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Influence of SWR on the hydrological response on two contrasting Mediterranean hillslopes at plot scale using rainfall simulations.

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Soil water repellency (SWR) has proved to be a common phenomenon in Mediterranean environments, where it is favored by a four-month-long dry season and a high organic matter input in the soil from vegetation. Among the main effects of SWR are reducing infiltration and enhancing overland flow. The objectives of this study are: i) to characterize the SWR in two contrasting hillslopes and over different microenvironments; ii) to determine the effect of SWR in infiltration, run-off generation and soil loss processes.
The experimental area is located in southern Spain (36°50′N, 4°50′W), 22 km northwestern of the city of Málaga, and includes two hillslopes having different exposures. In general, the area is characterized by a dry Mediterranean climate (mean annual precipitation: 576.1 mm year-1; mean annual temperature: 15.7°C), the dominance of water erosion processes on steep hillslopes (> 12.5°) with a substratum of metamorphic rocks (phyllites). Vegetation cover consists on an open wood of cork oak with typical degraded Mediterranean scrub, where the dominant genus is Cistus spp. Soil depths range from 20 to 50 cm.
Three soil microenvironments were selected on each hillslope: Soil covered by Cistus spp. and litter, soil covered by Cistus spp. removing the litter and bare soil. On each microenvironment SWR was measured by mean of WDPT method and 5 rainfall simulations was performed. Experiments were carried out in September, after a prolonged drought period, when SWR is supposed to be most strongly expressed.
The water repellency for all micro-environments was an order of magnitude greater on the north-facing hillslope ($p<0.000$), where the greatest value was found for plots of Cistus spp. with litter (843.2 s $\pm$ 675.4 s, followed by plots of Cistus spp. without litter (492.0 s $\pm$ 56 s) and bare soil plots (97.4 s $\pm$ 86.7 s). On the south-facing hillslope the Cistus spp. plots with and without litter had mean water repellency values of 77.3 s $\pm$ 49.3 s (strong repellency) and 35.9 s$\pm$ 34.8 s (slight repellency), respectively. The bare soil on the south-facing hillslope had negligible repellency (< 5 s). SWR had an evident effect in the hydrological response of the north-facing hillslopes, where ten of 15 experiment generated runoff, although the coefficients were low. In contrast, in the south-facing hillsope, where SWR was lower, the influence of this property was not detected. In this hillslopes only four experiments generated runoff and three of them were conducted in bare wettable soil.