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Spatial variability of groundwater-lake exchange and its controlling factors at Lake Fürstenseer See, Germany

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Decreasing lake levels were observed in the last 20 years at several lakes in northeast Germany including Lake Fürstenseer See. The decrease in water level of this enclosed lake added up to 1.25 m from 1988 until 2006. In lakes without inflow or outflow, groundwater-lake exchange plays an important role in the entire lake water budget.

The aim of this study is to investigate the spatial variability of groundwater-lake interactions at the Fürstenseer See and to understand the controlling factors behind the observed patterns.

The exchange of the lake with the adjacent groundwater system is currently being investigated using piezometer nests and temperature as natural tracer. 20 piezometers were installed to monitor a section of the lake shore where main inflow is expected. Hydraulic gradients are measured continuously using pressure sensors as well as manually on a monthly basis. Temperature surveys were carried out in summer 2011 and 2012. Thereby vertical temperature profiles to a depth of 0.4 m were measured in 10 m intervals at 0.5 m and 1.5 m distance from the shoreline.

The measurements indicated that groundwater inflow is highly variable in space, varying from 37 to 174 L/m^2/day and strongly decreasing with distance to shoreline. The general exchange patterns seem to be stable in time. This temporal stability will be tested with a third temperature survey in January 2013.

Linkages between exchange rates and possible controls are investigated with additional surveys and data analyses focussing on lakebed and shoreline morphology, sediment heterogeneities, general groundwater flow paths and vegetation patterns.