



Water budget determination for Northern groundwater dependent lakes using stable isotopes of water

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Understanding groundwater - surface water interaction is crucial in numerous water resources management problems. Stable isotopes of water can bring understanding of this interaction especially in catchment scale questions. In this study stable isotopes were used in a Finnish esker aquifer (Lat 64.58°, Lon 26.50°) where groundwater dependent lakes have suffered from seasonal water level declines. Esker aquifers are the main groundwater reserves in Finland used in water abstraction. In order to determine how hydrology of the lakes is dependent on groundwater, the isotopic composition of oxygen and hydrogen was studied from 36 sampling points during years 2010 to 2012. Samples were taken from 13 groundwater pipes, 11 lakes and 11 streams during winter, spring, summer and autumn. Additionally local precipitation was sampled. The CRDS-method (Picarro L2120-i analyzer) was used to analyze $\delta^{18}\text{O}$ - and $\delta^2\text{H}$ -values. The data from the study was used to define the Local Meteoric Water Line of the site ($\delta^2\text{H} = 7.60 \delta^{18}\text{O} + 6.70$) and the groundwater line of the esker aquifer ($\delta^2\text{H} = 7.59 \delta^{18}\text{O} + 4.79$). The groundwater line of the esker aquifer differs from the groundwater line of Finnish groundwaters ($\delta^2\text{H} = 8.51 \delta^{18}\text{O} + 16.65$) based on previous studies. This emphasizes the importance of using local isotopic values when stable isotopes of water are used in hydrological studies. Furthermore, the isotopic compositions of the examined lakes differed enough from the isotopic composition of the local groundwater to separate groundwater component in the lake hydrology. The results also verified that evaporation from lakes in Northern Finland can be high enough to utilize isotopic method for determination of groundwater and surface water interactions.