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Marine and terrestrial influence on submarine groundwater discharge in coastal waters connected to a peatland

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Coastal peatlands are characterized by intense interactions between land and sea, comprising both a submarine discharge of fresh groundwater and inundations of the peatland with seawater. Nutrients and salts can influence the biogeochemical processes both in the shallow marine sediments and in the peatland. The determination of flow direction and quantity of groundwater flow are therefore elementary. Submarine groundwater discharge (SGD) has been reported from several locations in the Baltic. The objective of this study is to quantify the exchange of fresh and brackish water across the shoreline in a coastal peatland in Northeastern Germany, and to assess the influence of a peat layer extending into the Baltic Sea.

The peatland with a size of 350 ha was previously drained by a dense channel system but is now undergoing the process of renaturation. The peatland is separated from the beach by a dune dike that is not maintained anymore. Below the peatland, a shallow fine sand aquifer differs in depth and is limited downwards by glacial till. Grain size analysis and slug tests indicate a higher hydraulic conductivity in a sand layer near the dune on top of the peat, and a less permeable peat layer on top of the aquifer. Water level and electrical conductivity (EC) are permanently measured in different depths at eight locations in the peatland. The water level in the peatland and the surrounding forest is close to or above ground level. First results indicate a groundwater flow direction towards the sea. Electrical conductivity measurements near the coastline indicate differences between 0.8 to 13 mS/cm in the sediment layers. EC fluctuates partially during storm events depending on the hydraulic gradient and the height and width of dunes.