Contribution ID: **50** Contribution code: **S10-MG-205** Type: **Poster presentation (virtual)**

A case study of high PM concentration despite the low anthropogenic pollution in March 2020 during the first COVID-19 lockdown in Sofia

Wednesday, 31 August 2022 11:56 (2 minutes)

The aim of this study is to investigate the atmospheric air quality in Sofia during a 2-week period in the beginning of the first COVID-19 lockdown in March 2020. Observations of the aerosol distribution measured with two laser particle counters for PM2.5 and PM10 on clear sunny days (7 a.m. to 2 p.m.) at a site inside the built area near the bus stop Pliska on the Tsarigradsko shose during 16-31 March 2020 are presented. Mass and particle number concentrations of PM with high temporal resolution are compared with the data reported by Executive Environmental Agency monitoring network. In the beginning of the period the concentrations of PM10 vary between 20 and 80 μg/m3 with a peak around 9 - 10 a.m and PM2.5 concentrations reach 30 μg/m3. On 28 March at 9 a.m. the PM10 and PM2.5 concentration raise up to 250 μg/m3 and 175 (μg/m3), correspondingly. This abrupt change in the aerosol content in the atmosphere is explained not with anthropogenic load, but with long range dust transport from the Karakum desert region (located between the eastern coast of the Caspian Sea and the steppes near the central Asian mountain ranges), which is a very rare event of intrusion compared to the typical in spring Sahara dust transport. The HYSPLIT back trajectory model is used as additional source of information in the selected days, showing transport in the layer 1000 m – 3000 m from North-West until 26 March and from East on 27-29 March. The GDAS boundary-layer depth at 12 UTC is between 1000 m and 1600 m which suggest intrusion from above during the period. These model data are compared to local meteorological and aerological observations. This study shows the importance of detailed in time laser particle counter observations of PM10, PM2.5 and finer particles for better explanation of causes for the low air quality in urban atmosphere.

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Session Classification: Poster session (virtual)

Track Classification: Scientific Sections: S10 Meteorology and Geophysics