

VOCs in Europe during the COVID-19 Lockdowns and Representation in an Urban Emission Inventory

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Abstract

The rapid spread of the SARS-CoV-2 virus and its consequences in the Spring of 2020 lead many European governments to issue stay-at-home orders for the sake of protecting the population. The decrease in human activities and anthropogenic emissions provided a unique opportunity for a real-world laboratory for atmospheric scientists. The impact on primary emissions, i.e., NO_2 , has been vastly studied but its consequences on secondary pollutants, O_3 and secondary organic aerosol (SOA), has been reported to a lesser degree and the understanding is more limited. One reason is the imbalance in the attention dedicated to volatile organic compounds (VOCs), important precursors for O_3 and SOA production. In the first part of the study, we report on the evolution of VOCs under lockdown in Europe by analyzing the concentrations reported to the Airbase of the European Environmental Agency. Data subsets were created based on synoptic patterns to account for human activity and the influence of meteorology. Traffic or urban stations exhibited the most important reduction in benzene and, more substantially, toluene concentrations. Xylenes, trimethylbenzenes and ethylbenzene also decreased, though less when the synoptic conditions were associated with slow flows. Acyclic alkenes showed no change or increased slightly, whereas n-alkanes increased under lockdown conditions. The evolution of the relative importance of the sources was investigated by means of diagnostic ratios. The results exhibit (1) a shift from traffic towards biomass/biofuel/coal burning and (2) an increase in domestic solvents use. In a second part we look at one VOC in particular, benzene, in Berlin. We employ a counterfactual approach by modelling the benzene concentrations at a traffic and an urban background site using the gradient boosted trees technique. The approach makes it possible to evaluate the representation of motorized traffic as a source of benzene in the emission inventory of Berlin.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

GEIA: Global Emissions Initiative