Geophysical Research Abstracts
Vol. 18, EGU2016-16422, 2016
EGU General Assembly 2016

Groundwater-surface water interactions: the behavior of a small lake connected to groundwater

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Interactions between lakes and groundwater have been under concern in recent years and are still not well understood. Exchange rates are both spatially and temporally highly variable and are generally underestimated. However these interactions are of utmost importance for water resource management and need to be better understood since (i) the hydrogeological and geochemical equilibria within the lake drive the evolution of lakes' ecology and quality, and (ii) groundwater inflow, even in low rate, can be a key element in both the lake nutrient balance (and therefore in lake's eutrophication) and vulnerability to pollution. In many studies two main geochemical tracers, i.e. water stable isotopes and radon-222, are used to determine these interactions. However there are still many uncertainties on their time and space variations and their reliability to determine the lake budget. Therefore, a lake connected to groundwater on a small catchment was chosen to quantify groundwater fluxes change over time and the related influences on the lake's water geochemistry. Through analyse in time and space of both tracers and a precise instrumentation of the lake, their variations linked to groundwater inflows are determined. The results show that each tracer provides additional information for the lake budget with the interest to well determine the information given by each measurement: the radon-222 gives information on the groundwater inflows at a point in space and time while water stable isotopes highlight the dominant parameters of the yearly lake budget. The variation in groundwater inflows allow us to discuss lake's evolution regarding climate and environmental changes.