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Baseflow separation methods in snowfed rivers in Mediterranean catchments: a process-oriented assessment for hydrograph analysis

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Water storage availability of semiarid regions is closely linked to the snow reservoir and its changes. The change of hydrological regime in mountain rivers is strongly affected by the snowpack's dynamics, which plays a crucial role during spring and/or summer season in Mediterranean areas, becoming one of the major water sources to streamflow. This influence can be analyzed from different approaches; however, due to the concurrence of different processes, whose interaction and propagation undoubtedly affect runoff and baseflow generation, a process-oriented approach is required for further understanding the ultimate reasons behind the observed changes. Hence, the partitioning of river flow into baseflow, subsurface flown, and runoff, is a key step in hydrograph analysis and for better understanding snowfed rivers and how climate variability can influence their regime.

This work presents an assessment of different baseflow separation methods in mountain rivers of semiarid areas in the framework of a process-oriented approach for identifying the major sources/sinks of water. The study area comprises the headwaters of the different basins in the Sierra Nevada area, in southern Spain, within an altitudinal range of 1000-3479 m a.s.l., high slopes, and different facing. For this, a 20-yr series of daily flow in a gauged point in the Guadalfeo River that drains the southwestern area of Sierra Nevada is analyzed. Five standard baseflow separation methods, together with the simulation by the physically-based hydrological model WiMMed, which includes the module SNOWMED developed from an energy-water balance approach and validated in the study site, were selected and their results compared. Discussion on the effects of the final baseflow series on the descriptors of the direct-runoff hydrograph (daily time step) series is also included, considering snowmelt- and rainfall-driven events, and their combination.

The results not only provide a better understanding of baseflow separation in snowfed rivers in semiarid regions, but also assess hydrograph analysis in a process-oriented approach.