EGU21-16450
https://doi.org/10.5194/egusphere-egu21-16450
EGU General Assembly 2021

Simulation of the impact of COVID-19 lockdowns on aerosols and radiation at a global and European scale in CAMS

Sophie Pelletier[1], Samuel Rémy[2], Zak Kipling[3], Marc Guevara Vilardell[4], Idir Bouarar[5], Richard Engelen[3], Johannes Flemming[3], Vincent Huijnen[6], and Mehdi Meziane[1]

[1]Centre National de Recherches Météorologiques, Université de Toulouse, Météo France/CNRS, Toulouse, France
[2]Institut Pierre-Simon Laplace, Sorbonne Université/CNRS, Paris, France
[3]European Centre for Medium-Range Weather Forecasts, Reading, UK
[4]Barcelona Supercomputing Center, Barcelona, Spain
[5]Max Planck Institute for Meteorology, Hamburg, Germany
[6]R&D Weather and Climate Modeling, Royal Netherlands Meteorological Institute, De Bilt, the Netherlands

The COVID-19 pandemic struck China in January 2020 and the rest of the world from February 2020 onwards. Public authorities enforced several kinds of lockdowns in order to limit the spread of the pandemic and reduce its impact on the health system: at the height of the first wave of the pandemic, more than one human in two was subjected to a lockdown, with associated disruption in local and international travel, industry, tourism etc. These lockdowns had a profound effect on anthropogenic emissions of aerosol, trace gases and greenhouse gases; in this work we focus on aerosols and a selection of trace gases.

The Integrated Forecasting System (IFS) of ECMWF is core of the Copernicus Atmosphere Monitoring Service (CAMS) to provide global analyses and forecasts of atmospheric composition, including reactive gases, as well as aerosol and greenhouse gases. In this work, we use two emission reduction scenario with an experimental version of the IFS in its CAMS configuration: a global and a European one. Global simulations of aerosols were carried out with these two scenarii and compared to a reference simulation without any COVID-19 impact, and to worldwide observations of PM2.5, AOD and trace gases.

The simulated PM2.5 using the global emission reduction scenario were found to reproduce quite accurately the observed evolution over China, India and United States. Over Europe, the simulated PM2.5 using the European reduction scenario were closer to observations and appeared more realistic. India was the only place where a significant impact on AOD and on temperature and radiation from the COVID-19 lockdowns was simulated. These simulations also provided information on how the aerosol speciation was altered by the COVID-19 lockdowns: over Europe and the U.S., most of the decrease in surface aerosols was simulated to come from nitrate aerosols. Over the U.S., this matched well with observations of speciated aerosols at surface.