Sampling strategies and first results on chemical composition of size-segregated aerosol fractions at Dome C (Central East-Antarctica) during the 2006 winter-over campaign.

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During the second all-year-round campaign (November 2005 - November 2006) at Dome C (DC - Central East Antarctica, 3233 m a.s.l., about 1100 km far from the coast-line), size-segregated aerosol samples were collected at Concordia Station (75° 06’ S, 123° 23’ E) by using different low- or medium-volume devices: 1. pre-selected cutoff collectors with PM10, PM2.5 and PM1 heads (contemporaneous and alternate samplings); 2. a 4-stage (>10, 10-2.5, 2.5-1, <1 um fractions), small-surface sequential impactor (Dekati PM-10 Impactor); 3. a 8-stage (10-0.4 um) sampler (Andersen 20-800 Impactor); 4. a medium-volume (12 m³/h) PM10 collector (a modified version of Tecora Echo Puf) for long-time sampling. Sampling resolution ranged from one day to one month, and air-volume spanned from 2.3 to 12 m³/h. During the aerosol collection, continuous measurements of size distribution of the aerosol particles were carried out by using a laser-scattering Optical Particle Counter (OPC) device. OPC was able to classify aerosol particles in 32 size-classes in the range 16 - 0.3 um with a 5-min resolution.

Aerosol measurements and samplings were carried out about 1 km upwind (with respect the dominant wind direction, mainly from southern sectors) to building and people activity, in order to minimise contamination by anthropic emissions (especially electrical power plants).

Although sampling activity was carried out all-year-round, severe weather conditions (especially air temperatures as low as ~80 °C in winter) limited the continuous aerosol collecting, damaging pumps and electronic devices. Anyway, a large number of samples, covering all the time period, was collected and used to describe seasonal pattern and temporal trend of load and chemical composition of aerosol at DC.

Finally, fresh snow (when occurring), superficial snow and hoar (when occurring) samples were collected both in summer and winter to study atmosphere-snow interaction. In particular, superficial snow and hoar (when occurring) were collected two times per day (minimum and maximum solar irradiance), in order to understand the sublimation/condensation effects on snow chemical composition at DC. A reliable knowledge of the present sources, atmospheric transport and depositional and post-depositional processes affecting snow and aerosol composition in high-altitude Antarctic plateau sites is propaedeutic for a correct interpretation of changes of paleo-atmosphere composition as a response to climate forcings.

The main goals of the scientific activity at DC were: 1. to describe all-year-round temporal profiles of chemical compounds usable as markers of source intensity or transport processes; 2. to identify seasonal pattern of chemical markers of biogenic productivity (sulphate, MSA), sea spray formation (Na, chloride, Mg), atmospheric processes (nitrate, carboxylic acids), continental dust inputs (Ca); 3. to enlighten particular events of aerosol production and/or long-range transport, such as phytoplanktonic bloom, abrupt advection of marine air masses in full winter, sea-ice formation, etc.; 4. to verify or discharge the hypothesis of a significant contribution of frost flower formation on pack ice in controlling atmospheric concentration sea-salt compounds in plateau sites (so correlating Na snow concentration to sea-ice extent); 5. to identify present Potential Source Areas (PSAs) of continental dust by geo-chemical and mineralogical analysis (PIXE, SEM-EDAX, ICP-MS) of insoluble dust monthly collected by the medium-volume sampler; 6. to study interchange processes between atmosphere and snow.

Here we report the first results obtained from the chemical analysis of filters collected with PM10, PM2.5 and PM1 samplers and multi-stage impactors.

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