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Hydrological response of the Mediterranean catchments- A review

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The Mediterranean region is a water stressed environment with increasing climatic and anthropogenic pressures. This work presents a review of 120 hydrological studies carried out in the Mediterranean region. It contributes to the ongoing hydrological research initiative on "Hydrology in a changing world" launched by the IAHS in 2014. It aims to understand the characteristics of hydrological response under Mediterranean conditions, taking into account changes driven by anthropogenic and climatic factors; and to compare modeling and regionalization approaches in use. The study region is divided into three sub-regions: Northwestern Mediterranean (NWM), Eastern (EM) and Southern Mediterranean (SM). Information on catchments responses and modeling approaches at different time scales (annual, dry season and event) were extracted from published studies, and analyzed. Results indicate regional discrepancies (between NWM, EM and SM sub-regions) in the distribution of climatic and hydrological response characteristics at the annual and the event scale. The NWM catchments are the wettest, and the SM catchments are the driest, while the EM catchments are intermediate and exhibit the largest variability. The NWM sub-region shows the most extreme rainfall regime in the Mediterranean, particularly, in an arc that extends from Northeastern Spain to Northeastern Italy. Observations indicate decreasing tendency in water resources due to both anthropogenic and climatic impacts, and a more extreme rainfall regime. Moreover, Mediterranean catchments show very heterogeneous responses in time and space which make the modeling of their hydrological functioning very complicated and data demanding, with increasing model limitations and uncertainties. Nevertheless, the models in use are classical ones; very few were developed to address these regional specificities. Regionalization studies in the Mediterranean are scarce even in term of low flows and FDCs which is surprising in a water-stressed region that witnesses long low-flows periods. Predictions of runoff hydrograph give poor results. For flow duration curves and low flows regionalization, statistical and geo-statistical methods appear to outperform parametric approaches and regression respectively. Mixed results were found for regional flood analysis which appears to be the most common regionalization practice in the area. Finally, given the great heterogeneity in the hydrological responses of Mediterranean catchments and the increasing anthropogenic and climatic pressures, the region appears to be in need for more detailed observations and new modeling techniques adapted to its specificities.

Keywords: hydrology, catchment, Mediterranean, modeling, regionalization, anthropogenic impact, climate change.