Séminaire

28 Janvier 2014, 12:15
Salle Louis Lliboutry, LGGE

Rita Traversi
Dept. of Chemistry "Ugo Schiff", University of Florence, 50019, Sesto F.no, Italy

Insights from aerosol and snow chemistry in the Antarctic plateau and in the High Arctic: Achieved results and pending questions

Aerosol particles affect the Earth's radiative balance by direct (scattering and absorbing solar radiation) and indirect (by conversion into Cloud Condensation Nuclei) effects, thus being able to trigger and/or control the current climate variations. Although both the effects are widely studied, their extent is still highly uncertain, especially concerning the magnitude of the forcing caused by aerosol-cloud interactions. As pointed out even in recent works (Carslaw et al., 2013), the major uncertainty in such an estimation is related to a poor knowledge of the pre-industrial aerosol budget and composition, when only "natural" inputs were at play. Hence, a better understanding of the factors controlling the abundance of atmospheric aerosol as well as its transport patterns, is highly relevant in contributing to the assessment of the forcing exerted by atmospheric aerosol on the global radiative budget. In order to address at best this issue, inner Antarctic sites like Dome C (East Antarctica) represent the ideal location, being as close as possible to the pristine environments, with a negligible anthropogenic input, and allowing to accomplish long-term observations thanks to the presence of a permanent scientific station. Moreover, a better knowledge of sources, atmospheric pathways, depositional and post-depositional patterns of the present-day Antarctic aerosol is basic in the interpretation of deep ice core records, such as the one retrieved at Dome C (EDC ice core).

Here we present continuous all year-round records of chemical compounds in atmospheric aerosol and surface snow from Dome C (2005-2010) and the main results so far achieved in terms of source intensity and dominant transport mechanisms as function of size class and seasonal timing. If the temporal behaviour and source apportionment have been constrained reasonably well for primary and secondary marine aerosol (e.g. Jourdain et al., 2008; Preunkert et al., 2008; Udisti et al., 2012; Becagli et al., 2012), other environmentally relevant species, such as nitrate and organic acids, exhibit a more complex picture due to their multiple sources, sensitivity to photochemistry (e.g. Frey et al., 2009) and post-depositional effects (e.g. Traversi et al., 2009) and need further work in terms of experimental observation and modelling in order to use these markers for paleoclimatic reconstructions.

A significantly different scenario is shown by the High Arctic, where the anthropogenic input cannot be neglected, especially during spring season. Intensive summer and all year-round sampling campaigns of size-segregated aerosol have been carried out at Ny-Alesund (Svalbard Islands) and Thule (North Greenland), respectively, since 2010. A preliminary study has allowed to point out local inputs as well as long-range transport processes by the use of specific source markers (namely, REEs) and to carry out a reliable source apportionment applying a Positive Matrix Factorization (PMF) approach to all the determined chemical markers (ion components, metals, REEs).

Becagli, S., et al. 2012. Atm. Environ. 52, 98-108.
Carslaw K.S., et al. 2013. Nature 503, 67-71.
Frey, M.M., et al. 2009. Atmos. Chem. Phys. 9, 8681–8696.
Jourdain B., et al. 2008. J. Geophys. Res. 113, D14308.
Preunkert S., et al. 2008. J. Geophys. Res. 113, D15302.
Traversi R., et al. 2009. Microchem. J. 92 (1), 7-14.
Udisti, R., et al. 2012. Atm. Environ. 52, 109-120.