Geophysical Research Abstracts
Vol. 15, EGU2013-11898, 2013
EGU General Assembly 2013

Evaluation of soil erosion as a basis of sediment yield in mountainous catchments: a preliminary study in the River Douro Basin (Northern Portugal)

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The River Corgo drains a meso-scale mountainous rural catchment with an area of 295 km2, underlain by crystalline rocks, in a temperate climate, which integrates the transboundary River Douro Basin, in the northeast of Portugal. A geochemical survey on oxic fluvial sediments of the river network shows considerable contents of metals associated to the finer particles (< 63um). The results on the study of the sediment properties indicate that these are essentially detrital in origin, derived from soils and weathering products. Moreover, taking into account the hydrological pattern of the catchment, the seasonal and spatial variability of metal contents associated to the sediments suggests that the control of metal in the sediments by their mineralogical, geochemical and physical properties is governed primarily at the level of the basin soils system, especially in the Wet Period, when the sediments are frequently remobilised (Reis, 2010). Although the soil particles are a common pathway of transport and entrance of metals in the fluvial network by runoff derived erosion, this mechanism is naturally more marked in mountainous catchments.

Modelling sediment and adsorbed contaminant transport within catchments can help to identify possible contaminant sources, as well as to estimate the delivered quantities of eroded material and associated contaminants. In catchments with the described morphological features, monitoring the transport of sediments poses some issues concerning: (a) the low mass yield of suspended sediment from river water, under low-flow conditions; (b) the maintenance of the sediment sampler's devices in the streams, in periods of high-flow or storm events. This study describes the preliminary results of a GIS-based mass balance model of overland sediment transport to the River.

The erosion, the first step of sediment transport, was estimated by an empirical model - The Universal Soil Loss Equation (USLE). The objective was to construct a GIS based potential soil loss spatial index model and posteriorly estimate the sediment yield for different locations within the catchment. The R factor was obtained from the literature; K factor was derived from the Soil Map of Trás-os-Montes; LS factor was calculated from the elevation digital model using the Simms et al. (2003) equation; C and P factors were derived from the Corin Land Cover Map produced for Portugal in 2006. The preliminary results indicate that the model is in accordance with the knowledge of the study area, and can be used as an initial indicator of areas of potential sediment source. So, the results show that potential loss is typically higher along the areas where the tributaries are deeply incised and bordered by steeper slopes, with locally extreme values.

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