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Characterization and transport processes of selected elements associated with atmospheric PM₁₀ in the Arctic region (Ny-Ålesund, Svalbard Islands)

The chemical composition of atmospheric aerosol is responsible for the impact of particulate matter on human health and, at a larger scale, on the ongoing climate changes.

The Arctic regions are showing to be the first areas affected by the present climatic variations. Consequently, the study of the chemical composition of atmospheric aerosol in the polar areas is important to understand the feedback processes between the climate forcing and the environmental responses.

In this study, the concentrations of main and trace metals in the PM₁₀ collected at Ny-Ålesund (Svalbard Islands) during the spring and summer 2010 and 2011 campaigns were determined. From the results obtained it is evident a seasonal pattern in the temporal profiles of the majority of the chemical components of the PM₁₀, that show higher atmospheric concentrations in March-April. The most likely explanation for this trend is the influence of continental sources on the composition of the Arctic PM₁₀. Indeed, Svalbard Islands are affected by aerosols coming from anthropized continental areas by long range transport processes, especially occurring in early spring.

The enrichment factors, calculated considering Fe as a crustal reference element, are higher than 100 for Zn, Mo, As, Cd, Hg, Pb and Na, indicating their non-geogenic origin (anthropogenic sources and sea spray).

The chemometric investigation shows an evident separation between spring and summer but not between 2010 and 2011 Arctic PM₁₀ samples, confirming the great importance of the seasonal pattern. Principal Component Analysis evidences a strong correlation among Al, Mn, Ti e Fe, as expected for metals mainly coming from crustal sources; among As, Cu, Hg, and Pb, ascribable to long range transport of pollutants from anthropized areas in North America and Northern Europe, and among Cr, Ni and V, likely related to emissions from fossil fuel, coal and heavy oil combustion processes.

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Primary author: Dr MALANDRINO, Mery (Dipartimento di Chimica, Torino)

Co-authors: Dr GIACOMINO, Agnese (Dipartimento di Scienza e Tecnologia del Farmaco, Torino); Prof. ABOLLINO, Ornella (Dipartimento di Chimica, Torino); Mr BUOSO, Sandro (Dipartimento di Chimica, Torino)

Presenter: Dr MALANDRINO, Mery (Dipartimento di Chimica, Torino)