# The BEACHES project initiative: First results of a multidisciplinary study of sandy beaches from the Southern North Sea (NW Germany)

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BEACHES (Biology, Ecology, Advection in Coastal High-Energy Systems) aims to investigate fundamental physical, chemical, and biological processes at the terrestrial / marine interface, which extends from permanently seawater-covered nearshore reaches to the terrestrial hinterland unaffected by sea salt. This zone includes the subterranean estuary (STE) with its advection-driven subterranean groundwater discharge (SGD). Different scientific disciplines are involved in BEACHES, such as biogeochemistry, microbiology, isotope geochemistry, organic geochemistry, planktology, hydrology, sedimentology, and modeling. The major aim of this initiative is to document and investigate the role of beach systems in coastal carbon, nutrient and trace metal cycling on different spatial and temporal scales, including extreme events. In the long run the project aims to help answering the question, how important SGD and processes within the STE are for global elemental cycles.

In a joint multidisciplinary pre-study we investigated the spatial distribution of DOC, nutrients (phosphate, nitrate, nitrite, ammonium, silica, alkalinity), trace metals (manganese, iron) and sulfate in pore waters retrieved on a beach transect. Furthermore hydrological, sedimentological and mibrobiological investigations were carried out. We can show that organic matter remineralization products are not highly enriched in the pore waters, because they are rapidly discharged into coastal surface waters, where they may trigger primary production. High nitrate concentrations indicate that redox conditions are oxic within the duneward freshwater part, while ammonification, denitrification, manganese and iron reduction seem to prevail in the seawater circulation zone. Microbial diversity analysis of various phylogenetic and metabolic key genes revealed a uniform response of the microbial composition to the different environmental settings.

We postulate that beaches form an important part of the land-sea continuum and cannot be ignored regarding global biogeochemical cycles.