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Characterization of the hydrological response of Mediterranean catchments at the annual water balance and the event scales

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Comparison studies of catchment hydrological behavior across various locations and temporal scales is a major tool for understanding hydrological processes and patterns that govern catchment responses. This work is a synthesis of hydrological studies reported in the literature covering over 200 catchments across the Mediterranean climates. It aims to characterize the hydrological response of Mediterranean catchments at the annual water balance scale and the event scale. For the former, physical and climatic catchment descriptors (area, elevation, slope, forest cover, karst, annual precipitation, annual evapotranspiration, aridity index), and catchment response indices (annual runoff, specific discharge, runoff coefficient) were extracted. While at the event scale, information related to the catchment wetness conditions, alongside with the meteorological event characteristics (date, duration, rainfall depth, rainfall intensity) and catchment response indices (runoff depth, maximum peak discharge, event runoff coefficient) were taken into account. Plotting these descriptors at both scales, showed that geographical proximity is a good indicator of catchment behavior with neighboring catchments exhibiting similar responses. At the annual scale, catchment response is mainly controlled by climatic forcing (precipitation and aridity index), moreover basin's annual runoff coefficient seems to increase with altitude. Catchments areas seem to only have an impact on small catchments (Area < 100 Km^2). However, some catchments exhibit a high runoff coefficient for Mediterranean climate; these are mainly catchments with predominantly groundwater contribution to surface water due to fractured substratum (Karst). At the event scale, results shows that catchment response, in term of maximum peak discharge and runoff coefficient, is strongly positively correlated with catchment wetness conditions and rainfall intensity. Catchment response time is also positively correlated with catchment area. The severity of the meteorological event and its respective response are highly affected by climatic conditions, with events in humid regions (Mediterranean Europe) being far more severe than in driest areas (Eastern Mediterranean). The study also presents a brief comparison with other climates worldwide.

Keywords: catchment hydrology, annual water balance, rainfall-runoff event, Mediterranean catchment.