



# Evaluating the Impact of COVID-19 Restrictions on Air Pollution

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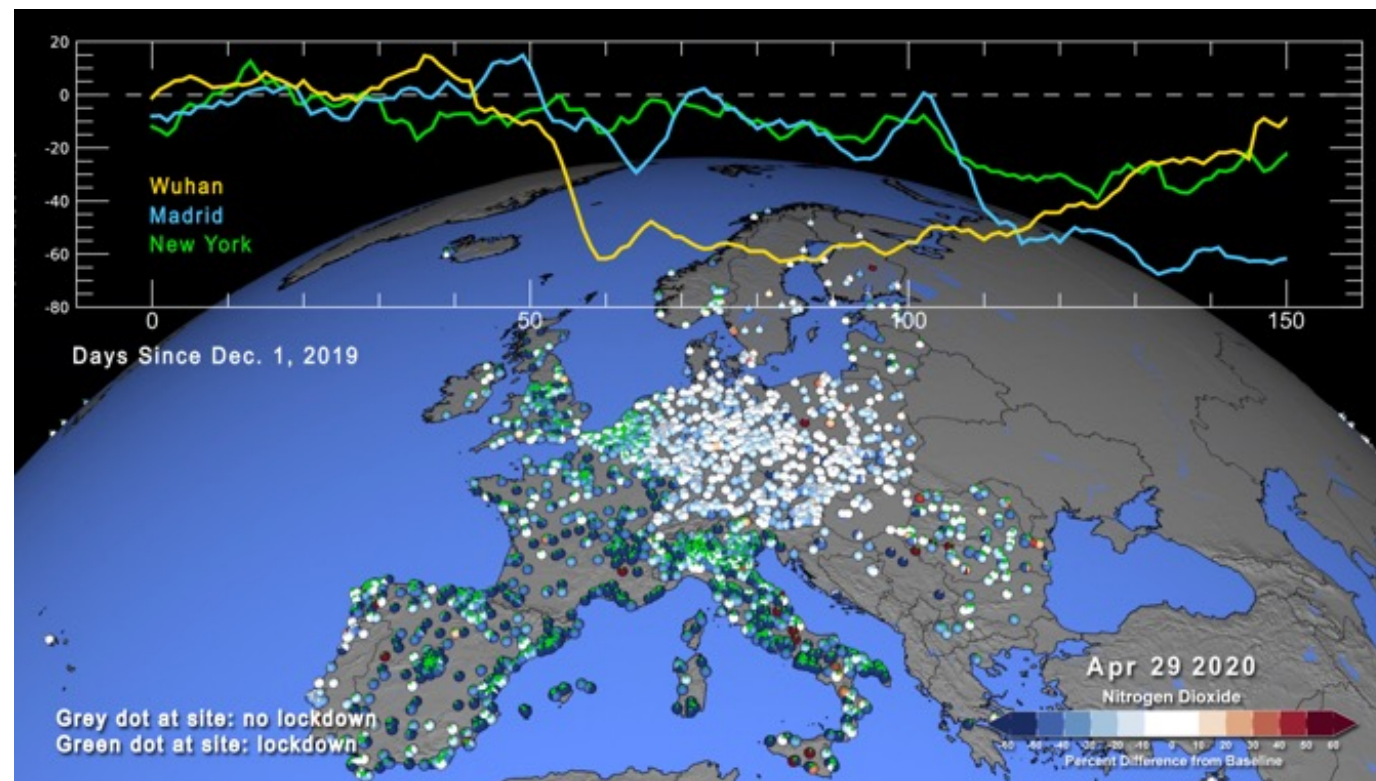
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Air pollution is the single largest environmental health risk factor for human beings. Understanding how air pollution changed due to the travel restrictions during the COVID-19 pandemic would offer invaluable insights into the interconnectedness of human activity and air pollution.

To measure this change, we used a machine learning algorithm driven by the NASA GEOS-CF model to assess changes in nitrogen dioxide and ozone, two gases associated with air pollution. We inputted data from 5756 observation sites in 46 countries from January through June 2020.

Our results show there was a broad decline in surface concentrations  $\text{NO}_2$  in the wake of the COVID-19 pandemic, with an average global reduction of 20%. Afternoon concentrations of surface  $\text{O}_3$  showed a small decline (1-2%), while nighttime concentrations showed a similar increase as a result of changes in atmospheric chemistry.

The study shows how combining observations and model simulations, using machine learning, can be used to remove the confounding effect of meteorology and atmospheric chemistry, offering an effective tool to monitor and quantify changes in air pollution in near-real time.



Deviation of observed surface nitrogen dioxide relative to a business-as-usual model estimate as a result of mobility restrictions in the wake of the COVID-19 pandemic. Shown are the estimated deviations on May 1, 2020 at all publicly available monitoring sites in Europe. Time series on top show daily deviations over Wuhan (yellow), Madrid (blue), and New York (green) since Dec 1., 2019. Source: <https://svs.gsfc.nasa.gov/4872>

Keller, C. A., Evans, M. J., Knowland, K. E., Hasenkopf, C. A., Modekurty, S., Lucchesi, R. A., Oda, T., Franca, B. B., Mandarino, F. C., Díaz Suárez, M. V., Ryan, R. G., Fakes, L. H., and Pawson, S., 2021: Global impact of COVID-19 restrictions on the surface concentrations of nitrogen dioxide and ozone. *Atmos. Chem. Phys.*, 21, 3555–3592, <https://doi.org/10.5194/acp-21-3555-2021>.