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Investigation of the mineralogical composition of desert dust particles during a transboundary pollution episode in the UK and implications for health effects

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Toxicological and epidemiological studies have supported links between desert dust particles and health impacts, such as worsened asthma, hospitalization for respiratory infections, and seasonal allergic rhinitis. Airborne desert dust particles could serve as a medium for interacting with chemicals on their surfaces, potentially enhancing the bioreactivity of fine particles during episodes of dust storms. The role of the different mineralogical composition (e.g. quarz, iron, feldspars) on the biological effects of mineral dust remains to be determined. In this work we analyze the severe dust event that affected the UK on 15 and 16 March 2022 in terms of the synoptic situation leading to this event, the spatiotemporal distribution of the dust plumes over UK and the chemical/mineralogical composition of the particles. We employ the METAL-WRF model to investigate the atmospheric properties and the quantification of particle concentrations in ambient air but also in dry and wet depositions of dust. The METAL-WRF model includes prognostic fields for ten (10) minerals: illite, kaolinite, smectite, calcite, quartz, feldspar, hematite, gypsum, phosphorus and iron. We also investigate the health impacts linked to the desert dust transport on the population in UK regions. Our results are discussed across similar findings at more frequently dust-affected regions such as the Mediterranean.

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