Submarine groundwater discharge to the southern Baltic Sea

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Submarine groundwater discharge (SGD) has been recognized as an important exchange pathway between hydrologic reservoirs due to substantial fluxes and its impact on ecology and biogeochemical cycles of the coastal oceans. In the southern Baltic Sea off Poland- the end-members of the system, namely the seawater and groundwater, are characterized with significantly different concentrations of chemical constituents. The mixing of groundwater and seawater occurs already in the sediment and consequently, a salinity gradient is formed. Thus, concentration changes/variations of selected water components in pore water samples is been observed according to a conservative or not-conservative trend. It has been established that groundwater is a source of NH_4^+, PO_4^{3-}, Cd, Co, Cr, Mn, Zn, and both dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) while it acts as a diluting factor for Hg, Ni, Cu, NO_3^- and NO_2^- in seawater. Estimates regarding volume of groundwater discharged to the Baltic Sea are proved to be around 1% of the river run-off. However, locally, as in the Bay of Puck, the contributions of groundwater to the fresh water discharge were significant. The estimated loads of dissolved inorganic nitrogen (DIN) -49.9 ± 18.0 t yr^{-1} and PO_4^{3-} -56.3 ± 5.5 t yr^{-1} into the Bay of Puck via SGD were significant in comparison with loads delivered to the bay from other, well-recognized sources. The groundwater discharge was also a substantial source of metals (Cd, Co, Cr Mn, Zn) in comparison with rivers. The carbon specific flux into the Bay of Puck was estimated at 850 mg m^{-2} yr^{-1} while DIC and DOC fluxes via SGD to the Baltic Sea were projected at 283.6±66.7 kt yr^{-1} and 25.5±4.2 kt yr^{-1}. The SGD derived carbon load to the Baltic Sea is an important component of the carbon budget, which gives the sea a firmly heterotrophic status.