Geophysical Research Abstracts
Vol. 14, EGU2012-12660, 2012
EGU General Assembly 2012

Groundwater ages, recharge patterns and hydrochemical evolution of a barrier island freshwater lens (Spiekeroog, Northern Germany)

T. Röper (1), G. Massmann (1), H. Meyer (2), and J. Sültenfuss (3)

(1) Department of Biology and Environmental Sciences, Carl-von-Ossietzky University of Oldenburg, Ammerländer Heerstraße 11, D-26129 Oldenburg, Germany , (2) Alfred Wegener Institute, Telegrafenberg A43, D-14473 Potsdam, Germany, (3) Institute of Environmental Physics, University of Bremen, Otto-Hahn-Allee, D-28359 Bremen, Germany

Freshwater lenses below barrier islands are extremely dynamic systems with regard to changes in morphodynamic patterns, groundwater recharge and discharge and also vulnerable to overabstraction of groundwater and pollution. Basic knowledge on hydrogeological and hydrochemical processes of a freshwater lens is important for retaining sustainable water management, especially in terms of climate change. This is the first study which gives a compact overview on the age distribution, reacharge patterns and hydrochemical evolution of a barrier island freshwater lens in the southern North Sea (Spiekeroog island, Eastfrisian Wadden Sea). Two ground- and surface water sampling campaigns were carried out in May and July 2011, supplemented by monthly precipitation sampling from July to October. 3H/3He ages, stable oxygen and hydrogen isotopes and major ion concentrations were determined. Results show that the freshwater lens reaches a depth of 44 mbsl, where an aquitard constrains further expansion in vertical direction. Groundwater ages are increasing from 4.4 years in 12 mbsl up to >70 years at the freshwater-seawater interface. Stable isotope signatures reflect average local precipitation signatures. An annual recharge rate of 600 mm was calculated with 3H/3He data. Freshwater is primarily Na-Ca-Mg-HCO_3- and Ca-Na-HCO_3-Cl water, while precipitation and seawater are Na-Cl water types. A trend towards heavier stable isotope signatures and higher electric conductivities in the shallower, younger groundwater within the freshwater lens could point towards increasing atmospheric temperatures in the last 30 years.