Geophysical Research Abstracts
Vol. 14, EGU2012-11471-2, 2012
EGU General Assembly 2012

Application of an eddy correlation system for the estimation of oxygen benthic fluxes in coastal permeable sediments impacted by submarine groundwater discharge

D. Donis (1), F. Janssen (1), M. Böttcher (3), D. McGinnis (4), M. Holtappels (1), F. Wenzhöfer (1,2)

(1) Max Planck Institute for Marine Microbiology, Celsiusstr 1, Bremen, 28359, Germany, (3) Leibniz Institute for Baltic Sea Research (IOW), Seestr.15, D-18119 Warnemünde, Germany, (4) University of Southern Denmark, Nordic Center for Earth Evolution (NordCee), Institute of Biology,5230 Odense M, Denmark, (2) Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany

Measurements of solute exchange across the sediment-water interface are crucial for marine environment monitoring. This interface has fundamental filter functions for the mass exchange between the seafloor and the water column. Being a non-invasive technique, the eddy correlation method, is probably the most accurate measurement for benthic fluxes. It does not interfere with local hydrodynamics and integrates over large areas, showing considerable advantages compared to traditional methods, i.e. microprofiles and benthic chambers. One of the most important exchange processes across the sediment-water interface is flux of oxygen, which is a predominant control factor for the biogeochemical activity in the sediment, carbon processing and the composition of benthic communities. The eddy correlation method performs simultaneous recordings of vertical velocities and oxygen concentrations at a specific distance to the seafloor and is becoming a standard method for resolving dissolved oxygen fluxes in aquatic systems. However, data treatment and interpretation, especially in shallow environments, is still challenging. One major concern in eddy correlation studies of coastal environments is how to consider surface wave motions that can dominate the turbulence range and that may bias flux calculations. A critical part of the data treatment thus is the removal of wave biases from the vertical velocity component, by separating the wave frequency oscillations (due to a tilted or miss-aligned sensor) from those containing meaningful flux contributions. Here we present in situ benthic oxygen exchange rates as determined by an eddy correlation system (ECS) and simultaneously deployed stirred benthic chambers. The study was carried out in a coastal ecosystem of the southern Baltic Sea that was impacted by low salinity groundwater discharge (Hel peninsula, Poland). Oxygen fluxes determined with ECS compared well with results from benthic chambers. Flux data and seepage rates are discussed in the context of groundwater and their importance for benthic biogeochemical processes in shallow sandy sediments. This work was supported by 7th framework EU ITN-project SENSEnet and BONUS+ project AMBER.