Geophysical Research Abstracts
Vol. 17, EGU2015-2032, 2015
EGU General Assembly 2015

Influence of throughfall spatial and temporal patterns on soil moisture variability under Downy oak and Scots pine stands in Mediterranean conditions

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Temporal and spatial variability of throughfall and stemflow patterns, due to differences in forest structure and seasonality of Mediterranean climate, may lead to significant changes in the volume of water that locally reaches the soil, with a potential effect on groundwater recharge and on hydrological response of forested hillslopes.
Two forest stands in Mediterranean climatic conditions were studied to explore the role of vegetation on the temporal and spatial redistribution of rainfall. One is a Downy oak forest (Quercus pubescens) and the other is a Scots pine forest (Pinus sylvestris), both located in the Vallcebre research catchments (NE Spain, 42º 12'N, 1º 49'E). These plots are representative of Mediterranean mountain areas with spontaneous afforestation by Scots pine as a consequence of the abandonment of agricultural terraces, formerly covered by Downy oaks. The monitoring design of each plot consists of 20 automatic rain recorders to measuring throughfall, 7 stemflow rings connected to tipping-buckets and 40 automatic soil moisture probes. All data were recorded each 5 min. Bulk rainfall and meteorological conditions above both forest covers were also recorded, and canopy cover and biometric characteristics of the plots were measured.
Results indicate a marked temporal stability of throughfall in both stands, and a lower persistence of spatial patterns in the leafless period than in the leafed one in the oaks stand. Moreover, in the oaks plot the ranks of gauges in the leafed and leafless periods were not significantly correlated, indicating different wet and dry hotspots in each season. The spatial distribution of throughfall varied significantly depending on rainfall volume, with small events having larger variability, whereas large events tended to homogenize the relative differences in point throughfall. Soil water content spatial variability increased with increasing soil water content, but direct dependence of soil water content variability on throughfall patterns is difficult to establish.