

FLUXMAP: importance of sediment type and macrobenthic functional biodiversity for biogeochemical cycling in the Belgian part of the North Sea

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Coastal seas cover only 10% of the total ocean but are responsible for the delivery of a wealth of ecosystem goods and services. Given the increasing human pressure on coastal ecosystems, it is surprising how little is known about the actual status of goods and services such as biogeochemical cycling in coastal sediments. In this study, we studied biogeochemical cycling at 10 stations representing the range of sediment types and macrobenthic communities in the Belgian part of the North Sea (BpNS) on a monthly basis from February till October 2011. Fluxes of oxygen, dissolved inorganic nitrogen and alkalinity were measured across the sediment-water interface. In some cases, sediment oxygen and pH profiles were measured. Denitrification and nitrification were estimated from an integrated mass budget. We tested whether there is a (1) spatial and (2) temporal difference in biogeochemical cycling and functional biodiversity of macrobenthos. Further, we (3) modeled oxygen, ammonium and alkalinity fluxes and denitrification from environmental variables including macrobenthic functional biodiversity (i.e. Bioturbation Potential).

We show that a wide diversity in habitat types exists in the BpNS, not only in terms of macrobenthic functional biodiversity, but also in terms of biogeochemical cycling. The muddy sediments appear especially important in alkalinity generation, which has repercussions on atmospheric CO₂ uptake, hence ocean acidification. Biogeochemical cycling in fine sandy sediments is strongly influenced by macrobenthic structural and functional biodiversity (highest denitrification rates and high importance of Bioturbation Potential in explaining SCOC, NH_x and alkalinity fluxes). Our results pinpoint the strong link between macrobenthic functional biodiversity and ecosystem functioning in terms of biogeochemical cycling. The presented models can therefore be a start in the development of (1) full coverage maps of biogeochemical cycling at the BpNS and (2) monitoring programmes in the framework of marine protection (e.g. Sea Floor Integrity within EU Marine Strategy).