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Temporal changes in suspended sediment transport in an Atlantic catchment, NW Spain

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Suspended sediment dynamics are still imperfectly understood, especially in Northwest of Spain, where few studies have been conducted. Using a dataset up to three years long
in the Corbeira catchment (NW Spain), the variability in suspended sediment load at different temporal scales (within-events variability, monthly–seasonal and annual) is analysed in this paper. The Corbeira catchment has an area of approximately 16 km2 and varies in altitude from 474 m asl at the highest point to 60 m asl at the outlet. The area has steep slopes, where dominate slopes are between 13 and 25%. The geology of catchment is characterised by basic schist. Main soil types are classified as Umbrisol and Cambisol. Soils are acidic and rich in organic matter. The soil texture is silt and silt-loam. Land cover consists of a mixture of forest (65%) and agricultural fields (mainly grassland, pasture and maize). Soil management is conventional. The type of cultivated land management (especially in cultivate maize land) produced areas of bare soil during a large part of the year, what potentially exacerbate the delivery of fine sediments from sources areas to the stream.
The catchment has been monitored since 2004 to study hydrochemical as well as hydrological and sediment response in a temperate humid environment. At the outlet discharge was continuously measured and suspended sediment were determined for 54 runoff events as well as under baseflow conditions during the study period (October 2004 to September 2007). Suspended sediment concentrations were determined by the gravimetric method. Suspended sediment load was calculated from the suspended sediment concentrations and discharge data. Within the catchment visual surveys were conducted after each rainfall event, especially in agricultural areas, to obtain information on erosion and sedimentation features. In areas where rills and ephemeral gullies erosion occurred, sediment production was evaluated by measuring channel volume. Sediment deposition areas were also measured.
The obtained results show that, on the within-event scale, most of the sediment peaks precede the discharges, implying that nearby zones to the stream are the main sediment source areas. In several cases it observed that rills and ephemeral gullies developed in cropland were the main source of sediment delivered to the stream. On the other hand, independent of the occurring sequences of the peaks of sediment and discharge, most of the events could present a clockwise hysteresis loop resulting from soil erosion. Furthermore, it was observed that the reduction in the suspended concentration in a sequence of events can be mainly associated with a phenomenon of sediment exhaustion. However, the apparent sediment exhaustion might simply reflect a progressive increase in baseflow dilution.
At the seasonal scale, most of the total annual suspended sediment load is transported during the autumn months, the period in which, generally, the largest number of events and maximum water yield occurred. By the contrary the percentage of the total annual suspended sediment load in summer was very low (<1%).
At the annual scale, the variability in sediment yield (4-11 Mg km-2 y-1) was highly correlated with water yield, resulting from the number and magnitude of events recorded yearly and almost all the suspended load is transported during only few events. For example, in the last hydrological year (2006/07) more than 80% of the suspended sediment load was exported in runoff events involving less than 10% of the time.