Unusually high concentrations of NaCl in non-marine aerosol

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Sodium chloride (halite) is a major constituent of sea-salt aerosols. In this study we report on unusually high concentrations of apparently non-marine halite in PM10 and PM2.5 colleted between 300 and 500 m above ground level in urbanized (population 1.9 mln people) and industrialized region of Upper Silesian conurbation in southern Poland, some 500 km from the nearest (Baltic) sea. A back trajectory analysis using the HYSPLIT model excluded a long-range transport of marine aerosol to the sampling site.

Sampling campaigns aimed at measuring vertical aerosol particle concentration profiles during smog episodes were conducted using a hot-air baloon in winter months of 2018 and 2019. Observations by analytical SEM/TEM revealed soot (70-80 vol%) and halite (8-15 vol%) as major constituents of airborne particulate matter. Quartz, dolomite, Fe-oxides, gypsum, fly ash, feldspars, Cd-, Pb-, and Zn-sulfides, steel, and metallic Fe were subordinate constituents.

The spatial and temporal association of soot and halite suggests residential coal burning as their emission source. The origin of soot was confirmed by Raman spectroscopy. Additionaly, road salting may also have contributed to the airborne halite elevated concentrations. The accumulation of both soot and halite within the atmospheric boundary layer resulted from the favorable weather conditions, i.e., almost stagnant air, the lack of precipitation, and the temperature inversion.

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