Geophysical Research Abstracts
Vol. 20, EGU2018-2971, 2018
EGU General Assembly 2018

What influences the spatial and temporal variability of groundwater discharge in a deep lake? A combined measuring and modelling tracer approach

Catharina Keim (1), Stefan Mirbach (2), Ulrich Lang (2), and Benjamin Gilfedder (1)

(1) University of Bayreuth , Department of Hydrology & Limnological Research Station, Germany (catharina.keim@uni-bayreuth.de), (2) Ingenieurgesellschaft Prof. Kobus und Partner GmbH, Heßbrühlstr. 21D, 70565 Stuttgart, Germany

The area Mehrerau consists of several former sand and gravel extraction sites within the shallow water zone in the Bay of Bregenz, Lake Constance, Austria. Two of these sites were investigated for groundwater discharge. The aim of this study is to investigate the spatial and temporal distributions of groundwater discharge. From May 2016 until February 2017, four field campaigns took place every three months. In total 79 samples were analyzed for Radon-222 as a groundwater discharge indicator. The results show a minimum of 1 Bq m^{-3}, a maximum of 101 Bq m^{-3}, a mean of 12 Bq m^{-3}, and a standard deviation of 15 Bq m^{-3}. The end member concentration of radon in the underlying aquifer was analyzed to be $\sim$ 2500 Bq m^{-3}. A high variability of radon concentrations between the different sampling sites but also within one sampling site and during different sampling days; was encountered. To get a better understanding of the processes influencing dispersal of groundwater in the lake and to be able to interpret the measurement data, the 3D numerical lake model AEM3D was used. Two simulation scenarios for the field campaigns in May 2016 and February 2017 were set up using measured meteorological data around the lake and hydrological data of all major tributaries as driving forces. In a previous study, potential groundwater discharge areas have been identified by anomalies in temperature measurement data. In the present study, the discharge locations in the model were positioned according to these findings. The model results show good correlation with the field data. The strong variability of radon concentrations within time and space is caused by the interplay between lake morphology and mixing processes in the water column, i.e. wind stirring, atmospheric heat exchange, and tributary inflow. According to this data set, two hot spots were selected to log temperature profiles in the sediment in order to quantify the flux of groundwater discharge/ recharge. These temperatures profiles collected data for six months in 2017. Our study found out that a combined tracer and modelling approach can provide important information to explain the spatial and temporal variability of groundwater discharge in a deep lake because many hydrological and meteorological factors influence the data collection and interpretation. This new knowledge about groundwater – lake – interaction can be a great benefit for other lakes.