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Chemical and geochemical composition of spring-summer Arctic aerosol collected at Ny Alesund, Svalbard Islands.

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Since March 2010, spring-summer (usually March – September) campaigns were continuously carried out at the Italian Gruvebadet Observatory, Ny Alesund, Svalbard Island. Aerosol was sampled by PM10 (daily) and 4-stage (4-day resolution) collector devices and size distribution was evaluated at 10 min resolution in the range 10 nm – 20 um (106 size classes by a TSI SMPS-APS integrated system).
Six-year (2010-2015) PM10 and size-segregated (>10, 10-2.5, 2.5-1, < 1 um) filters were analyzed for ion composition (inorganic anions and cations, and selected organic anions by Ion Chromatography), metal content (major and trace metals, including Rare Earth Elements - REEs, by PIXE and ICP-MS), Pb isotopic composition (by ICP-MS) and Elemental and Organic Carbon (EC-OC) concentrations.
The data set was elaborated by multi-parametric statistical analysis (Positive Matrix Factorization – PMF), in order to identifying and quantifying the contribution of the main anthropic and natural aerosol sources. Particular attention was spent in evaluating the anthropic contribution of nss-sulphate, nitrate, EC and heavy metals during the Arctic Haze in spring. The isotopic composition of Pb was used in identifying the source areas (North America, Greenland, North Europe, Siberia, Iceland) of anthropic emissions as a function of seasonality (different atmospheric circulation pathway). Crustal metals and, especially, REEs anomalies (with respect to the Chondrite-normalized profile) allowed characterizing the dust emissions from their Potential Source Areas (PSA). Biogenic markers (especially methane sulfonic acid – MSA – and bio-nss-sulphate) was used to obtain relevant information about the relationship between marine biogenic activity (primary productivity) and sea ice coverage and atmospheric conditions (irradiance, temperature, circulation pathways). The seasonal pattern of the nitrate deposition was also investigated.
Chemical and geochemical measurements were compared with high-resolution size distribution and back-trajectory cluster analysis in order to understand the seasonal pattern of the contributions of long-range transport (particles distributed in the accumulation mode, especially in spring) as well as the occurrence of nucleation events (in the nano-metric range, especially in late spring-summer).
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