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A multi-tracer study of submarine groundwater discharge into Wismar Bay, southern Baltic Sea

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Submarine groundwater discharge (SGD) is considered as an important route for water and dissolved material exchange between land and coastal seas. Both freshwater and (recirculated) seawater are referred to as SGD and may impact the composition and biogeochemical processes in coastal waters. The present study focuses on the identification and the spatial variability of SGD into the Wismar Bay, in the southern Baltic Sea. On across-shore transects covering Wismar Bay waters were sampled for analysis of Radium (Ra) isotopes, stable isotopes (H, O, C, S), dissolved inorganic carbon (DIC), nutrients and major cations. In addition, sediment cores were retrieved from several stations. The detection of short-living radium isotopes (^{223}Ra and^{224}Ra) in surface waters of the bay indicate benthic-pelagic coupling via pore water exchange with the water column that may be an indication for SGD. Moreover, enhanced concentration of dissolved manganese and barium, resulted from anoxic pore waters, were found in areas with higher Ra activity. Pore water profiles of salinity and major ions highlight the presence of freshwater about 50 cmbsf in sediments in the central part of the bay, probably related to the presence of a coastal aquifer. In contrast, other sediments demonstrate relatively constant pore water salinity distribution with increasing depth. Slight salinity maxima in almost all core at around 6 to 12 cmbsf seems to be relict from changing bottom water salinity in the past. The water isotope composition (δ^{18}O, δ^{2}H) of the low saline pore water is plot close to the local meteoric water line established for Warnemünde. Saline pore waters, in contrast, have water isotope composition aligned with southern Baltic Sea surface waters. The DIC concentrations increased with depths suggesting the mineralization of organic matter within the 50 cm sediments depth at all sides. Moreover, the values of DIC even exceeding the concentration found on the percolating fresh ground water. Thus, the overall contribution of elements to the coastal ecosystem is a function of the transport processes regulating element flux across the sediment-water interface.

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