Seasonal meteorological forcing controls runoff generation in a Mediterranean mountain catchment

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**Keywords.** Runoff; Seasonality; Forest; Mountain catchment; Hydrological response

**Abstract.** Hydrological processes in Mediterranean climates featuring an increment in the frequency of dry periods are being increasingly studied. However, our knowledge on how the seasonality in meteorological forcing controls runoff generation in mountain, forested catchments in the Mediterranean area is still rather poor. In this context, this work aims at better understanding the role played by seasonal variability in meteorological forcing on the hydrological response of a small catchment in central Italy.

The Re della Pietra experimental catchment (2 km2, 650-1280 m asl) is located in the Tuscan Apennines, and, on average, receives 1180 mm of precipitation/year unevenly distributed through a wet (November-May) and a dry period (June-October). Forest cover is close to 100%, consisting mainly of beech trees, with minor oak trees and conifers. The equipment includes a weather station, four stream gauges (0.3 – 2 km2), soil moisture probes at two depths, stream electrical conductivity probes in three stream sections, three groundwater wells, nine sapflow sensors and 12 multiparametric tree probes.

Results from 2021 showed that runoff response to rainfall was rapid throughout the year at all spatial scales but long hydrograph recessions were observed during the wet period, and high peaks with flashy response occurred in the dry period. Soil moisture clearly responded even to small rain events and showed a strong seasonal behaviour as well, with a coupled response and very similar values at both depths in the wet season, and a decoupling in the dry season. Conversely, groundwater table responded only to major events (>10 mm).

During the wet period, event water proportion in the stream estimated through electrical conductivity was higher in the headwaters, then becoming similar at all scales during the dry period, when pre-event water dominated. Diel fluctuation patterns in streamflow were observed at all scales in summer and were consistently time-shifted compared to sap flow and stem radial variation of beech trees, revealing a strong influence of evapotranspiration on runoff generation.

Overall, these results provide new and useful insights on the seasonality of hydrological response of Mediterranean mountain catchments at different spatial scales.

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