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Ground water discharge and turbulent transport in oceanic bottom boundary layers in a flow channel

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The anthropogenic impact on the Baltic Sea is a long term focus of research. While the inflow from rivers and the North Sea is well known, the amount and composition of ground water being discharged via permeable coastal sands has recently put into the focus of the graduate school BALTIC Transcoast at the University of Rostock. In previous investigations the significance of the input of nutrients and oxygen through the submarine groundwater discharge (SGD) , has been established (Burnett et al. 2001, Taniguchi et al. 2006., Moore 2010). Following Slomp and van Cappellen (2004) the SGD also provides an important input of tracer gases in coastal waters.

In the subproject „Waves and Turbulence on wavy coastal seabeds inducing vertical scalar transport“ a laboratory experiment has been developed to investigate the ground water discharge in the coastal shallow water. Therefore, in a water channel waves are produced employing a Piston-type wave generator to induce an unsteady wave motion. A laser-induced-fluorescence (LIF) setup is used to quantify the amount and distribution of ground water discharged through a permeable seabed model. In a simultaneous measurement planar PIV (particle image velocimetry) data is acquired to determine the instantaneous velocity field. From the resulting sequences of concentration and velocity fields the turbulent motion, the transport and the mixing above the seabed can be quantified.

The results demonstrate the influence of the wave motion on the time scale, direction and amount of turbulent transport of the discharged submarine groundwater as seen in the turbulent Reynolds fluxes. For a planar seabed it can be obtained, that the vertical transport is dominated by the diffusive velocity, whereas the horizontal transport is governed by the wave motion. The mixing however occurred in the porous media itself while the spatial transport of the tracer takes place in the water column.

Literature

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