Geophysical Research Abstracts
Vol. 21, EGU2019-1308, 2019
EGU General Assembly 2019

From point to catchment scale – using soil moisture observations to understand karstic discharge behavior at the Swabian Alb (Germany)

Romane Berthelin (1) and Andreas Hartmann (1,2)

(1) Chair of Hydrological Modelling and Water Resources, University of Freiburg, Germany (romane.berthelin@hydmod.uni-freiburg.de), (2) Civil Engineering, University of Bristol, UK

In many countries, karst groundwater is an important source of drinking water. Due to their importance for water management, karst systems have been studied for many years. The most typical approach to characterize a karst system is the disintegration of its output signal measured at the karst spring which includes discharge observations, the hydrochemical signal or tracer information. In this ongoing study, we elaborate on the value of soil moisture observations to characterize the input signal to the aquifer, i.e. the karstic groundwater recharge dynamics. We hypothesize that karstic recharge occurs when precipitation exceeds the saturation deficit of the soil and that recharge volumes can be estimated by the accumulated rainfall during saturation. Our study site is located at the Swabian Alb karst region (Germany). The site is drained by several karst springs and streams whose contributing areas are not exactly known. In order to account for the variability of soil types, soil thicknesses, and land use types, we use >90 locations to measure soil moisture at two depths (10cm and 20cm) that are distributed between forest and grassland. To identify the beginning and end of the soil saturation period for each individual location, data transformation (e.g., moving averages or filtering) is necessary. Using the periods of saturation, we can estimate the amount of potential groundwater recharge for each soil moisture monitoring location. To upscale local recharge to the contributing areas of the karst springs and streams, we compare different upscaling methods that (1) scan for a single "most representative" measurement location, (2) calculate average recharge values of selected subsets, and (3) distinguish between grassland and forest. To benchmark the different upscaling methods, we use runoff volumes derived from the karst spring discharges and stream discharges. We are confident that our study will contribute to a better understanding of how scale transitions affect hydrodynamics and overall provide a direction for more precise recharge estimations in karstic regions.