EGU21-9987
https://doi.org/10.5194/egusphere-egu21-9987
EGU General Assembly 2021

Understanding storage and discharge behavior of a high-elevated and geologically complex karst catchment using numerical approach, Dolomites (Alps)

Giorgia Lucianetti[1], Zhao Chen[2], Andreas Hartmann[3], and Roberto Mazza[4]
[1]University of Roma Tre, Science Department, Viale Guglielmo Marconi 446, 00146 Rome, Italy (giorgia.lucianetti@uniroma3.it)
[2]Environmental Resources Management, Siemensstr. 9, 63263 Neu-Isenburg, Germany (chen.zhao@gmx.de)
[3]Chair of Hydrological Modeling and Water Resources, Freiburg University, Freiburg, 79098, Germany (andreas.hartmann@hydmod.uni-freiburg.de)
[4]University of Roma Tre, Science Department, Viale Guglielmo Marconi 446, 00146 Rome, Italy (roberto.mazza@uniroma3.it)

Water resources from high-alpine karst aquifers are used for drinking, hydropower generation and artificial snowmaking. Therefore, understanding of their storage and flow dynamics is crucial for a sustainable water management. However, high-alpine karst areas are characterized by a great geological complexity due to the presence of mountain block fractured and karst aquifers interdigitating with the heterogeneous valley floor porous aquifers. For that reason, hydrogeological characterization and model prediction remains a big challenge. In this work, we investigated a geologically complex alpine catchment in the Dolomites (Italian Alps) by using experimental data and a reservoir numerical model to simulate three years of stream discharge. The structure of the model is based on experimental knowledge of the catchment and on previous studies and investigations. It (1) includes snow dynamics and accounts for hydrogeological heterogeneities, (2) separately considers karstic conduit and matrix flow in a dolomitic aquifer and flow through the porous deposits accumulating on the slopes and at the valley floor in an unconsolidated aquifer (non-karst), and (3) takes into account the groundwater transfer between the two aquifers. In the frame of a multi-step model evaluation, we used a Regional Sensitivity Analysis with three performance measures including observations of catchment discharge, karst spring discharge and unconsolidated aquifer spring discharge to assess the realism of model simulations. We show that the newly developed model reliably reproduces the hydrogeological variability of the catchment, even during strongly different hydroclimatic conditions. Analyzing its simulated storage dynamics, we can show that despite its moderate storage, the porous aquifer contributes most to catchment discharge, while the largest storage of the system is the matrix of the dolomite aquifer that recharges the unconsolidated aquifer together with discharge from the karstic conduits. A clear seasonality of groundwater storage in the karst matrix and of unconsolidated aquifer discharge indicates a strong sensitivity of this complex aquifer system to climatic variability.