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Determination of a high-altitude karstic aquifer recharge conditions: case study of Savica River aquifer in NW Slovenia

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The recharge area of a high altitude karst aquifer of Savica River in NW Slovenia was researched with the means of snow water equivalent (SWE) modelling, snow cover area (SCA) variability and discharge analysis in order to determine its recharge characteristics, mainly the impact of snowmelt to the investigated aquifer. Savica River is located in the Julian Alps and originates from two separate karstic springs at the end of caves, with Velika Savica contributing up to 82 % and Mala Savica up to 17 % to the whole discharge of the river, averaging 5,1 m3/s. The river represents the main tributary of the Bohinj Lake. The general area represents a karstified terrain, formed mainly in Upper Triassic Dachstein limestone. The impact of snowmelt in karstic aquifers, especially in mountain environments, is not well researched, lacking firstly in information on the processes occurring in the snowpack in connection to groundwater flow processes and secondly in monitoring data. For this study, precipitation, snow depth, and temperature data was used from meteorological stations in the area for SWE determination. Daily SWE variation was calculated with an empirical equation and a deterministic point-snowmelt model. 8-day composits of 500 m maximum snow cover area from Terra MODIS were used for SCA curve derivation. Savica River discharge data measured downstream at the gauging station Savica Ukanc was compared with both types of results, leading to a qualitative estimation of snow impact in relation to rain event recharge of the aquifer in question. Snow cover ablation at the beginning of the snowmelt season in early spring was shown to generally coincide with the main increase in river discharge although still showing response to rain events as rapid and higher wavelength increases in discharge throughout the hydrological year. A karstified network of conduit channels with low retention in the investigated aquifer and a presence of a snow-dominated mountainous catchment was confirmed adding to the current state of hydrogeological research of the area until now conducted mainly by speleological and isotopic investigations. The characterisation of the aquifer's recharge area was improved, its altitude estimated between 1600 masl and 2500 masl.