Quantifying the transfer times of suspended sediment during floods with ^{7}Be and $^{210}Pb_{xs}$ measurements in a drained lowland catchment of central France

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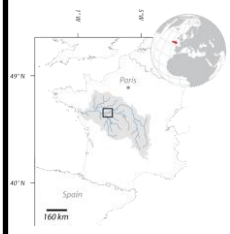
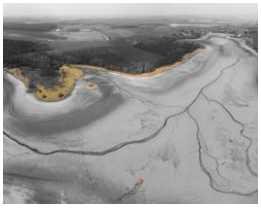
Context



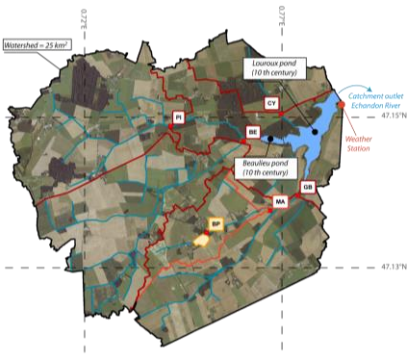
- The Louroux Pond catchment (25 km²), located in the Loire River basin (central France) is representative of intensively cultivated environments of Northwestern Europe.
- It is subject to severe erosion and river siltation.
- This catchment was equipped with an extensive network of tile trains after 1945 to produce crops in this former wetland.

Tile drain



- There is a need to better understand sediment dynamics during flood events in this drained catchment.

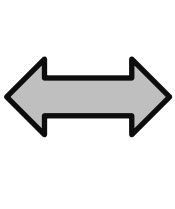
Materials and Methods

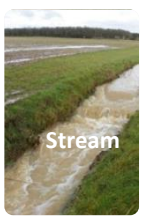


- Hydro-sedimentary parameters (i.e. water level, turbidity) were continuously recorded at the 7 monitoring stations equipped with automatic samplers.
- Three flood events were investigated in 2013-2014, and two successive flood events were studied in 2015-2016.

Radioactive tracers

- In this catchment, sediment was shown to be almost exclusively supplied by surface sources (99 ± 2.5%; Foucher et al., 2015).
- The method based on $^{7}Be/^{210}Pb_{xs}$ measurements is therefore applicable, despite earlier critiques of thus technique (Walling et al., 2013; Evrard et al., 2016).
- The signatures of source material and sediment were compared.





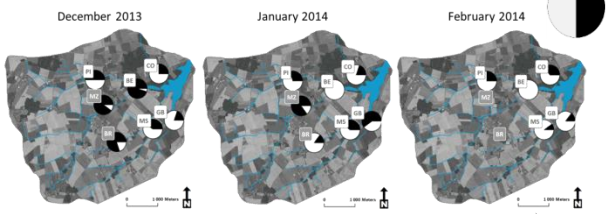
$$\%\ of\ recently\ eroded\ sediment = 100 \times \frac{(A/B)}{(A_0/B_0)}$$

A: ^{7}Be sediment
A_0: ^{7}Be source
B: $^{210}Pb_{xs}$ sediment
B_0: $^{210}Pb_{xs}$ source

Results

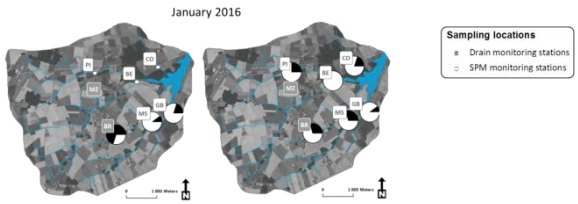
- The mean fraction of recently eroded sediment, estimated for the entire Louroux catchment, increased from 45 ± 20% to 80 ± 20% between December 2013 and February 2014, and from 65 ± 20% to 80 ± 20% in January 2016.

« recent » *« old »*



Progressive exhaustion of sediment previously accumulated in the river channel

	1st flood	2nd flood	3rd flood
% of recently eroded particles	40 ± 20%	70 ± 40%	80 ± 20%
Residence time of particles	95 ± 40 days	40 ± 10 days	15 ± 5 days



	4th flood	5th flood
% of recently eroded particles	65 ± 20%	80 ± 20%
Residence time of particles	45 ± 10 days	20 ± 5 days

Conclusions and perspectives

- These results demonstrate an initial flush of sediment previously accumulated in the river channel before the increasing supply of sediment recently eroded from the hillslopes during subsequent events.
- This research highlights the utility of coupling continuous river monitoring and fallout radionuclide measurements to increase our understanding of sediment dynamics and improve the management of soil and water resources in agricultural catchments.

Reference
Le Gall, M., et al. (2017). *Scientific Reports* 7, 42099.