EGU2020-17306
https://doi.org/10.5194/egusphere-egu2020-17306
EGU General Assembly 2020

Variability of sulphur compounds at the Boknis Eck Time-Series Station in the Baltic Sea during 2009-2016

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Dimethyl sulphide (DMS), as a volatile organic sulfur compound, plays an important role among the reduced sulphur gases in the atmosphere. DMS emitted from seawater constitutes a significant component of the global sulphur cycle and may affect climate by forming atmospheric aerosols which could form cloud condensation nuclei and thus modify cloud properties. DMS is produced from its major precursor dimethylsulphoniopropionate (DMSP) by complex interactions of phytoplankton and bacterial processes. Dimethyl sulphoxide (DMSO) is the major non-volatile dimethyl sulphur pool in the ocean and plays an important role in the biogeochemical cycle of DMS, although its formation and consumption pathways are poorly understood compared to DMSP.

Although the Baltic Sea is the largest brackish water system of the world, observations of sulphur compounds from the Baltic Sea are limited. The variations of seawater DMS, DMSP and DMSO as well as various phytoplankton marker pigments were investigated at the Boknis Eck Time-Series Station (BE, located in Eckernförde Bay, southwest Baltic Sea) during the period 2009 - 2016. Average DMS (1.8 nmol L^{-1}), dissolved DMSP ($DMSP_d$, 3.3 nmol L^{-1}) and particulate DMSP ($DMSP_p$, 10.5 nmol L^{-1}) concentrations were generally low, while dissolved DMSO ($DMSO_d$, 14.6 nmol L^{-1}) and particulate DMSO ($DMSO_p$, 13.1 nmol L^{-1}) concentrations were comparably enhanced in the water column during the study. Strong seasonal variations in the concentrations of the sulphur compounds have been linked to the phytoplankton succession over the entire investigation period. Depth profiles of sulphur compounds were generally related to Chlorophyll a concentrations. The averaged DMS flux was 16.3 µmol m^{-2} day^{-1} suggesting that BE is a net source of atmospheric DMS. Monthly averaged air-to-sea DMS fluxes at BE varied considerably and they were well-correlated with surface DMS concentrations as well as the relative abundance of haptophytes instead of the wind speed. This time-series study illustrates the importance of phytoplankton community in shaping the distribution of the sulphur compounds and fluxes to the atmosphere in the Baltic Sea.

How to cite: Zhao, Y., Booge, D., Schlundt, C., and Bange, H.: Variability of sulphur compounds at the Boknis Eck Time-Series Station in the Baltic Sea during 2009-2016, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-17306, https://doi.org/10.5194/egusphere-egu2020-17306, 2020