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Monthly variations in rainfall and time to ponding in Mediterranean soils: implications on effective runoff generation

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Saturation of top soil is a critical issue in runoff generation. Time to ponding depends on the potential flux flow, the volumetric water content at initial and saturated conditions, the saturated hydraulic conductivity (K_{fs}) and the maximum rainfall intensity (I_{30}). Runoff appears when soil is saturated and rainfall intensity is higher than soil infiltration. In this work both time and rainfall to ponding are calculated at monthly scale for different types of soils in a subcatchment of the Estaña's Lakes area (External Ranges of the Spanish Pyrenees). Soils in the study area are Calcisols, Lithic Leptosols and Rendzic Leptosols. Monthly cumulative runoff was calculated by using a combined flow algorithm and monthly effective runoff was obtained after accounting the effect of soil microtopography, roughness, infiltration properties and number of monthly erosive events. Time to ponding varies significantly for the different soil types and month of the year. The lowest values occur in September and the highest in January with values ranging from 32 to 837 seconds in Calcisols. These soils do not become saturated in March and December due to the low values of I_{30}. Lithic Leptosols only become saturated in September and Rendzic Leptosols in July and September when I_{30} is higher than K_{fs}. Antecedent soil moisture also varies seasonally for the different soil types. The percentage of rainfall to ponding from the total monthly precipitation varies from 0.8 % in September to 7.1 % in January in Calcisols and from 0.01 % in September to 0.05 % in July in Rendzic Leptosols and is 0.2 % in September in Lithic Leptosols. The percentage of effective runoff generated in September represents 58 % of the annual volume of effective runoff though rain-

fall recorded in September only represents 14 % of the annual rainfall. The volume of effective runoff in May and October is much lower than in September in spite of similar values of precipitation because I_{30} in May and October is much lower than I_{30} in September. These results highlight the key role of the parameters of I_{30} and K_{fs} in controlling the generation of runoff. The estimation of monthly effective runoff facilitates the comprehension of the effect of the temporal variations of climatic and soil properties. The information gained can be of interest to understand and control the processes of runoff generation in Mediterranean environments.