COUPLING BETWEEN ATMOSPHERE AND SEAWATER IN BLACK SEA: AN INTERGRATED APPROACH

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Abstract

The current study presents a complete data set of major and trace metals, organic and elemental carbon in sediment traps deployed in the South Western Black Sea. In addition data on atmospheric deposition of major and trace elements have been simultaneously obtained in a seaside resort on the Bulgarian Black Seas Coast. Atmospheric lithogenic mass fluxes accounts for 53- 65% of the lithogenic material in sediment traps. In general in sediment traps the lithogenic part was found to be the most abundant fraction (40%) followed by POM and carbonates (about 20-23% each). EC and others (probably opal material) accounted for the remaining %.

Keywords: Atmospheric Input, Black Sea, Sediments, Metals, Carbon

Introduction

For the area under investigation, Black Sea, the chemical composition of atmospheric deposition and sediment trap samples will be discussed. In total 48 sediment trap and 18 atmospheric deposition samples have been collected and analyzed for the major and trace metals (Al, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Cd and Pb), while sediment traps have been in addition analyzed for organic and elemental carbon. The aims of this study are to evaluate the seasonal variability of atmospheric deposition and settling material in Black sea and moreover the role of atmospheric deposition on Black Sea major and trace metals levels.

Materials and Methods

The sediment traps were deployed in the South Western Black Sea (43º01,812N 29º28,498E) at two depths (930m and 1930m) during the period October 2007 to December 2008. The sediment trap samples were collected, on a two–week basis and immediately after collection an aliquot was filtered through a precombusted and pre-weighted quartz fiber filters (Whatman QMA, diameter 47mm) for further analysis. Atmospheric deposition samples were collected at a seaside resort on the Bulgarian Black Seas Coast in Varna close to the sediment trap area. The samples were collected on a monthly sampling interval from March 2008 to April 2009 using the technique described by [2]. After collection all samples were filtered through 0.4 µm Millipore polycarbonate filters.

An acid microwave digestion procedure followed by Inductively Coupled Plasma Mass Spectrometry was applied to measure metal concentrations (Al, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Cd and Pb) in sediment trap and deposition samples. In addition sediment trap filters were analyzed for Organic and elemental carbon (OC and EC), with the Thermal-Optical Transmission (TOT) technique [1].

Results and Discussion

The temporal variations of mass fluxes present a seasonal pattern: Lower fluxes occurred from January to March, whilst higher fluxes from November to December for both depths (Figure 1,2). The percentage of OC in sediment traps at the two depths (930m and 1930m) was found to be 10 and 11%, respectively. Carbonates have been also measured and they account for 22 and 23% of the total mass at the two depths. The lithogenic part was estimated using Fe as a crustal tracer and was found to vary between 40 and 38% at 930 and 1930m, respectively. A detailed comparison between atmospheric deposition and sediment trap fluxes of elements is presented and discussed in this work.

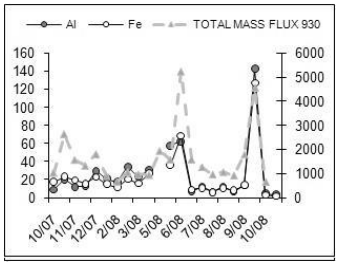

Fig. 1. Seasonal variations of total mass fluxes (mg m^{-2}) and of lithogenic origin elements

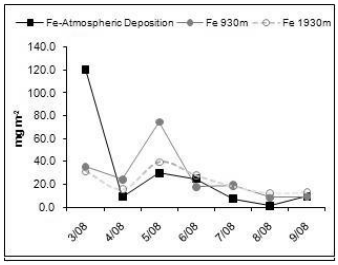

Fig. 2. Comparison between the fluxes of Fe (in mg m^{-2}) for both deposition and sediment traps

References

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