



First results on size distribution and chemical composition of Arctic aerosol (Ny Ålesund - Svalbard Islands and Thule - Greenland) during the 2010 campaign.

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Aiming to better understand the complex feedback between climate forcing and environmental changes in Arctic, one of the most critical regions of the Earth, an intensive campaign for direct measurements and sampling of atmospheric particulate was carried out at Ny Alesund (Svalbard Islands, Norway) and Thule (North Greenland) in March – September 2010.

Svalbard Islands (Norway), located in the northernmost point yet influenced by the warm West Spitsbergen Current, are an ideal location to study the interaction between the climate changes and the atmosphere, ocean and land variations. In particular, Ny Ålesund (78.6 ° N, 11.6 ° E) is a site where international cooperation ensures the continuous study and monitoring of a large number of physical and chemical key-parameters characterizing the Arctic ecosystem. During the 2008-2010 period, two relevant scientific platforms were built in the framework of the CNR CCT-IP (Integrated Project Climate Change Tower) and PRIN07 “Dirigibile Italia” scientific projects: a 34-m high tower, with meteo probes and photometers (up-welling and down-welling radiation) distributed on 5 levels, and an observatory (Gruvebadet) for aerosol measurements and sampling.

During the 2010 campaign, the measurement of physical, optical and radiative properties of snow and aerosol in the PBL were coupled with an intensive sampling of size-segregated aerosol particles, by several kinds of impactors and at different time resolutions. The aerosol particles size distribution was carried out by using a coupled system of two counting/sizing devices: one SMPS (Scanning Mobility Particle Sizer), working in the range 6 - 500 nm, and one APS (Aerodynamic Particle Sizer), able to count the atmospheric particulate in the range 0.5 – 20 µm. The two instruments were synchronized in order to obtain a unique spectrum of 106 size-classes in the range 6 nm – 20 µm every 10 minutes. More than 26,000 spectra were collected in the campaign period.

Aerosol sampling was carried out by several collectors: a PM10 sampler (24 h resolution) with Teflon filters, for ions and metal determination; a 4-stage impactor (4-days resolution) with polycarbonate (>10, 10-2.5, 2.5-1 µm fractions) and Teflon (< 1 µm) filters, for ions and metal size-segregated analysis; a 12-stage impactors (4-days resolution) with polycarbonate filters, for elemental characterization by PIXE analysis; a TSP medium-volume collector with quartz filters, for EC and OC measurements.

Ion measurements were carried out with a system of three ion chromatographs, coupled with a flow-injection computerized system for sample loading, able to separate inorganic anions (fluoride, chloride, nitrate, sulphate) and cations (sodium, ammonium, potassium, magnesium, calcium) and selected organic anions (acetate, propionate, glycolate, formate, pyruvate, methanesulphonate, oxalate).

Principal and trace metals were analyzed by ICP-AES, ICP-HR-MS and PIXE measurements.

EC and OC fractions were determined by a thermo-optical SUNSET analyser, by using the NIOSH protocol.

Chemical parameters have been compared with the high-resolution particle size-distribution, meteo conditions, back-trajectory reconstruction and statistical analysis (Positive Matrix Factorization and Absolute Principal Components Analysis) for source apportionment and to understand changes in source intensity and transport processes during the March-September 2010 period.

In parallel with the scientific activity in Ny Ålesund, a PM10 sampling campaign was carried on at Thule (76.5° N 68.8° W), Greenland. In the same site, measurements of optical properties and vertical distribution of atmospheric aerosol (by LIDAR) have been also carried out.

This wide data set will help to clarify origin, transport and deposition of aerosol particles in the Arctic and their relationships with the optical atmospheric properties and the PBL dynamics.

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