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Hydrological response variability in a small vineyard catchment (D.O. Penedès, NE Spain): effects of rainfall intensity and soil moisture conditions

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The catchment of Hostalets de Pierola, a small tributary of the low course of the Anoia river (Llobregat basin), is located in the Catalan Prelitoral Depression (Penedès Depression) on Pliocene gravels and detritic Miocene substratum. The catchment size is 0.46 km2 with an average slope of 7.2 %. The main land use in the catchment is vineyards (62.3 %), with other crops and land uses with minor occupation: olive trees 4.8 %, winter cereals 9.5 %, alfalfa 8.5 %, among other).

In order to carry out a research on the hydrological response and sediment transport in a representative catchment of vineyard areas in the Spanish Mediterranean region, the catchment was equipped with pluviographs to measure rainfall amount and intensity, soil moisture content sensors and a flume (HL 4" type) to measure water flow in the outlet. This water gauging allows to measure flows up to 3400 l•s-1, and it is equipped with two ultrasonic level sensors and a data-logger for data register. In parallel, monitoring of subsurface water flow of the catchment was carried out in the natural source called Can Flaquer.

During the springs of 2011 and 2012 several rainfall events occurred, which allow a preliminary analysis of the hydrological response of the catchment, in comparison with rainfall characteristics (depth and intensity) and the antecedent soil moisture content. The spring events include episodes up to 27 mm, with maximum intensities of 50 mm•h-1 and peak flows up to 1100 l•s-1. The surface runoff of the catchment ceases very quickly, in a few hours after the end of rainfall events, indicating a limited role of soils in water retention and a very active percolation into the aquifer of the Pleistocene gravels. The runoff rates of the analyzed events were relatively low (between 1 - 12 %), depending on the rainfall characteristics and the antecedent soil moisture, indicating a high soil permeability. An important part of the infiltrated water follows a slow subsuperficial way to the water source, which maintains a continuous flow ranging between 0.2 and 0.6 l•s-1.

The analyzed floods occurred with important sediment yield generated in the agricultural fields of the catchment as well as in the unpaved paths that constitute the drainage ways. This causes important erosion problems in the fields and accumulation of sediments in the lower part of the catchment.