



Supplement of

Modeling the impact of COVID-19 on air quality in southern California: implications for future control policies

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35 Regarding the emission reductions of power plants during the lockdown, we checked the change of CO₂,
NO_x, and SO₂ emissions from power plants measured by the Continuous Emission Monitoring System
(CEMS). The time series of SO₂ and CO₂ emissions in southern California during the pre-lockdown and
lockdown periods are shown in Fig. S3 (NO_x emissions are not available during this period). We can see
40 that the CEMS-based SO₂ emissions have a strong day-to-day variation, making it difficult to achieve an
accurate estimate of the COVID-19 related emission changes. The average SO₂ emission decreases by 39%
between the pre-lockdown and lockdown periods defined in this study, larger than the reduction rate
estimated based on electricity demand (7%). However, it is noted that the above CEMS-based reduction
rate is also subject to large uncertainty due to the strong fluctuation of emission rates.

We then examined the potential impact of this difference on our results. As reported in the CARB emission
45 inventory (CARB, 2021), the emissions of VOC, CO, NO_x, and PM₁₀ from power plants account for less
than 1% of the total emissions, and the emissions of SO₂, NH₃, and PM_{2.5} all account for less than 3%. For
this reason, the different emission reduction rates estimated based on the CEMS and electricity demand will
translate into less than 1% difference in the total emissions of any pollutant (from 0.05% to 1%), which is
50 expected to have a limited effect on the simulation results of mean air pollutant concentrations in southern
California.

References

California Air Resources Board (CARB) (2021), 2012 Estimated Annual Average Emissions STATEWIDE,
[https://www.arb.ca.gov/app/emsinv/2017/emssumcat_query.php?F_YR=2012&F_DIV=&F_SEASON=A&](https://www.arb.ca.gov/app/emsinv/2017/emssumcat_query.php?F_YR=2012&F_DIV=&F_SEASON=A&SP=SIP105ADJ&F_AREA=CA#7)
55 [SP=SIP105ADJ&F_AREA=CA#7](https://www.arb.ca.gov/app/emsinv/2017/emssumcat_query.php?F_YR=2012&F_DIV=&F_SEASON=A&SP=SIP105ADJ&F_AREA=CA#7), access: April 1, 2021.

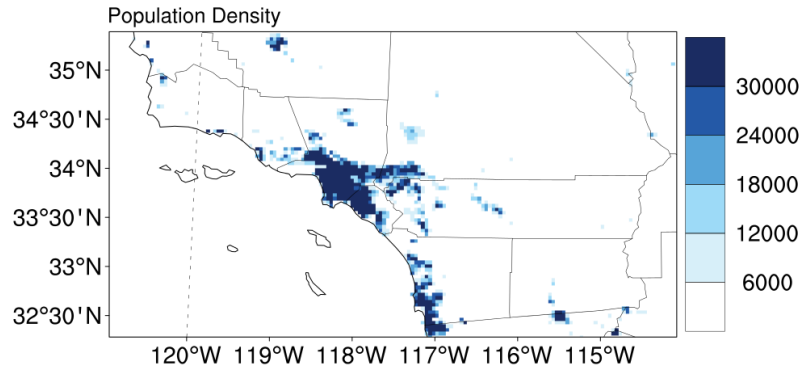


Figure S1. The population density in the area this study focuses on.

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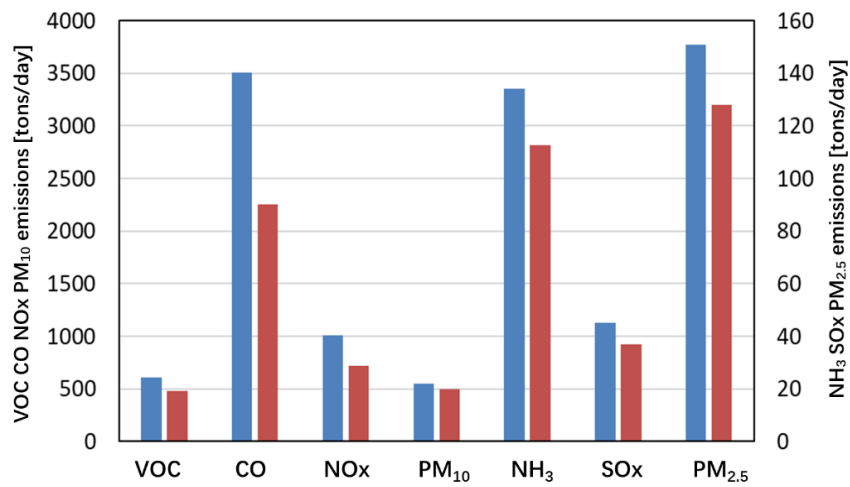
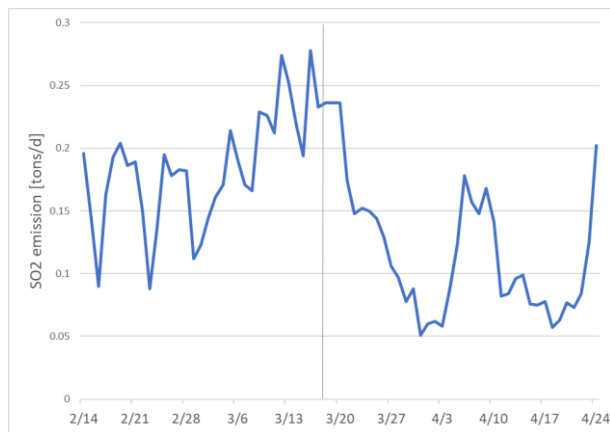


Figure S2. Air pollutant emissions in southern California with (red) and without (blue) the COVID-19 lockdown.

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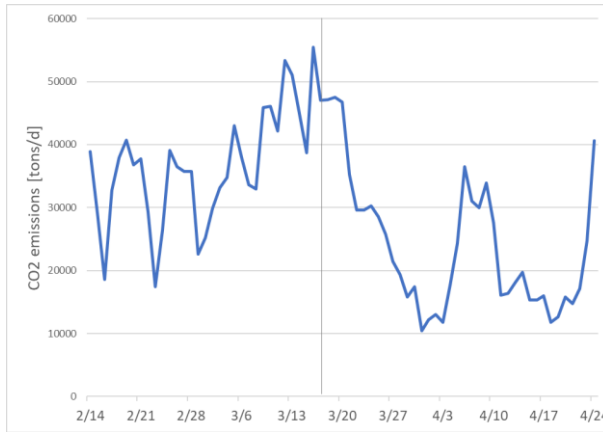


Figure S3. The power plant emissions of SO₂ and CO₂ in southern California measured by the CEMS before and during the COVID-19 lockdown.

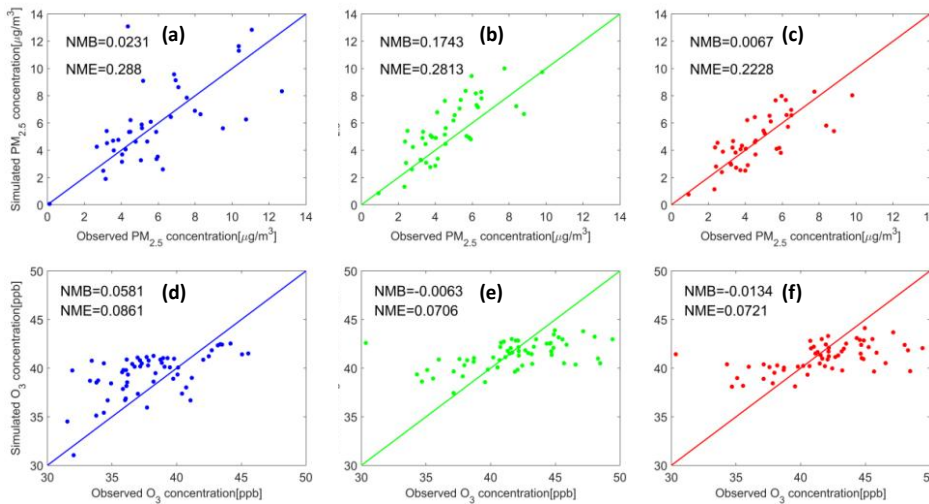
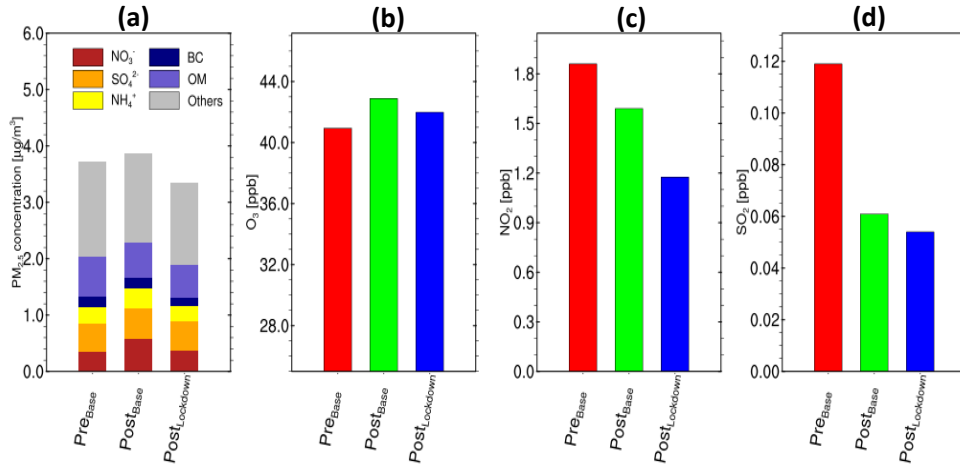


Figure S4. Scattergrams of the simulated and observed monthly average PM_{2.5} and MDA8 O₃ concentrations in southern California. (a-c) are for PM_{2.5} and (d-f) are for MDA8 O₃. (a, d) are for the pre-lockdown period (February 18 to March 18) under the Base scenario (Pre_{Base}); (b, e) are for the lockdown period (March 19 to April 23) under the Base scenario (Post_{Base}); (c, f) are for the lockdown period under the Lockdown scenario (Post_{Lockdown}).



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Figure S5. Mean concentrations of simulated air pollutant concentrations in southern California: (a) PM_{2.5} components; (b) MDA8 O₃; (c) NO₂; (d) SO₂. Pre_{Base}, Post_{Base}, and Post_{Lockdown} have the same meanings as in Fig. 3.