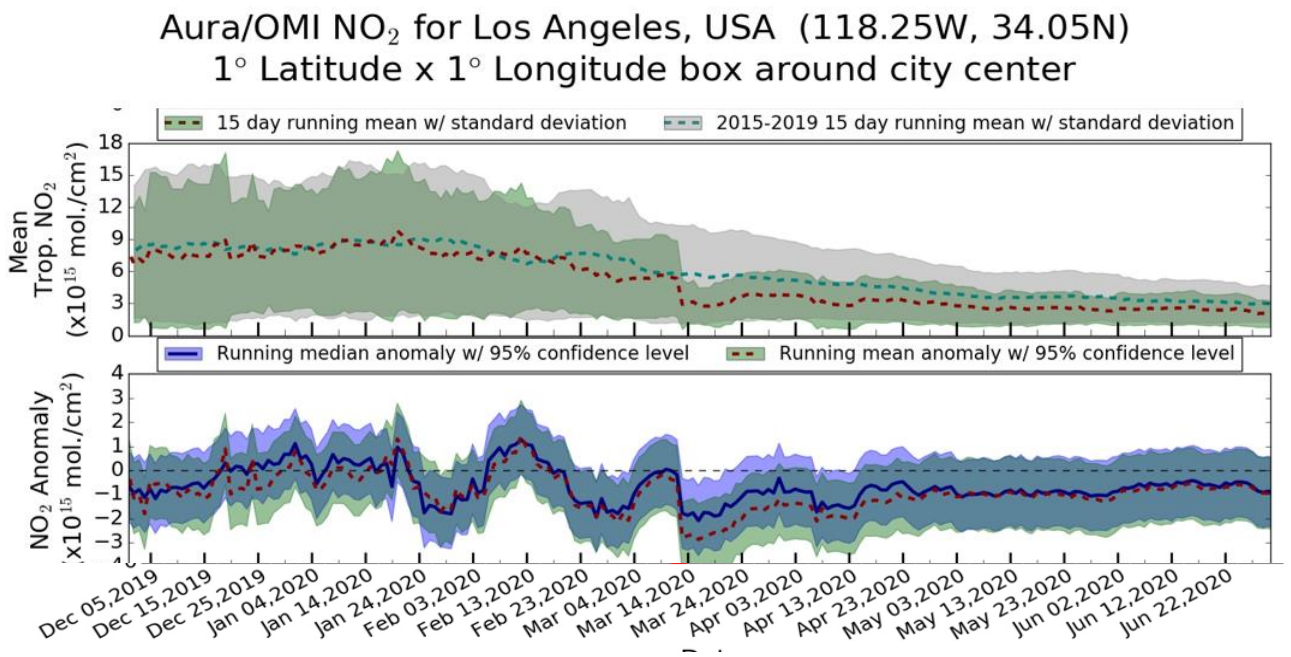
Reduction: (2020-base)/base						
	Jan	Feb	March	April	May	June
Los Angeles-LAX	30%	8%	-34%	-21%	22%	-10%
Long Beach-Route 710 Near Road	13%	-8%	-22%	-32%	-10%	5%
Los Angeles-North Main Street	-4%	-7%	-54%	-39%	-17%	-38%
Anaheim-812 W Vermont St. Near Road	-12%	-3%	-36%	-27%	-33%	-33%
Azusa	-1%	-4%	-43%	-38%	-12%	-40%
Fontana-Arrow Highway	18%	6%	-28%	-25%	1%	-22%
San Bernardino-4th Street	2%	-2%	-36%	-28%	-8%	-18%

Red = 15-30% increase
Grey = +/- 15%
Blue = 15-30% decrease
Green = 30+% decrease

Base = 2015-2019 average

RAMBOLL

Top Down Emissions Characterization: Satellite NO_2 Columns



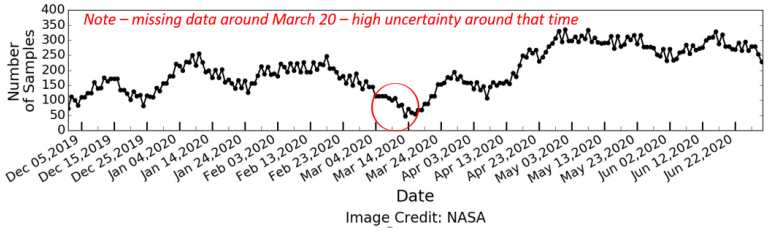
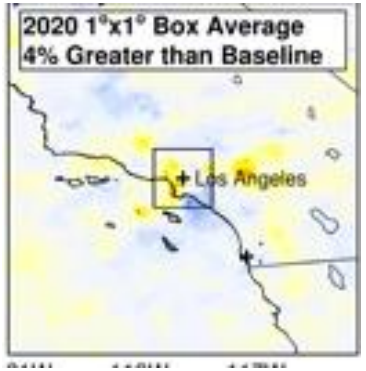


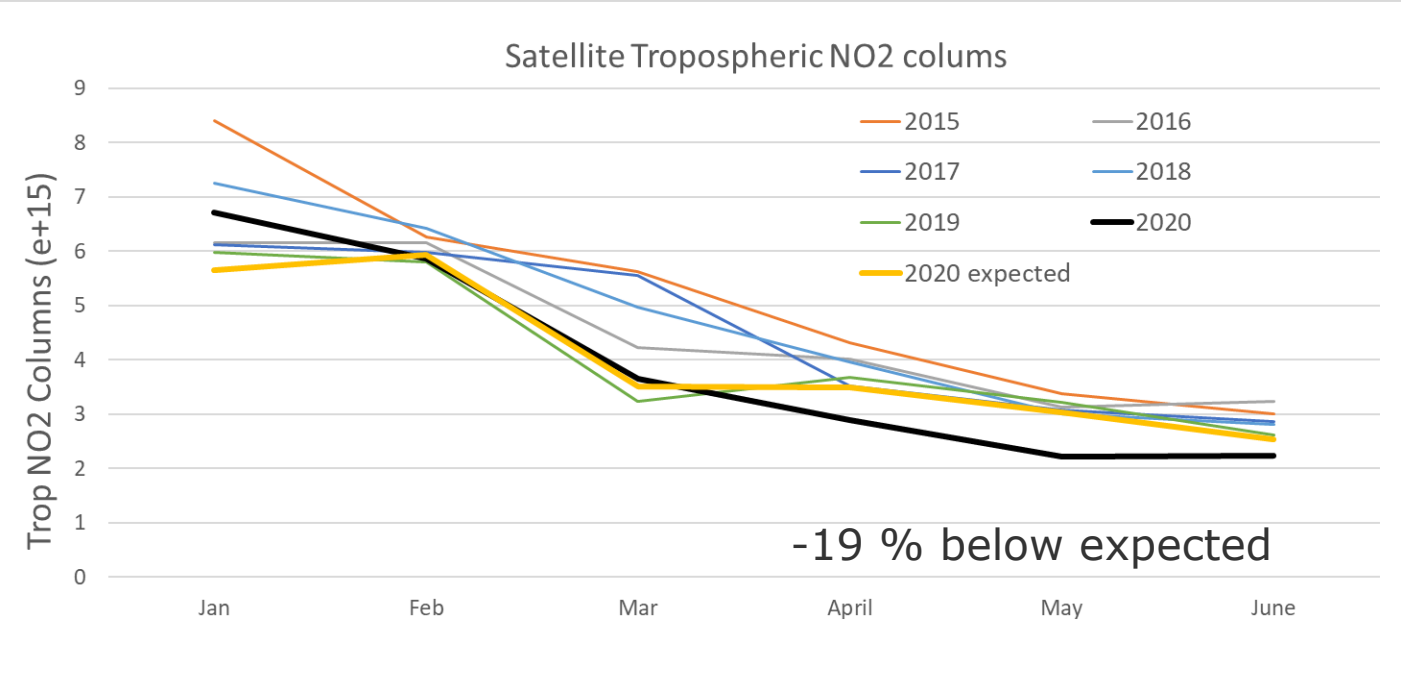
Image Credit: NASA



- NASA has generated plots for select U.S. cities, where they:
  - Compare 2020 to 2015-2019
  - Calculate a 15-day running mean to smooth out noisy satellite data
  - Compare 2020 mean and standard deviation (SD) to 2015-2019 mean and SD
  - Anomaly plot is the difference between 2015-2019 baseline and 2020
  - Zero anomaly line is dashed 0 line
- Consistently lower since March
- Does not separate COVID-19 response from longer term trends. (See next slide)

RAMBOLL

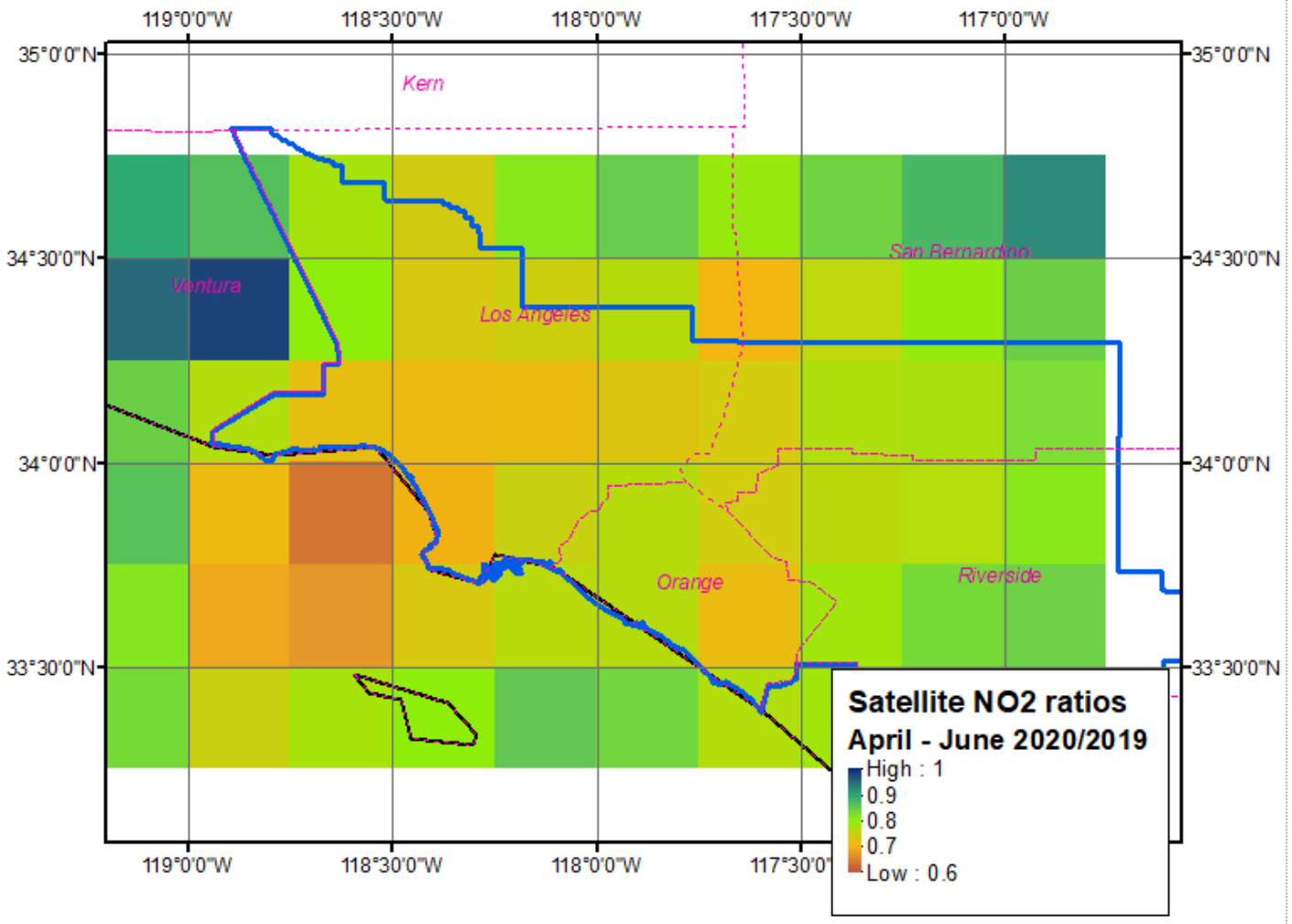
Top Down Emissions Characterization: Satellite NO2 Columns



- Download the NASA data for each year/day
- Average over months
- Perform similar "2020 expected" analysis
- Satellite estimated COVID-19 reduction in NO_2 adjusted for the 5-year trend over April – June is -19%

Top Down Emissions Characterization: Satellite NO_2 Columns Spatial Variations

- Satellite data can potentially be used to inform NOx reductions that vary across the basin once the modeling period is determined
- Example plot shows OMI satellite data of ratio of 2020 over 2019 for tropospheric NO_2 columns
- 2020 is 70% - 80% of 2019 throughout much of the basin
- Considerable "devil in the details" when working with this data

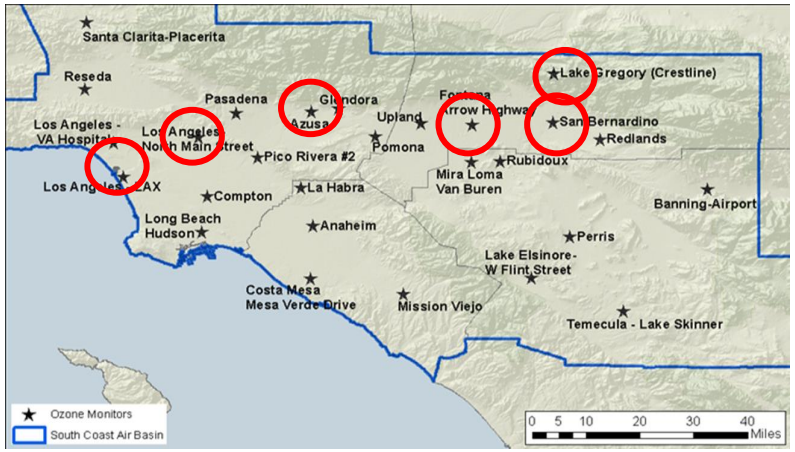


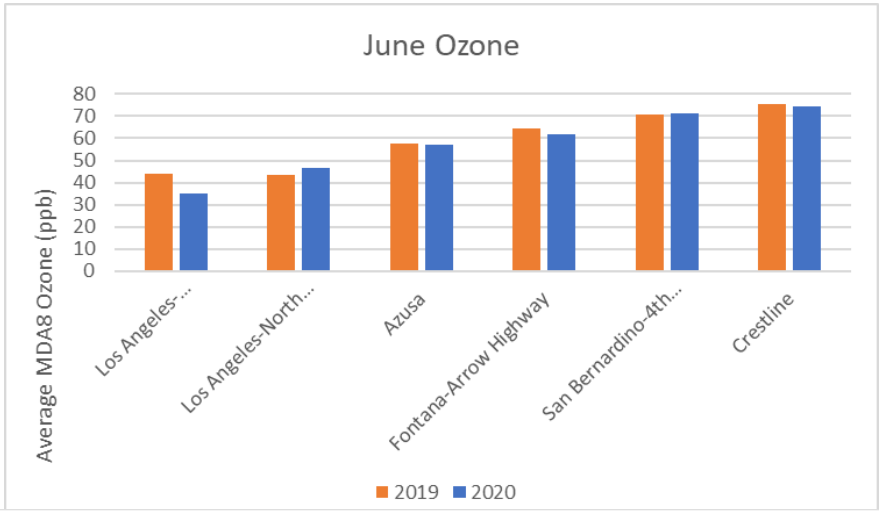
https://giovanni.gsfc.nasa.gov/giovanni/#service=TmAvMp&starttime=2019-04-01T00:00:00Z&endtime=2019-06-30T23:59:59Z&bbox=-119.4562,33.1403,-116.6766,34.6674&data=OMNO2d_003_ColumnAmountNO2TropCloudScreened&variableFacets=dataProductPlatformInstrument%3AOMI%3B

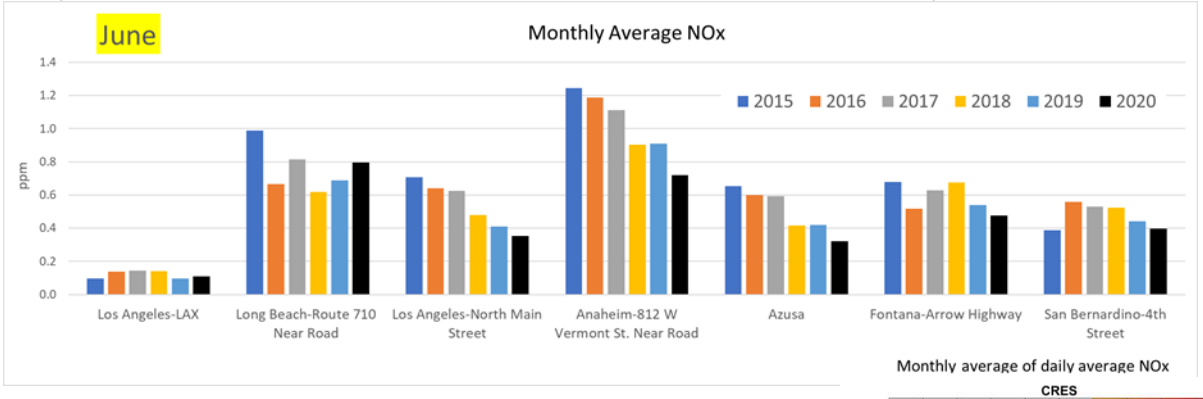
Top Down Emissions Characterization: Summary

- NOx air concentrations measured by surface monitoring and tropospheric NO_2 columns detected by satellites both indicate a COVID-19 impact on NOx/NO_2 since March and continuing through the present after accounting for recent year declining trends
- Surface concentration NOx data and satellite NO2 data with temporal and spatial variations could be used to guide or validate NOx emissions estimates in the SoCAB due to the COVID-19 response

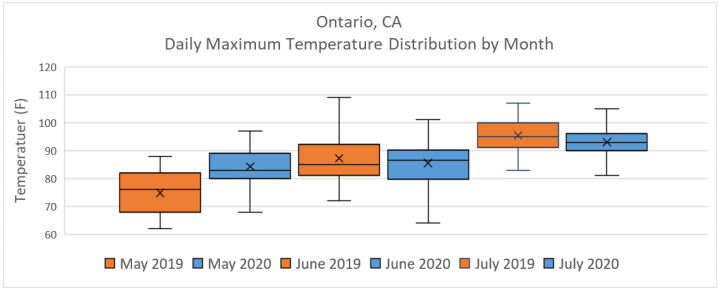
Observed Ozone Changes: Compare June 2019 and June 2020

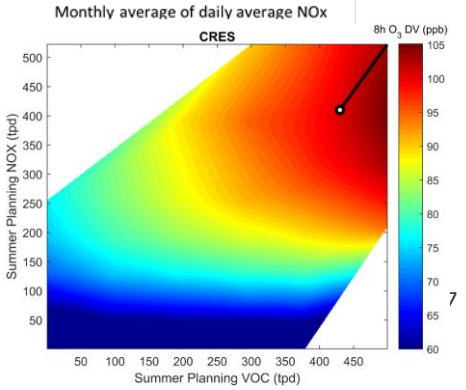






- Recall June 2019 and 2020 had comparable ozone conducive conditions. 2019 slightly more conducive on average
- NOx surface concentrations in 2020 < 2019 most locations
  - What about changes in VOCs?
- Ozone in non-coastal sites very similar in June 2019 and 2020 on average
  - What does this imply? Ozone unresponsive to change in emissions. Transitional regime, and/or following contour line for those sites

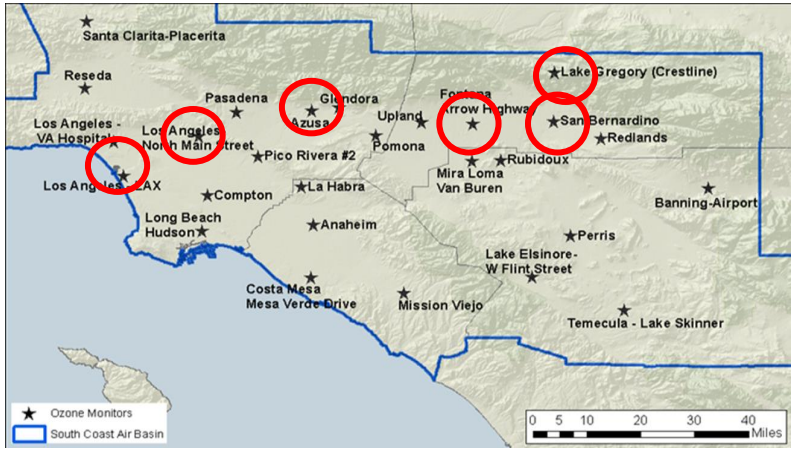




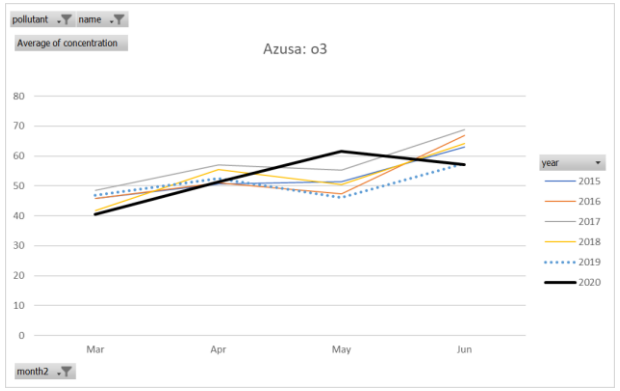
RAMBOLL

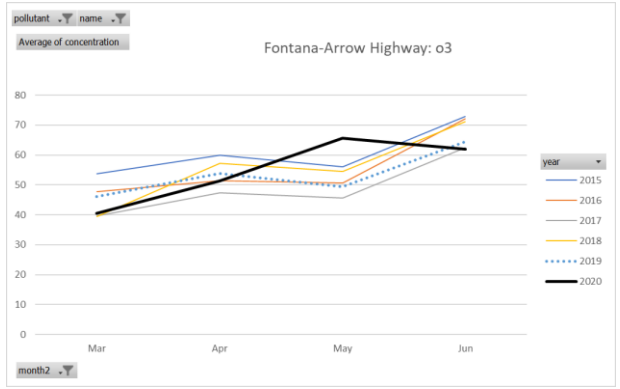
Exhibit F.1

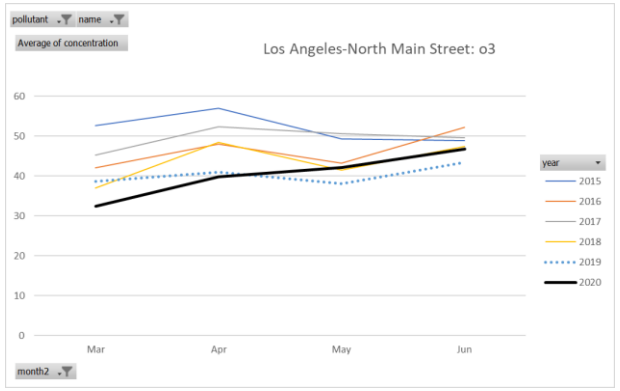
Observed Ozone Changes

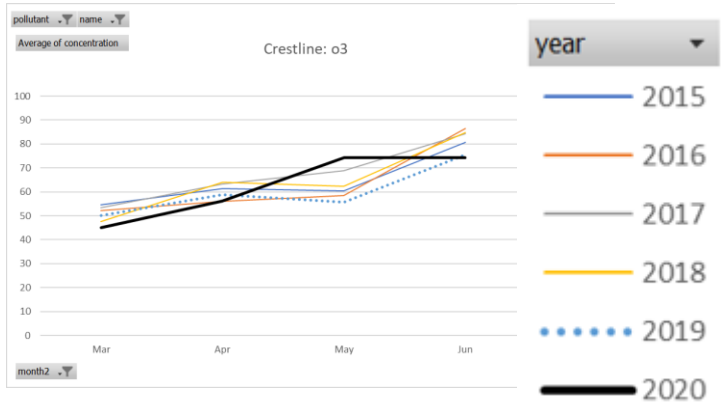


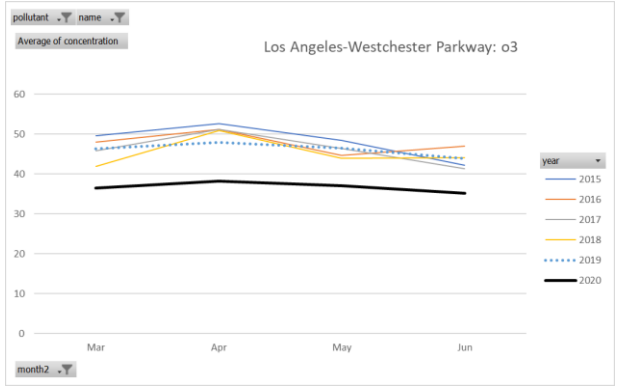
- 2015 – 2020 March – June monthly averages of MDA8 ozone at 6 sites across the basin
  - March/April comparable to past 5 years (slightly lower)
  - Inland sites consistently higher O3 in May compare to past 5 years (likely due to Met; e.g., T850)
- June 2020 mostly similar to June 2019
- LAX substantially lower than last 5 years March – June, no traffic to airport? But NOx plot did not indicate that.

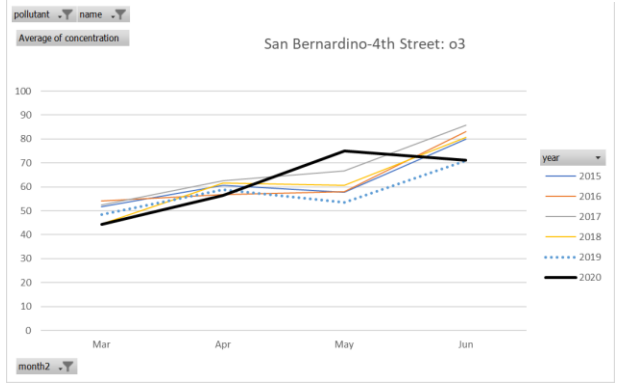






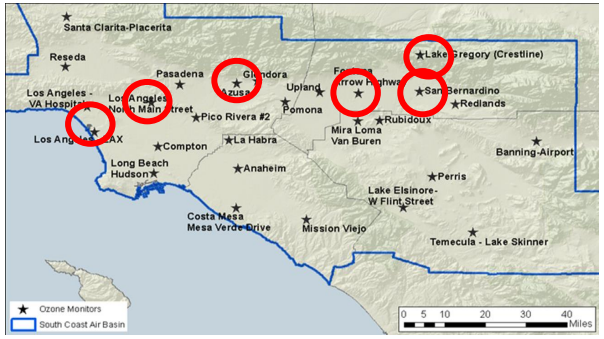


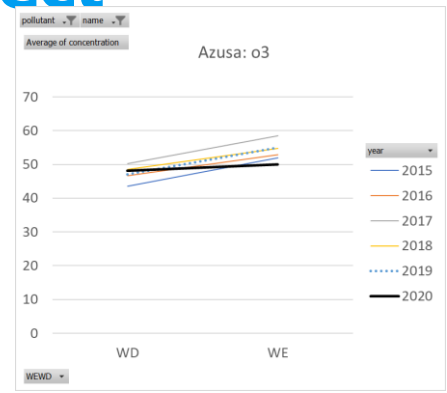


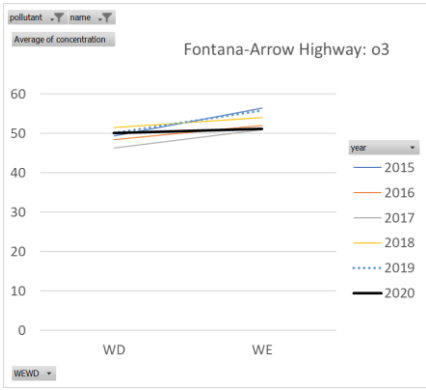


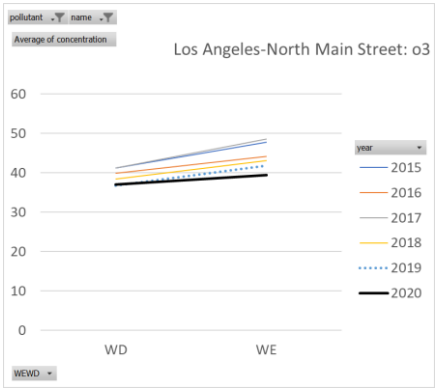
Observed Ozone Changes: Weekend Effect

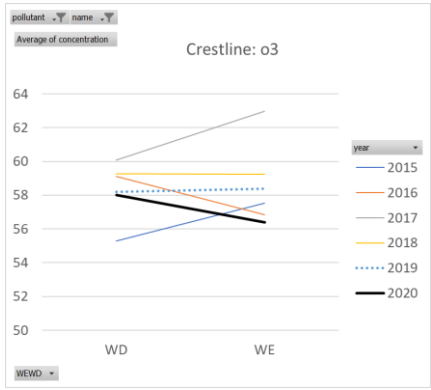
- The COVID-19 response (e.g. reduced commute driving) leads to a less pronounced difference in activity between weekends (WE) and weekdays (WD)
- Previous years indicate a weekend ozone effect (i.e. WD < WE) at all 6 sites for all years except for Crestline for some years (likely because it is transitioning from VOC to NOx-limited)
- Flat 2020 WE/WD ozone plots (i.e. no weekend effect in 2020) for sites with persistent weekend effect in prior years suggest 2020 weekend/weekday emissions are similar (or, lack the typical well-defined distinction)
- Further analysis of these plots is complicated since multiple confounding factors are relevant: (1) Total emissions reductions, (2) emissions reductions by WE/WD, (3) recent trends in emissions reductions over 2015-2019, (4) meteorological factors (e.g., 2017 ozone conducive year, 2020 ozone conducive May), (5) location of each site on the ozone isopleth plot. However, by reducing some parameters (e.g., restricting by meteorology to similar year/months such as omitting May, and focusing on 2019/2020 only) this type of analysis could be a key metric for evaluating the ability of air quality models to correctly simulate response of emissions reductions

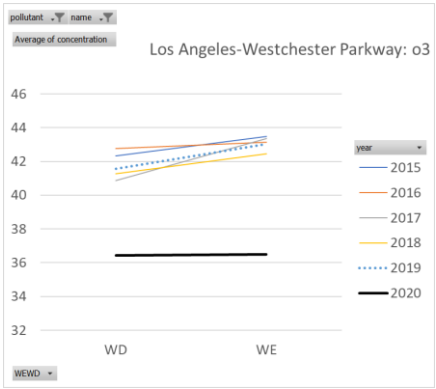


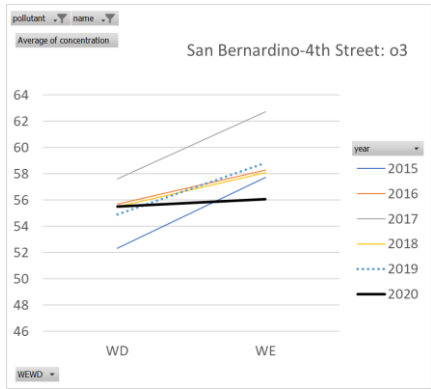












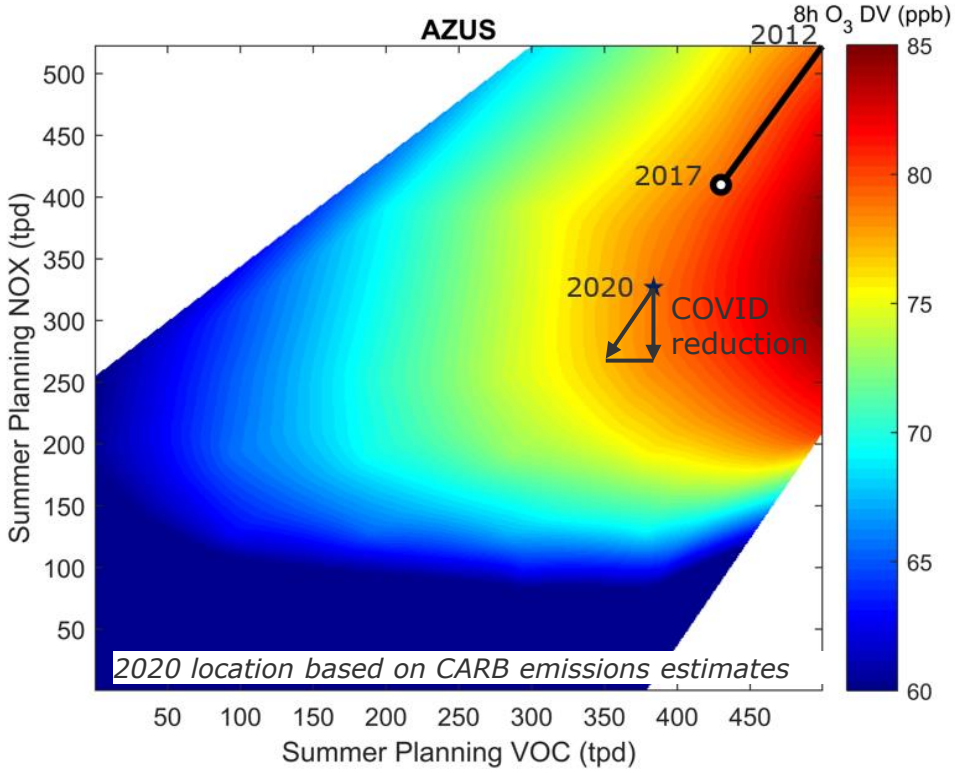
March – June WE and WD averages

Observed Ozone Changes: Summary

- Some deviations from typical ozone have been observed since the COVID-19 shutdowns were implemented
- May 2020 had high ozone in SoCAB, which is likely attributable to meteorological factors
- June 2020 had met conditions and ozone very similar to June 2019, therefore was unresponsive to NOx reductions
- LAX had much lower ozone, the reason is not known. Note that NOx was not substantially reduced
- A lack of ozone weekend effect in 2020 suggests that weekday/weekend emission levels were similar in SoCAB
- A refined weekend/weekday effect analysis could be performed that could be a key metric in an air quality models evaluation

Isopleth Discussion

1. Isopleths are for DVs based on peak ozone season days
2. Have not estimated VOC COVID-19 reductions
   - Expect the changes to be much less than NOx
   - If no change in VOC, then moving along the ridgeline of the ozone isopleth so no change in ozone with the 20% NOx reduction
3. Basin-wide NOx ~ 20% reduction from 2019 (satellite derived)
4. Close to transition region so would expect moderate to slight decrease in ozone, or no change, or slight increase depending on VOC reductions based on COVID-19 reductions at AZUSA location
5. More refined WE/WD analysis could potentially better inform location on the isopleth figure



Conclusions

- Surface measurements and satellite data indicate a COVID-19 impact on NOx/NO_2 in the SoCAB since March which continued through June (at a lower level) of about 10 – 30%, even after accounting for recent declining trends
- June 2019 and 2020 were meteorologically similar and therefore similar in terms of ozone formation conducive conditions
- June 2019 and June 2020 ozone levels were similar in the SoCAB at ozone design value monitors (i.e. Crestline, San Bernardino and Fontana locations)
- The analysis indicates that observed ozone levels were unresponsive to the reduction in NOx emissions (i.e. neither a NOx-disbenefit nor NOx-benefit was observed in June in the design value sites of the SoCAB)
- Do models respond in a similar fashion as the observed changes in ozone in response to the COVID NOX emissions reductions?