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Satellite-based investigation of the impact of COVID-19 restrictions on cloud properties in industrial regions

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The understanding of aerosols and their impact on climate via their interactions with clouds remains one of the largest uncertainty to our current estimates of future climate warming. A change in the amount of aerosol in the atmosphere, whether natural or artificial, can have a direct impact on cloud particle nucleation. However, anthropogenically induced aerosol-cloud interactions (aci) are thought to counteract some of the effects of global warming, quantifying their effect on total radiative forcing is vital for future climate predictions.

To tackle this problem, recent research has focused on so-called natural laboratories in order to better understand aci, meaning experiments where aerosol emissions are relatively well localized and understood, hence removing one important aspect of the aci uncertainties. For instance, volcano eruptions, ship tracks, industrial tracks, or contrails represent such laboratories. The purpose of the study is to assess if emission restriction events can act as a natural laboratory for aci studies, almost in a reverse manner as industrial tracks. Here, we will compare regional cloud properties observed during the lockdown periods to climatologies using MODIS satellite cloud droplet number concentration (N_d) retrievals. CAMS global reanalysis and CAM-chem model simulations are used to study CCN activity and aerosol emissions during the lockdown period. This study will focus on different industrial regions to examine if there are any clear signals of aci. It is found that there is no significant decrease in N_d during lockdown compared to climatology at a regional scale. Although there is a reduction in various anthropogenic activities such as industrial emissions, motor vehicle emissions, etc but the background CCN conditions played an important role in the influence of N_d.