Geophysical Research Abstracts
Vol. 19, EGU2017-11993, 2017
EGU General Assembly 2017

Quantifying the transfer times of suspended sediment during floods with 7Be and 210Pbxs measurements in a drained lowland catchment of central France

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Intensification of agriculture after WWII increased soil erosion and sediment supply to rivers in Northwestern Europe. The Louroux Pond catchment (25 km^2), located in the Loire River basin (central France), is representative of these intensively cultivated environments and subject to severe soil erosion and river siltation. This catchment was equipped with an extensive network of tile drains that were installed after 1945 to produce crops in this former wetland.

In order to decrease the deleterious impacts induced by accelerated soil erosion in this region, there is a need to better understand sediment dynamics during flood events. To this end, natural fallout radionuclides were analysed in both sediment sources and suspended matter transiting the river network to quantify the respective proportions of recently eroded vs. resuspended material. Accordingly, 7Be and 210Pbxs concentrations were measured in overland flow and suspended sediment collected in the pond tributaries during a succession of floods that occurred during winter in 2013–2014 and in 2016.

The results show that the mean fraction of recently eroded material transiting these rivers increased from 40 $\pm$ 20% to 80 $\pm$ 20 in 2013–2014, and from 65 $\pm$ 20% to 80 $\pm$ 20% in 2016. These results demonstrate an initial flush of sediment previously accumulated in the river channel during the first winter floods. Then, the fraction of sediment recently eroded from the hillslopes significantly increased during subsequent events. This research illustrates the added value of combining continuous river monitoring and fallout radionuclide analyses to improve our knowledge of sediment dynamics and to protect soil and water resources in these environments.