^{222}Rn Surveys for the Detection of Submarine Groundwater Discharge: Why did the tracer fail in the Eckernförde Bay?

J. SCHOLTEN[1], M. KREUZBURG[1,2], .E PETERMANN[3], M. LOPES DE PAIVA[4], D. KÖHLER[5], M. SCHLÜTER[5], J. RAPAGLIA[6], M. SCHUBERT[3]

[1]Sedimentology, Coastal- and Continental Shelf Research, Kiel University, Germany; js@gpi.uni-kiel.del
[2]Leibniz Institute for Baltic Sea Research, Germany
[3]Helmholz Centre for Environmental Research - UFZ Leipzig, Germany
[4]Universidade Federal do Rio Grande, Brazil
[5]Alfred-Wegener Institute, Germany
[6]Department of Biology, Sacred Heart University, US

Little information is available on the occurrence of Submarine Groundwater Discharge (SGD) in the western Baltic Sea and its importance for the nutrient supply to coastal areas. For the detection of SGD measurements of Rn-222 (Rn, $t_{½}$ = 3.8 days) in surface seawater close to the shoreline have proven to be a powerful technique. As Rn is enriched in SGD relative to seawater elevated Rn concentrations along the coastline can be interpreted as a first indication of SGD.

We measured Rn along the coastlines of Mecklenburg Bay, Kiel Bay and Eckernförde Bay. The average Rn concentration in seawater was 9.7 Bq/m³ with highest concentrations up to 66.7 Bq/m³. Several Rn anomalies were detected in the area off Warnemünde, Wismar, Kiel Bay and Eckernförde Bay indicating possible locations of SGD. However, even though extensive sediment pore water analyses and seepage meter measurements revealed an average SGD flux of 21 cm/d (range 0.6 cm/d - 173 cm/d, n= 342) along the north-western coastline of the Eckernförde Bay, no Rn anomalies where observed here. Rn concentrations in seawater are significantly affected by wind induced turbulences of the sea surface, and this effect increases with wind speed. Our modelling results indicate that the relatively strong winds (up to 10 m/s) prior to our Rn survey in the Eckernförde Bay have the potential to decrease the Rn concentrations in seawater by up to factor 5. Therefore, it is likely that a wind-induced decrease of Rn in seawater masked SGD locations in the north-western part of the Eckernförde Bay. Our results highlight the importance of the consideration of weather conditions prior to Rn SGD surveys for the successful application of Rn as a tracer of SGD.