EGU22-1591
https://doi.org/10.5194/egusphere-egu22-1591
EGU General Assembly 2022
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Monitoring and understanding soil erosion processes in elementary agricultural catchment and its consequences on the hydro-sedimentary fluxes in river (northern France)

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In France, erosion by water run-off is estimated to 1.5 t ha^{-1} yr^{-1} and can reach 10 t ha^{-1} yr^{-1} in the large agricultural area of northern France. The Canche River watershed (1294 km²) in the Hauts-de-France region has been studied since 2016 to better understand its high sensibility to soil erosion. Agricultural soil erosion leads to the gradual disappearance of fertile topsoil, which constitute a non-renewable resource at human time scale. Once the soil is eroded, its pathway through the river may significantly degrade the water quality e.g. in terms of suspended particulate matter and nutrient, fertilizer, pesticide, and heavy metal input. Since almost a decade, efforts are made to reduce soil erosion by installing anti-erosion equipment such as fascines, grass strips, and retention basins. The aim of this study is to understand and characterize erosion process from small to large scale.

This study presents the monitoring of two intercalated sub-catchments from the Canche River watershed. The first elementary catchment (Pommeroye creek; 0.54 km²) disposes of a multiparameter high frequency (10 min) monitoring station (turbidity, liquid yield, conductivity, automatic sampling) completed by monthly field monitoring of the soil surface characteristics. This monitoring aims to understand detailed erosion processes such as hysteresis phenomena or the impact of anti-erosion management at catchment scale. To support these measurements, drone overflights are carried out to calculate the volume of soil moved or stored in ravines and at fascines between two distinct erosion events.

A second monitoring station further downstream in the intermediate-sized catchment (100 km²) of the Planquette River (tributary of the Canche River) follows the transit of suspended particulate matter to understand the transit time from up to downstream and the hysteresis phenomena between liquid and solid fluxes.

Over the last year (2021), more than 30 erosion events have been recorded on the elementary catchment, showing a variability on the amount of exported soil depending on the rain amount but also on seasonality on the soil surface characteristics and finally, the importance of the

phenomenon of deposition/remobilization of the eroded material. The drone overflights between two important erosion events will help to estimate the importance of this deposition/remobilization phenomenon. The soil surface monitoring during the last year showed clearly the degradation of the infiltrative characteristics leading to an increased susceptibility to erosion. This degradation rate depends on the culture type and the time passed without plant cover.