



## Analysis of high-resolution flow vs. suspended sediment concentration curves to determine sediment sources in agricultural and forestry watersheds with contrasting characteristics

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The Government of Navarre (Spain) began to implement in 1995 a network of five watersheds representative of different agricultural and forestry conditions in Navarre. In this paper we focus on 4 of them. La Tejería and Latxaga watersheds occupy about 200 ha in a humid sub-Mediterranean climate and are almost completely cultivated with winter grain. Oskotz Principal watershed comprises 1,688 ha under sub-Atlantic climate, most of it covered with forest (61%) whereas the remaining area is covered by pastures and arable land. Within the Oskotz watershed, a 434 ha sub-watershed almost fully covered with forest namely Oskotz Forested, is also monitored.

Ten-minute data on flow (Q), water turbidity (T) and the most important meteorological variables are recorded in all the watersheds. Samples are collected daily to determine the concentration of suspended sediments (SSC) and various dissolved substances. In addition, and since 2006, during particularly heavy rainfall-runoff events, another parallel sampling is activated to determine the sedimentogram in much greater detail. The number of samples taken depends on the Q and T variations detected.

For this study, events have been selected that meet the following requirements: i) there is a clear raising flow phase and a clear decreasing flow phase; ii) at least six samples have been collected and processed throughout the event for SSC determination; iii) the linear regression between Q and T yields a value of  $r^2 > 0.75$ . From this regression equation it is possible to obtain a very detailed sedimentogram (tenminute basis).

A total of 30 events meet the requirements, 7 in La Tejería, 9 in Latxaga, 5 in Oskotz Forestal and 9 in Oskotz Principal. Hysteresis is observed in all of them. In the cereal watersheds, 75% of the hysteresis curves are of hourly character, that is, with the peak of the sedimentogram located in the rising part of the hydrograph. In these watersheds, the remaining 25% correspond to curves with a complex structure linked to the occurrence of several flow peaks in the same event, which will require further study. In the Oskotz Forestal watershed 3 of the curves are clockwise and two are "eight" shaped, while in Oskotz Forestal 8 of the nine curves are clockwise and one is "eight" shaped.

These preliminary results suggest that in the cereal watersheds the main sediment sources are in

the proximity to the watershed outlet, probably in the same channels. In the Oskotz watersheds, the main sources are also mostly located in the vicinity of the outlet, although occasionally other sources far from the outlet are also activated, mainly in the forest watershed.