First measurements on the carbonaceous fraction in central Antarctic aerosol

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In industrialised and continental areas, the atmospheric aerosol carbonaceous fraction, such as Elemental Carbon (EC) and Organic Carbon (OC), are currently used in identifying and quantifying primary and secondary sources from natural and anthropogenic emissions (biomass burning, vegetation and marine emissions, combustion processes etc.). In urban sites, the TC contribution can be dominant in the aerosol mass budget.
On the contrary, very few data were obtained from polar regions, especially from Central Antarctica, where atmospheric concentrations are very low and the main contributions come from long-range transport of partially oxidised C-cycle compounds from marine biogenic emissions.
In this study we show the first results of the OC and EC atmospheric concentration in aerosol samples collected at Station Concordia, Dome C (East Antarctica, 75 °S, 123 °E, 3220 m a.s.l., about 1100 km away from the nearest coast).
Aerosol sampling were carried out in the framework of the "Station Concordia" international project, during the 2006/07 austral summer campaign (Nov 06 – Feb 07) and the following 2007 wintertime period (Mar 07 – Oct 07).
Bulk aerosol samples were collected on pre-fired quartz filter 47 mm diameter, 2 μm nominal pore size, by using a Tecora Echo-PM sampler operating at 2.3 m^3/h local conditions. Samplings lasted from 1 to 2 weeks, corresponding to air volumes ranging from 250 to 700 m^3 (local conditions: P around 640 mbar, T° ranging from -30 to -70 °C), in order to collect a sufficient aerosol quantity. Sampler hardware and software were improved in order to correct external/internal temperature gradient.
The sampling site was located in the "clean air zone" of Station Concordia area, about 1 km upwind with respect buildings and human activities. In order to prevent the contamination from power plants and base activity, a meteorological trigger was set up to stop the sampling when air masses were coming from a selected angular sector facing the base camp.
Filter holders were pre-washed prior sampling under a laminar flow hood and filters were stored in pre-cleaned polycarbonate Petri dishes, sealed in polyethylene bags, at – 25 °C until the analysis.
Parallel collections of size-segregated aerosol samples were carried out by several devices (PM10 and PM2.5 samplers, 8-stage Andersen impactor) and the results have been already published (Becagli et al., 2009; Jourdain et al., 2008; Preunkert et al., 2008; Udisti et al., 2008).
Here we present the first quantification of the carbonaceous component on aerosol samples collected all year round at Dome C. In our knowledge, no other data are available up to now on OC and EC aerosol concentrations in the central Antarctic region, at least in winter period.
TOT (Thermal Optical Transmittance) method was used for OC/EC quantification (Birch and Cary 1996).
Preliminary results show that OC concentration during winter is about 50 ng/m^3 while EC values are generally below the detection limit of the technique. The analysis of the complete data set in comparison with others biogenic marker (e.g. methanesulphonic acid, low molecular weight carboxylic acid, non sea salt sulphate) will allow to establish possible sources of OC.

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