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## **Extended Abstracts**

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title: **Hydrology of a groundwater dependent Esker lake**

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## **INTRODUCTION**

In Finland, the main source of groundwater is from esker deposits from the last ice age. Small lakes are typically found in eskers. These lakes are formed in the last glacial stage where ice melted and a hollow depression was left. These lakes usually lay in the groundwater sand deposit with no specific outlet or inlet. Also the catchment for surface water is often small. Lakes at Rokua esker have been suffering from large water level changes and a permanent decline of water level has raised considerable concerns as the area is also used for recreational and tourism. A potential threat for the lakes and the groundwater is the drainage of peatlands which normally are found in the discharge zone of the aquifer. As the lake catchments are potentially small without inlets and outlets also the natural variation in water levels could be high. The aim of this study was to understand in more detail the hydrology of the groundwater deposit and the lake systems so potential causes for lake level variations could be determined.

## **MATERIALS AND METHODS**

A small lake within the esker Rokua was studied in detail. Direct seepage measurements were carried out using the approach by USGS with some modifications (Rosenberry, LaBaugh, 2008). The seepage was measured at regular intervals around the lake. Climate data was observed and groundwater levels and water levels registered with pressure probes. Long term data on climate and hydrology was also used for comparison.

The dynamics in the lake water level changes were modeled with a water balance approach in Matlab. The model included estimation for seepage and the groundwater-lake interaction.

## **RESULTS**

The preliminary results from 2009 show that the direct seepage measurements show large variation in seepage along the shoreline with a clear area of water input and a clear area of water output. The water balance model clearly shows that the water level changes depend on climatic variations (precipitation and evapotranspiration). Also seepage from the lake is a significant component in the water balance.

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## **REFERENCES**

Rosenberry D.O., LaBaugh J.W., 2008: *Field techniques for estimating water fluxes between surface water and ground water*. U.S. Geological Survey Techniques and Methods 4–D2. 128 p.



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