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Air quality improvements caused by COVID-19 lockdown measures in Central Europe – contributions of emission sectors and the meteorological situation

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Corona lockdown measures caused unprecedented emission reductions in many parts of world. However, this does not linearly translate into improved air quality, since weather phenomena like precipitation, wind and solar radiation also show a significant impact on pollutant concentration patterns. The aim of this study is to disentangle effects of emission reduction and meteorology on the air quality in Central Europe during the first major lockdown from March to June 2020. For this purpose, the Community Multiscale Air Quality Modeling System (CMAQ) was used with updated emission data for the year 2020, including time profiles for sectors and countries that approximate the lockdown emission reductions. The contributions of street traffic, air traffic, ship traffic, residential heating and industry to NO_2 , O_3 and $\text{PM}_{2.5}$ concentrations were investigated. Meteorological data was derived from the regional COSMO model in CLimate Mode (COSMO-CLM). Additional city scale measurements were used to account for exceptional weather conditions as well as emission reduction effects at hotspots like traffic stations. Therefore, selected air pollutant and meteorological measurement data in the cities of Hamburg, Liège and Marseille are compared against the statistical trend of 2015 to 2019.