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Manganese in two tidal basins of the North Sea: Pelagic and benthic tracer dynamics

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This study compares seasonal manganese (Mn) dynamics in the water column and sediments of two tidal systems in the southern (backbarrier area of Spiekeroog Island) and northern (Sylt-Rømø tidal basin) Wadden Sea of the German Bight in the years 2008 and 2009. The aim was to provide information about site-specific properties of two tidal basins and to extract common features which are valid for the entire Wadden Sea of the North Sea.
Qualitative similarities are seen in the seasonal pattern of dissolved Mn in the open water column. Both systems show increasing Mn levels in spring and late summer due to elevated biological activity as well as a significant depletion period in early summer, thus indicating a comparable seasonal behaviour of Mn for the entire Wadden Sea. However, significant quantitative differences are observed with a 6-fold higher Mn level in the Spiekeroog area. This difference is probably caused by a larger sediment area/water volume ratio and a comparatively higher release of dissolved Mn from the tidal flat sediments compared to the Sylt-Rømø tidal basin.
Transects into several tidal basins of the northern Wadden Sea were carried out to examine the importance of the Wadden Sea as a potential Mn source for the North Sea. Our data show a distinct seasonal dependency with higher Mn concentrations in late summer compared to early summer and autumn. Furthermore, significant quantitative variations are seen, which arise from differing hydrological-morphological, hydrodynamical, and sedimentological properties. Comparison with the southern Wadden Sea indicates that the northern area is a less important source for dissolved Mn. In contrast, the export of particulate Mn seems to be more important in the northern Wadden Sea showing higher concentrations in the summer months and clear gradients from the tidal basins into the North Sea, respectively. These findings have to be considered in future modelling approaches estimating Mn budgets for the entire Wadden Sea.