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Spatial and temporal variability of groundwater-surface water interactions along a lake shore

T. Blume (1), S. Krause (2), K. Meinikmann (3), and J. Lewandowski (3)

(1) GFZ German Research Centre for Geosciences, Hydrology, Potsdam, Germany (blume@gfz-potsdam.de), (2) University of Birmingham, (3) IGB Berlin

Investigating the inflow dynamics of a groundwater dominated lake system is a major challenge as inflow is a) invisible to the eye and b) likely to be highly variable in space and possibly also in time.

In this study the spatial and temporal variability of groundwater–surface water interactions along a lake shore is investigated by combining different experimental methods. Study area is Lake Hinnensee, situated 100 km north of Berlin in the TERENO Observatory of north-eastern Germany. The lake is a purely groundwater dominated with no surface inflows or outflows. The experimental approach includes the measurement of vertical hydraulic gradients along piezometer transects, spatial arrays of temperature profiles in the lake sediment and sediment surface temperature patterns investigated with fibre optic temperature sensing. We thus get an impression of both: spatial patterns as well as their temporal stability. This approach furthermore allows us to carry out a "cost-benefit" analysis for the different methodologies, comparing effort with scientific benefit.

The results show that groundwater exfiltration into the lake is to some extent variable in time and it is highly variable in space: there is a strong gradient perpendicular to the lake shore as well as high heterogeneity along the lake shore.