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The effect of SARS-CoV-2 on atmospheric particulate matter (AOD) as observed by satellites

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After the outbreak of SARS-CoV-2 in December 2019 and its spread worldwide in the following months and seasons, the governments around the world were forced, one by one, to impose lockdown measures in their countries during the 'Covid Year' of 2020, trying to slowdown or even stop the spread of the virus. These nationwide lockdowns, included measures that led to the reduction of human movement, such as transportation, in urban areas, while they also diminished the industrial activity. Since transportation and industrial activity are among the major sources of emission of anthropogenic aerosols, it is possible that a change, namely a decrease, of the atmospheric aerosol loading is observed during the year 2020.

In this study, we examine and quantify the possible effect of worldwide Covid19-related lockdowns on air quality, and more specifically on the aerosol optical depth, which is a good measure of aerosol loading. The analysis is done at global scale using Collection 6.1 Level-3 daily 1°x1° latitude-longitude gridded spectral Aerosol Optical Depth (AOD) data from Moderate Resolution Imaging Spectroradiometer (MODIS) on AQUA satellite during the period 2003-2020. We assess the possible anomaly in AOD values during 2020 by comparing their annual, seasonal and monthly mean values with the corresponding climatological ones for the period 2003-2019. A trend analysis is also performed using time series of deseasonalized AOD anomalies during the period 2003-2020. Special emphasis is given to specific great urban areas, as well as to areas where stricter measures were taken for limiting the virus' spread. For these areas of interest, a further analysis using higher resolution (10km x 10km) MODIS Level-2 AOD data was made in order to capture local changes in AOD that could be hindered by the coarser resolution Level-3 data. Finally, for these regions, the AOD changes estimated using MODIS Level-2 data are intercompared with the corresponding ones using data from local AERONET (Aerosol RObotic NETwork) stations. Preliminary results show a clear reduction in AOD values, mainly starting from April 2020 and becoming more clear in late spring and early summer (May and June) of 2020.