# Impact of the COVID-19 Containment Measures on Air Pollution in California

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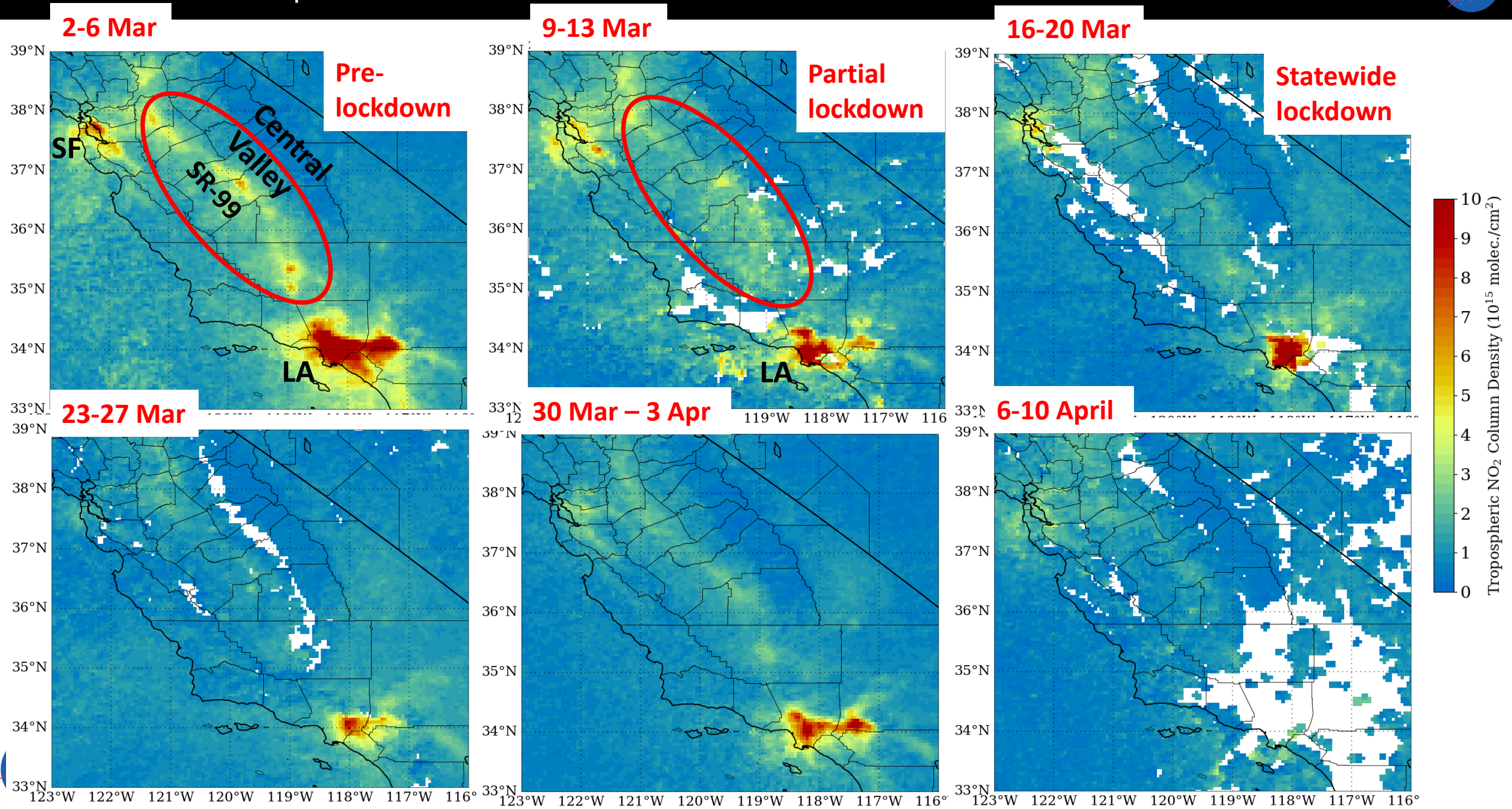
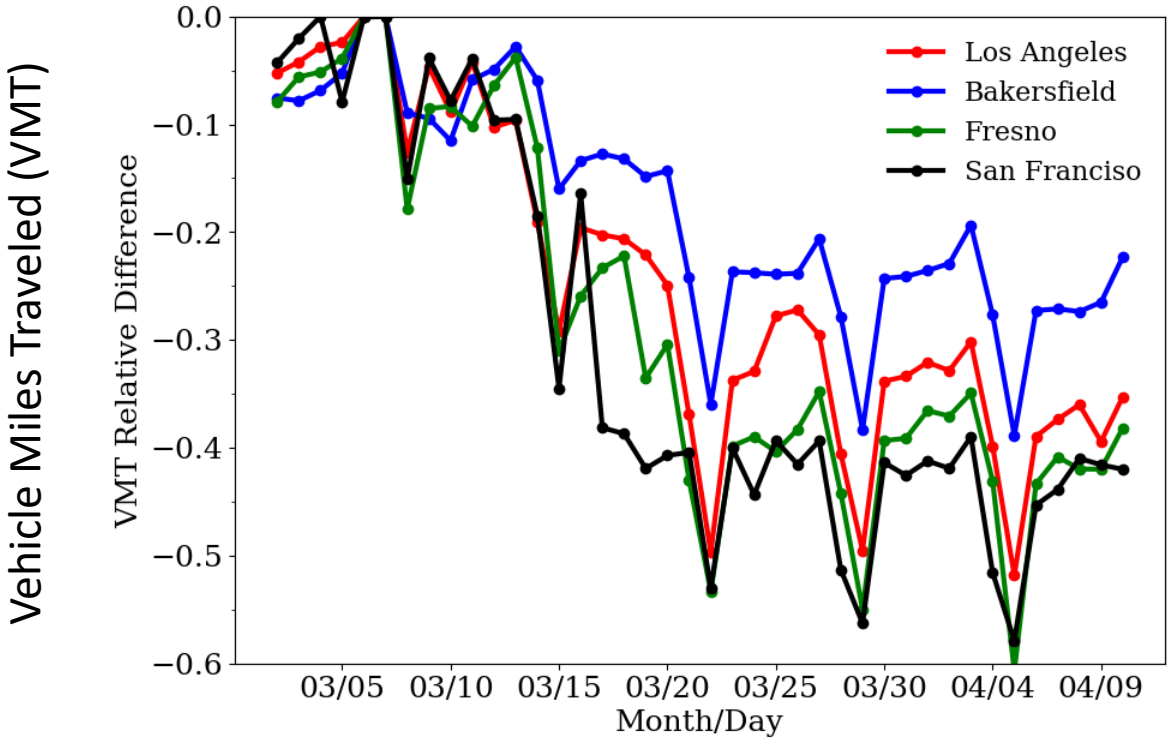
**Naeger, A. R., and K. M. Murphy (to be submitted AAQR)**

# TROPOMI L3 Maps and Containment Measures in CA



# Traffic and Containment Measures in CA




- Seasonal / meteorological factors drove the tropospheric $NO_2$ reduction during second week of March (9-13 March) when less strict containment measures led to relatively small decreases in
- Steep decreases in VMT during the week of statewide “shelter in place” order (16-20 March) were coincident with strong $NO_2$ reductions
- Weekend compared to weekday effect becomes stronger during the post-initiation period of COVID-19 containment measures

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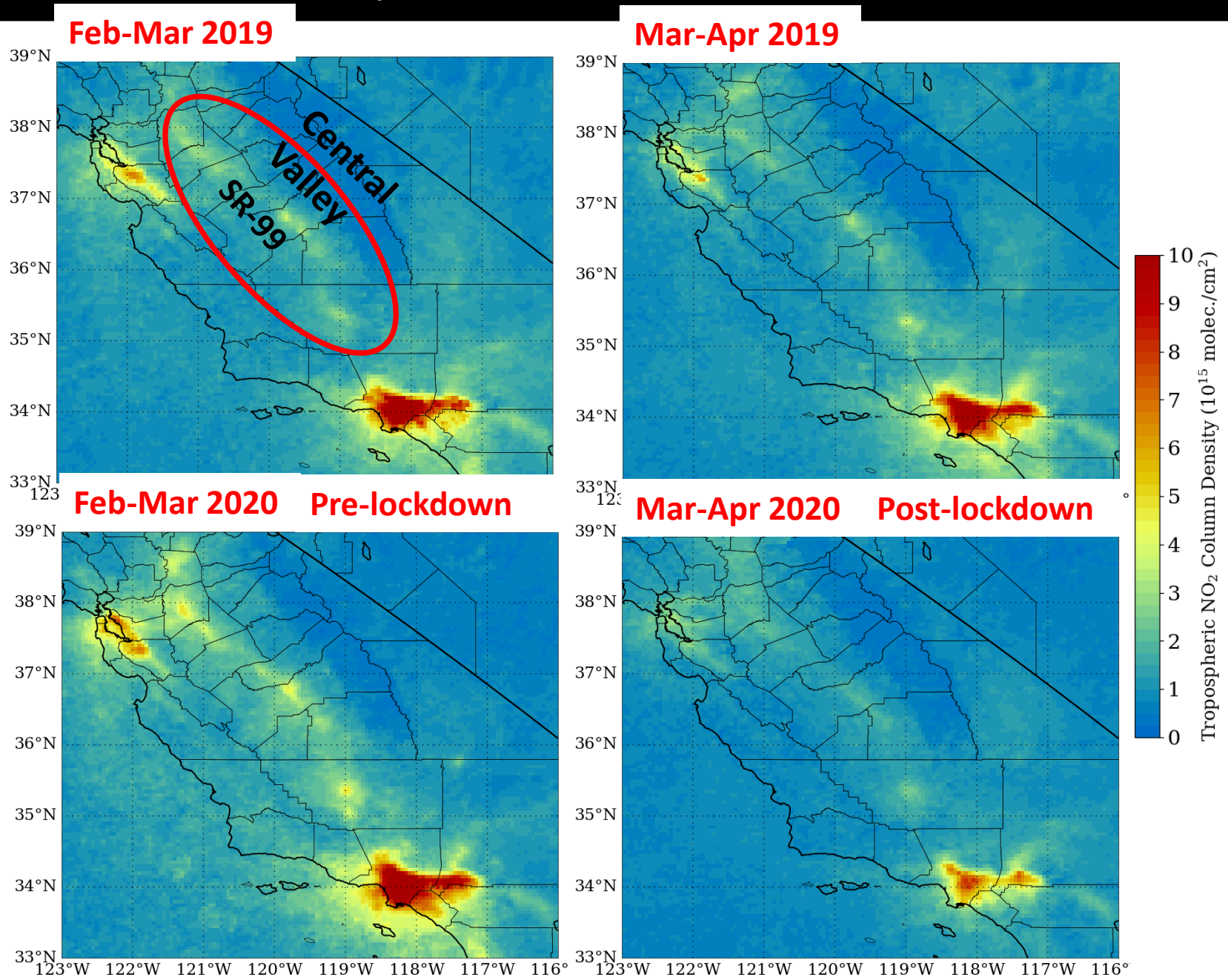
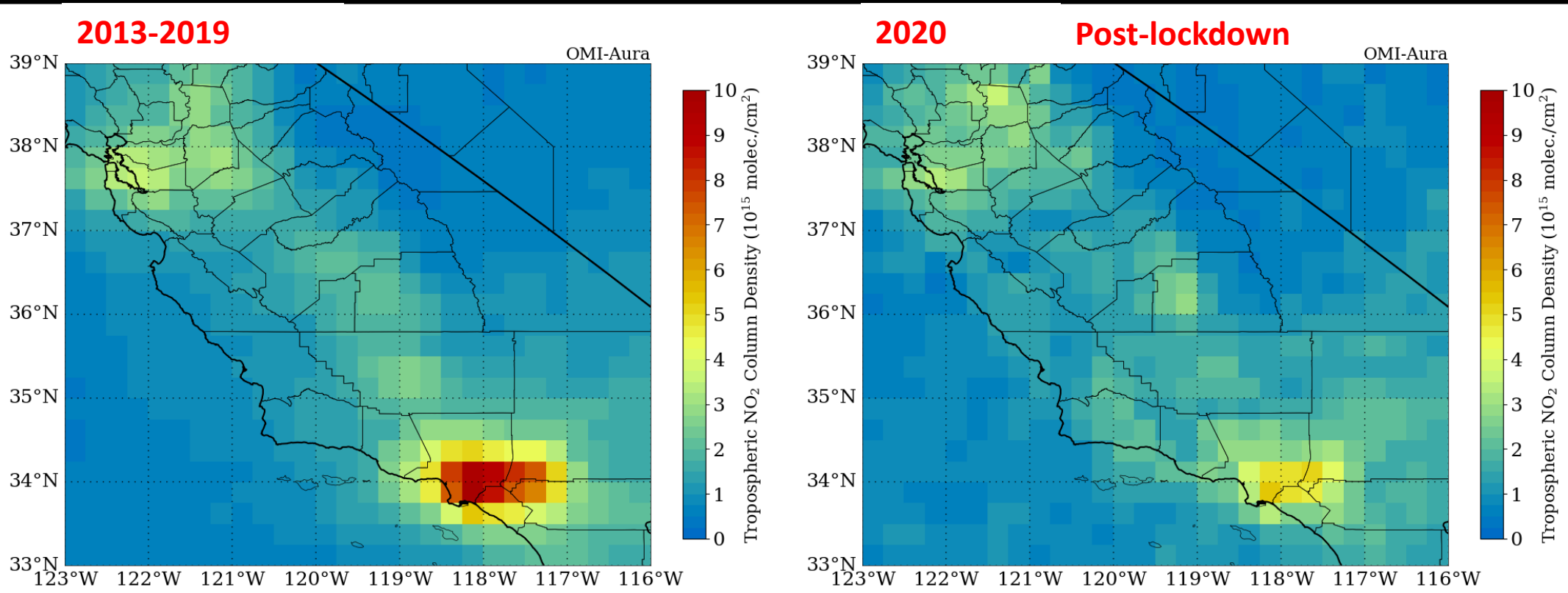
# TROPOMI L3 Maps – 2019 vs 2020




- Tropospheric $NO_2$ levels were significantly lower across major cities in CA during COVID-19 containment period in 2020 compared to the analogous time period in 2019
  - Los Angeles – 47% reduction
  - San Francisco – 24% reduction
  - Bakersfield – 25% reduction
  - Fresno – 35% reduction
- Different meteorological conditions likely contributed to the more drastic $NO_2$ reduction in 2020 as shown by TROPOMI L3 maps during pre-lockdown period (Feb-Mar 2019 vs 2020)

# $NO_2$ Climatology from OMI Observations




- Long-term $NO_2$ from OMI L3 gridded data shows similar $NO_2$ reductions in Los Angeles and San Francisco compared to TROPOMI, but smaller reductions over Central Valley along SR-99
- Coarser resolution of OMI (0.25°) likely underestimating localized areas of $NO_2$ columns associated with fine-scale emissions in Central Valley.
- Aggressive air quality regulations adopted in California to reduce emissions can explain part of the decrease in $NO_2$ during this 8-year period

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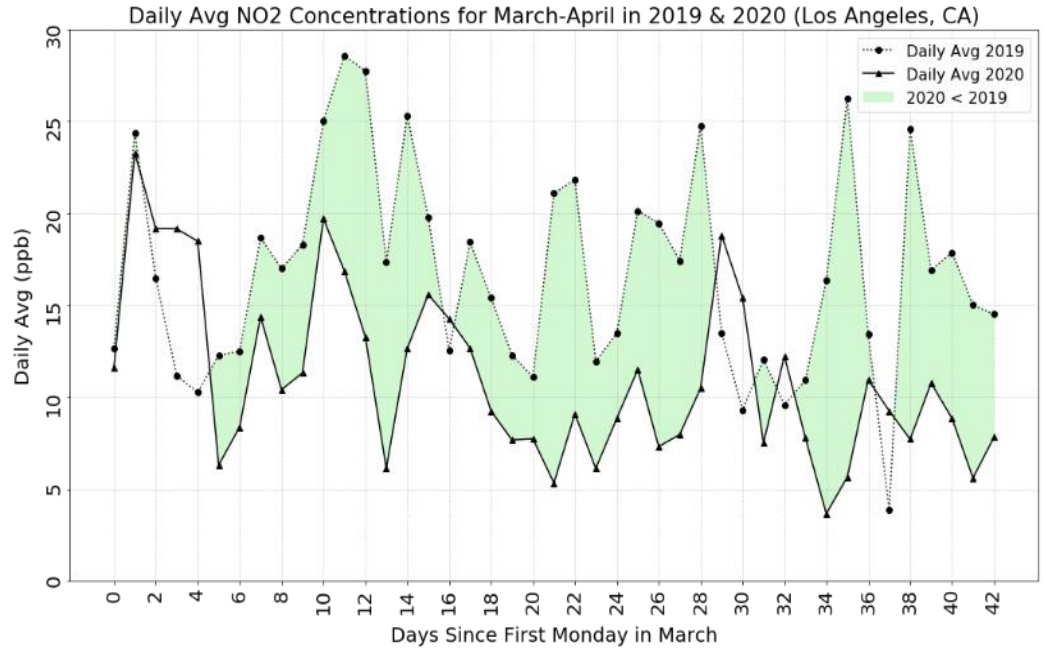
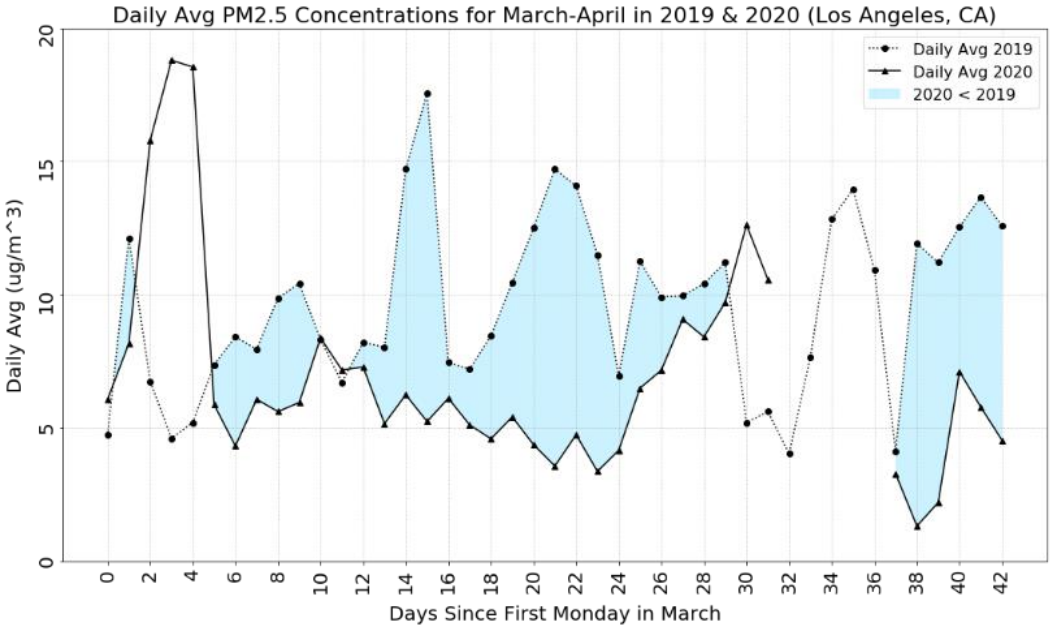
# Ground-based Measurements from CARB




- Surface $NO_2$ difference in Los Angeles from 2019 to 2020 is consistent with the 40-50% reduction observed from space by TROPOMI / OMI during the COVID-19 period
- Daily averaged PM2.5 concentrations show a similar decline as $NO_2$ throughout much of March 2020 that remain well below same period in 2019
- During analogous 5-week periods in 2019 and 2020, averaged PM2.5 concentrations were about 9.9 and 6.1 μg $m^{-3}$, which closely resembles the decrease in surface $NO_2$.
- Ground-based measurements suggest that the COVID-19 containment measures led to a reduction in emissions that contributed to a decrease in air pollution at the surface

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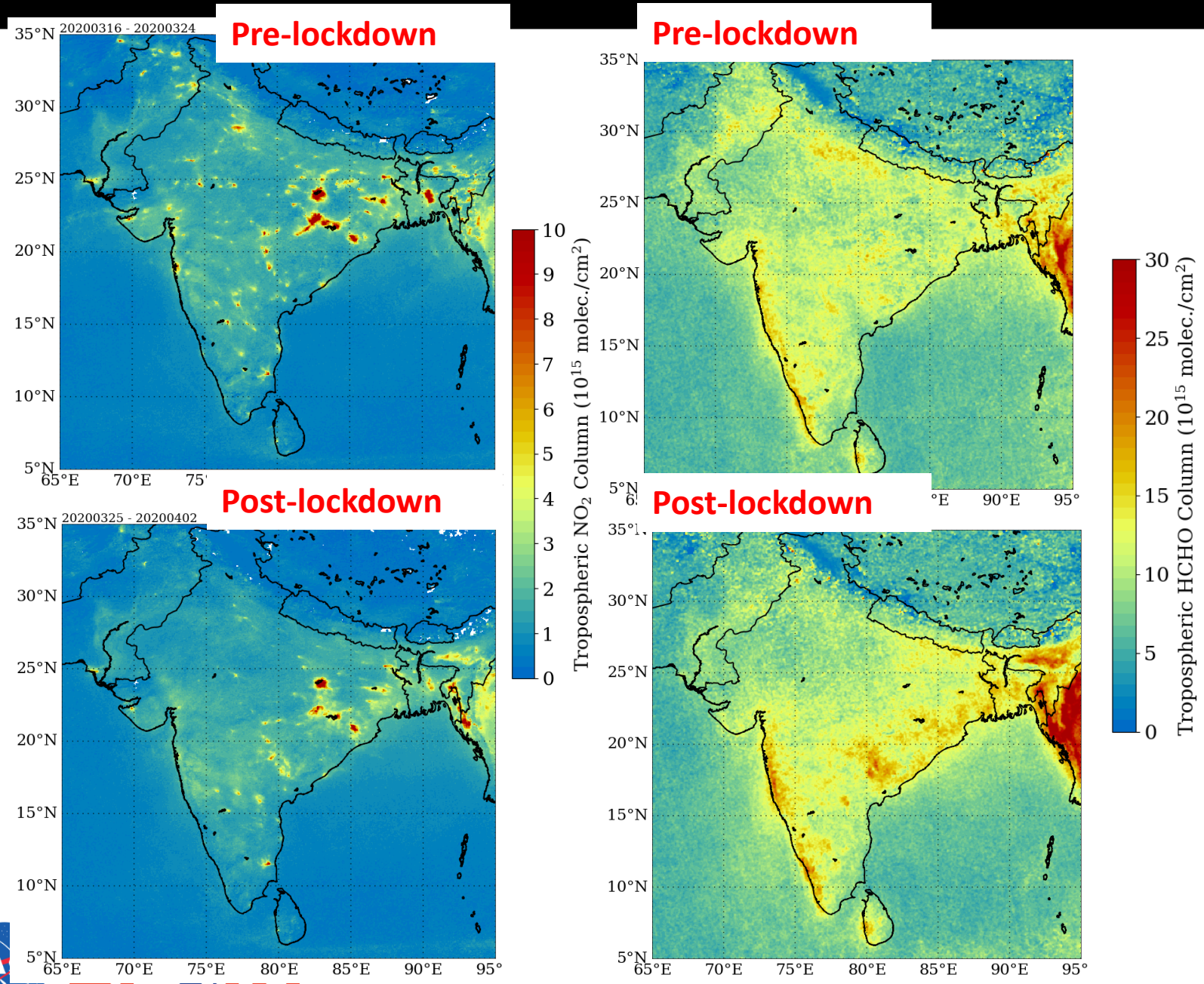
# TROPOMI Observes Pollution Reduction over South Asia




- First look at TROPOMI L3 imagery over India shows strong $NO_2$ reductions in North India and Pakistan in addition to HCHO
- Biomass burning and other natural emissions contributing to some areas of increases in trace gases in west India, Myanmar, and Bangladesh

Short-term Prediction Research and Transition Center