Geophysical Research Abstracts
Vol. 18, EGU2016-15739, 2016
EGU General Assembly 2016

Quantification of Submarine Groundwater Discharge Using a Radon (222-Rn) Mass Balance and Hydrogeological Modelling

Eric Petermann (1), Reiner Stollberg (1), Jan Scholten (2), Kay Knöller (3), and Michael Schubert (1)

(1) Helmholtz Centre for Environmental Research, Groundwater Remediation, Leipzig, Germany , (2) University of Kiel, Institute of Geosciences, (3) Helmholtz Centre for Environmental Research, Catchment Hydrology, Halle, Germany

Apart from river and surface water runoff subsurface discharge of groundwater plays a key role in coastal water and matter budgets. Two major forms of submarine groundwater discharge (SGD) can be distinguished: (i) pure freshwater discharge from continental aquifers that are connected to the coastal sea driven by a positive hydraulic gradient (fresh SGD) and (ii) re-circulation of seawater that has penetrated permeable coastal sediments (re-circulated SGD), e.g. driven by tidal pumping. The localization of SGD zones and the quantification of SGD fluxes is of high interest for coastal water management due to potential threats related to SGD, namely (i) the detrimental impact of discharging nutrient- or contaminant-laden groundwater on coastal seawater quality, an aspect that is of relevance along coastlines which are impacted by agriculture, industry or intense urbanization, and (ii) the loss of freshwater to the ocean, an issue that is of major relevance in all coastal areas with (seasonally) limited freshwater availability.
In this work, we discuss estimates for the total (fresh + re-circulated) SGD fluxes derived from a mass balance of the radioactive noble gas radon (222-Rn) with estimates of fresh SGD fluxes derived by hydrogeological modelling. The precision of the mass balance results depends on the adequate determination of the mass balance source and sink terms. These terms are calculated based on field observations of environmental tracers (salinity, δ18O, 222-Rn, 223-Ra, 224-Ra, 226-Ra) in seawater and porewater, as well as on meteorological data. The numerical hydrogeological model estimates groundwater flow based on groundwater monitoring data, river flow data, groundwater recharge estimates, tidal dynamics, and density effects along the freshwater/seawater interface.
We compare these two independent methodological approaches of SGD flux estimation, discuss results regarding their relevance for the regional water balance and reason the implications of SGD fluxes for water management of the coastal zone.