

Organic carbon in the sea surface microlayer and in submicron aerosol particles – measurements from the Atlantic Ocean

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The export of organic compounds from the oceans can establish a considerable carbon flux in the Earth system. The detailed transport processes and especially the impact of environmental drivers in the organic carbon transfer are not yet fully understood. Here we present a broad study of measured dissolved organic carbon (DOC) and particulate organic carbon (POC) concentrations and enrichment in the sea surface microlayer (SML) as well as equivalent measurements in marine aerosol particles. For the first time, enrichment factors of organic carbon in marine ambient aerosol are reported that based on concerted measurements of seawater and aerosol particles. The measurements were conducted at different field campaigns in the Atlantic Ocean: at the Cape Verde islands, during two Atlantic transects with the RV Polarstern, and during a campaign at the Raune Fjord in Bergen, Norway. In oceanic water, concentration of DOC were in average 161 $\mu\text{mol/L}$ in bulk water and 225 $\mu\text{mol/L}$ in the SML. Average POC concentrations were 13 $\mu\text{mol/L}$ in bulk water and 17 $\mu\text{mol/L}$ in the SML. Instead of a constant enrichment of DOC or POC there are rather two pattern: high enrichment in samples with low concentrations and low enrichment when concentration were high. In seawater (bulk water and SML) small, mostly insignificant effects, concerning concentration and enrichment of DOC and POC were found regarding the impact of wind stress and chl-a concentrations. Differences between SML and bulk water concentrations are more pronounced at times of high chl-a, but all in all these effects are not strong. The thickness of the SML is affected by biological activity but probably caused by a more surface-active part of the DOC/POC pool and this is not reflected in the sum parameters. In the ambient marine aerosol particles water-soluble organic carbon (WSOC) and water-insoluble organic carbon (WISOC) concentrations were in average about 0.2 $\mu\text{g m}^{-3}$, respectively. Higher concentration differences of WSOC and WISOC were observed regarding different wind and chl-a regimes. This is also reflected in the enrichment factors of organic carbon in the aerosol particles (EF aer). EF aer of DOC/WSOC and POC/WISOC are from 104 up to 105 and significantly higher at elevated chl-a concentrations. This points to a chemo-selective transfer of organic compounds from the ocean, notably the SML, to the atmosphere, that could be affected by the biological activity of the ocean.