$\delta^{13}C$ of size segregated aerosol particles collected in Preila and Baltic Sea

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Marine aerosol contributes significantly to the global aerosol load and consequently has an important impact on both the Earth's albedo and climate (O'Dowd, 2004).

The aim of this work was to identify size segregated aerosol particles origin using the carbon stable isotopes method.

Experimental

The aerosol samples were collected at the Air pollution research station in Preila (55°55′N, 21°00′E, 5 m above sea level) which is located in western Lithuania on the coast of the Baltic Sea, on the Curonian Spit from 26 November 2012 to 12 January 2013 and in Baltic Sea during the cruise with the R/W "Oceania" on 09 – 17 November 2012. The nearest source of anthropogenic pollution, the Klaipeda city, is at the 50 km distance. Thus, carbonaceous atmospheric aerosols were transported to the Preila site by continental and marine air masses. A Micro-Orifice Uniform Deposition Impactor "MOUDI 110" was used to collect samples in size intervals ranging from 18 μm to 0.056 μm. Aluminium foils of 47mm diameter (pre-fired for 5 h at 600^0C) were used. A total of 7 collections in Preila and 2 collections in Baltic Sea were done. In addition, the low volume PM_1 sampler was used. As the main aim of the study was to identify the origin of incoming carbonaceous aerosols, the HYSPLIT air mass backward trajectory model was used for the analysis of results (Draxler, 2003).

Total carbon isotopic ratios ($\delta^{13}C$) were measured at each stage of MOUDI and at quartz fibre filters of PM_1 using the elemental analyzer (FlashEA 1112) connected to the stable isotope ratio mass spectrometer (ThermoFinnigan Delta Plus Advantage). Simultaneously the carbon amount at each stage was measured using the elemental analyzer with a thermal conductivity detector (Garbaras, 2008). The 1/4th part of the foil/ quartz fibre filter was placed into the tin capsule and combusted in the oxidation furnace at the temperature of 1020º C and with the oxygen excess. Carbon of the sample oxidized into CO_2 gas, which passed to the mass spectrometer ionization cell through the gas distribution device ConFlow III.

Results

During the experiment the aerosol carbon isotopic ratio variation between accumulation and coarse modes in Preila ranged from -24.3 ‰ to -29.3 ‰ and in Baltic Sea from -24.7 ‰ to -28.2 ‰. It implies that in both cases the carbonaceous particles in the same size range were from almost the same sources. The $\delta^{13}C$ values for the aerosol particles PM_1 transported from longer distances depended on the air mass transport directions. Air mass transports during the Preila experiment were few characters. At first it was mainly from West and Southwest - more from the continent (United Kingdom, Germany, Denmark, Belgium, Netherland, Poland, and Russia) in such transport scenario the main source of carbonaceous aerosols in accumulation mode could be transport emissions and coal burning, moreover average of carbon isotopic ratio for accumulation mode was -28.1‰. However after ten days when it was from West and one episode was purely from Russia, Sweden and Norway the average $\delta^{13}C$ = -26.2‰.. The last episode was from South with the average $\delta^{13}C$ = -26.5‰. All these air mass transports changes have a good agreement with aerosol carbon isotopic ratio taking into account influence of coal burning, transport emissions and marine aerosol.

Results from Baltic Sea (Fig.1) demonstrate a good agreement of MOUDI and PM_1.

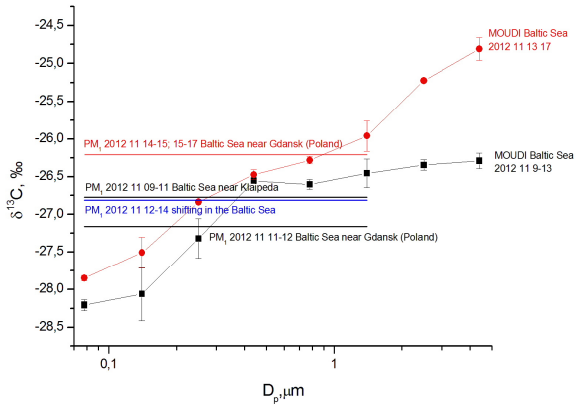

Figure 1. Experimental data from Baltic Sea.

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Draxler, R.R. and Rolph, G.D. (2003) HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://arl.noaa.gov/ready/hysplit4.html) (NOAA Air Resources Laboratory, Silver Spring, MD.

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