PAHs and ALKs in the Arctic (Svalbard Island) aerosol: results from the AREX2011 oceanographic campaign.

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Arctic Region is a very critical area for global climate changes and for transport, deposition and accumulation processes of airborne pollutants. During summer 2011 (20 June-12 Aug 2011), the AREX2011 oceanographic campaign was organized on board OCEANIA ship. Oceanographic activity was coupled with the study of the atmospheric particulate load and chemical composition (linked to sources, transport processes and atmospheric reactions of aerosol) in the Arctic. Aerosol samples were collected during the cruise in the Artic Glacial Sea, from Tromsø (Norway) to Svalbard Islands, along longitudinal and latitudinal transects, and the concentration of trace organic compounds in the aerosol, polycyclic aromatic hydrocarbons (PAHs) and *n*-alkanes (ALKs), was determined. PAHs arise from combustion sources, with a large contribution of anthropic activities; ALKs are emitted from various anthropic and natural (biogenic emissions) sources.

During AREX2011, 24 samples of total suspended particles (TSP) were collected by using a medium volume sampler (200 l min^{-1}, on 110 cm Ø quartz fiber filters). TSP samples (a spot of ¾ of filter each) were extracted in dichloromethane by a ultrasonic bath, and analyzed by GCMS for PAHs and ALKs. A total of 15 PAHs (3,4,5 and 6 aromatic rings) and 13 ALKs (from C20 to C32) were determined.

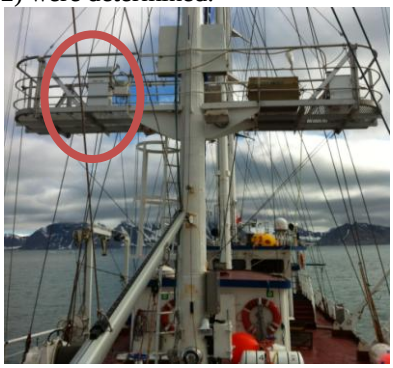

Figure 1 Aerosol (TSP) sampling during the AREX 2011 oceanographic cruise

The average TSP concentration during AREX2011 was 5.1 (± 4.6) μg m^3, with a minimum and maximum value of 1.3 and 21.6 μg m^{-3} respectively.

The PAH concentration (the sum of 15 PAHs) ranged between 0.008 and 0.061 ng m^{-3}. Low molecular weight PAHs (3 and 4-ring PAHs) were the largest components among the PAHs analysed, and PHE, FLNT and PYR were the dominant ones, each of them accounting for about 23% (for a total of 70%) of the total PAHs concentrations (Figure 1). Larger molecular weight PAHs (5 and 6-ring PAHs) were less abundant, and contributed only for 15% of total PAHs concentrations.

As a whole, PAHs concentrations were low (100-1000 time less than the concentrations usually measured in polluted environments -Perrone et al. 2012), as expected for remote sites not directly affected by anthropic activities.

Also ALKs concentrations were very low, in the range of 0.001- 0.005 ng m^{-3} (as sum of 13 ALK: C20-C32). Such concentrations are much lower in the Arctic marine aerosol than in non-marine remote aerosol from South-West Europe (> 1 ng m^{-3}) (Pietrogrande et al., 2010).

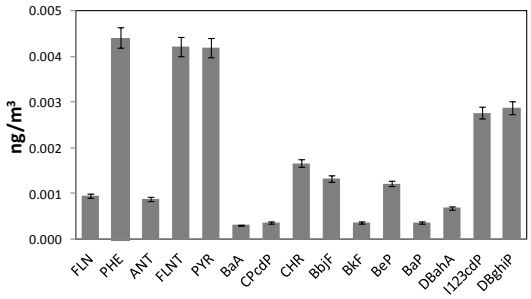

Figure 2. PAHs concentrations (ng m^{-3}) in the Artic Glacial Sea aerosol

In order to evaluate the sources contribution to the PAHs budget in the Arctic Glacial Sea aerosol during the summer 2011, the chemical mass balance (CMB) model was applied. The major sources of PAHs were petroleum combustion (about 50%) and coal combustion (30%), while the impact of biomass burning was very low or not identified.

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Pietrogrande C., et al. (2010) *Distribution of n-Alkanes in the Northern Italy Aerosols: Data Handling of GC-MS Signals for Homologous Series Characterization*, Environ Sci Technol **44**, 4232-40

Perrone MG., et al. (2012) *Source of high PM2.5 concentrations in Milan, Northern Italy: Molecular Marker data and CMB modelling.* Science of the Total Environment **414**, 343-55.