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# Impact of COVID-19 lockdowns on carbonaceous aerosols at a European rural background site

To prevent the fast propagation of COVID-19, a series of restrictions measures have been put in place, leading to a reduction in emissions from most anthropogenic sources. Elemental (EC) and organic carbon (OC) are among the major constituents of ambient aerosols that have attracted growing interest due to their adverse effects on human health and climate warming. In this study, the impact of the lockdown restrictions on carbonaceous aerosols (ECOC) was explored at a European rural background site combining two approaches referred to as the "horizontal (HA)" and "vertical (VA)" approaches. To the best of our knowledge, this is the first study worldwide focusing on the impact of COVID-19 on aerosol on vertical distribution. The measurements were performed at the ground level (4 m a.g.l.) and on top of the 250 m-tall tower belonging to the Czechia National Atmospheric Observatory Košetice (49°35'N, 15°05'E). The HA showed that the lockdowns did not systematically result in lower concentrations of both EC and OC fractions unlike $NO_2$ (25 to 36% lower) and $SO_2$ (10 to 45% lower). EC was generally lower during the lockdowns (up to 35%), likely associated to the traffic restrictions whereas increased OC (up to 50%) could be attributed to enhanced emissions from the domestic heating and biomass burning during this stay-home period, but also to the enhanced concentration of the secondary organic aerosol (SOC). EC and OC were generally higher at 4 m suggesting a greater influence of local sources near the surface. Interestingly, the VA revealed a significantly enhanced correlation between EC and OC measured at 4 m and those at 230 m, suggesting a stronger influence of aged and long distance transported aerosols during the lockdowns. This study reveals that lockdowns did not necessarily affect aerosol absolute concentrations but it certainly influenced their vertical distribution. Therefore, analyzing the vertical distribution can allow a better characterization of aerosol properties and sources at rural background sites, especially during a period of significantly reduced human activities.