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The observed evapotranspiration combining the energy and water balance for different land use under semiarid Mediterranean catchment

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The Mediterranean semiarid cultivated catchments are affected by global and climate change and are characterized by very complex hydrological systems. The improvement of their management requires a best understanding of the hydrological processes and developing reliable means for characterizing the temporal dynamics of soil water balance in a spatially distributed manner. The main objective of this study is: i) to analyze the observed evapotranspiration in relation to natural drivers (i.e. rainfall and soil properties) and anthropogenic forcing (i.e. land use and crop successions), and) ii to assess the differences in both energy and water balances. We focus on a hilly semiarid Mediterranean catchment devoted to rainfed agriculture, so-called the Kamech catchment, which is located in the Cap Bon Peninsula, north-eastern Tunisia. The site belongs to the OMERE observatory for environmental research and it is monitored for the different hydrological cycle components under influence of anthropogenic forcing. The analysis is based on in-situ data measured under the common cereals/legumes/pasture cropping systems within the Kamech catchment. Energy and water balance components and vegetation parameters were collected in different fields and during various crop growth cycles. The results showed the highly variable response of energy and water balances depending on soil types, land use, and climatic conditions. The annual rainfall is mainly converted into evapotranspiration during the growing cycle for different land uses. The runoff amounts, for most of the sites, correspond to less than 10% of the rainfall amount. The evapotransipration ratios differed significantly across site and season in relation to soil properties and cumulated rainfall. We observe large differences in soil water dynamics among the legumes (fababean and chickpea) and cereals (wheat, oat, and triticale). Soil water is larger for legume crops, despite substantial plant growth during winter-spring. This is ascribed to the shallow root systems of fababean and chickpea that induces a restricted access to deep water. Despite drought conditions during summer, bare soil following annual pasture and legumes corresponded to larger amounts of soil water as compared to cereals. The amount of available water observed ranges from 0 mm to nearly 100 mm.