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Long-range transport of Icelandic volcanic dust over the Arctic

Beatrice Moroni (1), Olafur Arnalds (2), Pavla Dagsson-Waldhauserova´ (2,3), Stefano Crocchianti (1), Riccardo Vivani (4), and David Cappelletti (1)

(1) Department of Chemistry, Biology and Biotechnology, University of Perugia, Perugia, Italy (b.moroni@tiscali.it), (2) Agricultural University of Iceland, Hvanneyri, Iceland, (3) Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Prague, Czechia, (4) Department of Pharmaceutical Sciences, University of Perugia, Perugia, Italy

Iceland is the most important and the best-studied high-latitude dust area in the Northern hemisphere for its vast areas of dust emission, strong winds and high frequency of dust days year round [1]. This fact along with the issues on air mass atmospheric circulation [2, 3] suggest a significant contribution from Iceland in the air masses reaching the Arctic. This work aims to evaluate the type and extent of the Icelandic dust contribution at the Ny-Ålesund station, Svalbard Islands.
We characterized representative sediment samples from Iceland and Svalbard and compared them to a set of aerosol samples collected in Ny-Ålesund in the second half of April 2011, i.e. the most favourable period for Icelandic dust advection over Svalbard in that year. The sediment samples were analyzed by X-ray diffraction (XRD) to detect the mineralogical constrain of the geochemical markers. Both aerosol and sediment samples were examined by scanning electron microscopy coupled with EDS microanalysis (SEM-EDS) and image analysis to detect and to provide a morpho-chemical characterization of the mineralogical markers of dust provenance. For the days identified as belonging to Icelandic dust episodes, the daily net Icelandic dust load was then obtained by subtracting the background value to the PM10 value recorded on that day.
Comparison between local and Icelandic sediments reveals the metal oxide particles as the most representative and distinguishing mineralogical/phase markers for Iceland dust sources. In particular, we have considered the magnetite-chromite and the magnetite-ülvospinel associations as marker facies of the tholeiitic magmatic series and the presence of volcanic glass as a further indicator of provenance from Iceland. The morphochemical characteristics of the metal oxide particles in the aerosol samples compared to those of the sediment samples have proved to be a powerful tool to separate Icelandic from other sources for aerosol and dust such as Greenland and the industrialized areas in Eurasia.
Results of dust load calculations provide different values in April 2011 according to the variable contribution of Icelandic dust in that period [4]. Compared to the PM10 mass concentration registered from April to September 2011 the extent of the Icelandic mass contribution results about 2% of the total mass, and turns to about 7% in April. This means that the Icelandic contribution to the aerosol at Ny-Ålesund, though small to moderate in the long term, cannot be neglected especially during spring.

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