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Multiple approach for base-flow assessment in a typical Mediterranean basin

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A typical Mediterranean landscape resulting from the co-evolution of climate-soil-vegetation interactions is characterized by densely vegetated (Mediterranean macchia) steep hillslopes and large flat gravelly alluvial plains with multiple meandering river bed. Therefore, the dominant runoff generation process takes place in the form of the saturation excess mechanism occurring in the coarse alluvial aquifer at the valley bottom which is in turn fed laterally by the subsurface flows through the hillslopes. This mechanism characterizing the water balance partitioning and flows through the catchment hydrogeological units is under investigation in an experimental site representing a closed system for surface and groundwater flows conveying into an artificial reservoir in which the storage volume is monitored (as well as other minor fluxes). A physically-based mathematical filter was calibrated on long term climatic/hydrologic signatures - modified from Furey & Gupta (2001) - and applied to the daily records of rainfall and inflows to the lake in order to estimate the time series of the base-flow component (i.e. hydrograph separation). The results of the filter show that the groundwater contribution to the reservoir inflows is dominant (with a BFI approaching 85%). A validation experiment was then performed on crucial water balance signatures obtained through the widely documented process-based model, SWAT, capable of estimating both groundwater and surface components of the inflows to the reservoir (as well as evapotranspiration) on a daily base. A good agreement was found in such signatures compared to those obtained from the estimation procedures involved in the mathematical filtering which instead follow a fully data-driven approach. Moreover, these findings are now being validated through a recently installed system for water table and flow monitoring in the alluvial aquifer which is operated in parallel with the existent weather stations and reservoir inflow measurements.