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All year round chemical composition of aerosol reaching the inner Antarctic Plateau (Dome C – East Antarctica)

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Since 2005, continuous, all-year-round aerosol sampling was carried out at Dome C (Central East Antarctica, 3233 m a.s.l., about 1100 km far from the coast-line), in the framework of Station Concordia project. Size-segregated aerosol samples were collected in summer and winter period by using different low- and medium-volume systems, including pre-selected cut-off samplers (with PM10, PM2.5 and PM1 heads) and multi-stage (Andersen 8-stage and Dekati 4-stage) impactors. Sampling resolution and volume range from 1 day to 1 month and from 2.3 to 12 m3/h respectively.
Aerosol study at Dome C aims to improve our knowledge on present day source intensity, transport efficiency and pathways (including stratosphere-to-troposphere interchanges) of particles reaching internal sites of Antarctica and to understand size- and chemical-fractionation effects occurring during the transport (by comparison with coastal aerosol composition). Besides, more information on atmosphere-snow interaction, including depositional and post depositional processes, as well as the effect of sublimation/condensation processes on snow surface, improves the reconstruction of past atmosphere composition from EPICA-DC deep ice core, drilled in the same site.
Here we report some results of the chemical composition of the Antarctic background aerosol reaching Dome C, pointing out the seasonal pattern and the temporal trend of some ionic components used as tracers of sea spray, marine biogenic and crustal emissions.
The atmospheric load in the summer is more than one order of magnitude lower than that measured in coastal sites and chemical composition is dominated by secondary aerosol, mainly originated by biological marine activity (S-cycle), and distributed in the finest aerosol fractions. H2SO4 from oxidation of biogenic DMS is the main component, while the contribution of HNO3 to the ionic budget is difficult to evaluate because of the re-emission into the atmosphere from the filter surface (acidic deposition). The ionic load was even lower in winter, when secondary biogenic aerosol decreases and larger particles from primary source (especially from sea spray) prevail. Sea spray plays a significant role in winter and spring aerosol, when more frequent and effective transport events from marine areas around Antarctica occur. In the same transport conditions, even relatively large dust content (as revealed by Ca2+ concentration) is measured in the Dome C aerosol.
Longer observations performed with higher temporal resolutions, yield greater information about the relationship between atmospheric circulation patterns and the load and chemical composition of atmospheric aerosol reaching DC in different seasons.
Fractionating effects leading to a reduction of sulphate/sodium ratio (used as marker of “frost flowerš̈ource) seem generally do not affect in a significant way the winter aerosol composition, even if few negative values of non-sea salt sulphate were calculated along the whole analyzed period. This evidence could show that sea spray aerosol from frost flower can reach the inner Antarctic plateau when particular transport processes occurs.