The VERSEAU - TRACKSED - DRASTIC Project: Quantification of sediment fluxes in the Loire hydrographic basin

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Starting point: the good ecological status of water bodies

Percentage of water bodies in less than good ecological status or potential in rivers and lakes

The Loire Brittany water agency meets problems with stream siltation

Study site

European Environment Agency, 2015
Characterise the present-day sediment fluxes in the Brittany Loire river Basin

Is the basin eroding? Where is the sediment coming from?

2 steps:

> The suspended sediment loads
> The sources
3500 stations:
- daily flow data
- High spatial resolution
- low temporal resolution for SS

Good spatial coverage
Study site: the Loire and Brittany river basin

- A lowland area in France
- Loire - Brittany river basin ~155 000 km² (28% of French metropolitan territory)
- 111 small to large scale catchments ($10^1 - 10^5$ km²) chosen ~78% of the whole basin
Area specific suspended sediment yield calculation

National databases

Suspended sediment concentration (C)
Once in a month sampling over more than 7 years

Flow discharge (Q)
Daily measurements

2 calculation methods (Delmas et al. 2011)\(^1\)

\[ C = a Q^b + a_5 \delta S \]

Rising discharge
Falling discharge

Variations of sediment stock

Long term mean SY values with a maximum uncertainty of 30%
Analysis of yields at annual time scale
Large SSY database obtained from homogeneous data and calculation methods

Comparison with literature data: low values

No spatial pattern of SSY distribution

Gay et al. 2014

Some values:

SY ~ 10^{-4} - 10^{1} Mt. yr^{-1}

SSY ~ 2.9 - 32.4 t.km^{-2}.yr^{-1}
Large discrepancies between years but...
Homogeneous trend of catchments within the Loire and Brittany river basin
- 41 catchments with more than 30 years data
- Calculation of moving average of SSY using different time steps: 2 - 42 years
- Comparison of coefficient of variation for each time step
- 18 years of annual data are needed to provide a mean value of SSY with less than 10% of potential variation
Characterise the present-day rates of erosion of the Loire river Basin

Is the basin eroding? Where is the sediment coming from?

2 steps:

- The suspended sediment loads
- The sources
Mass movement
Concentrated erosion
Mean = 18 t.km$^{-2}$.yr$^{-1}$

Hillslope erosion
Mean = 114 t.km$^{-2}$.yr$^{-1}$

Bank erosion
Mean = 4 t.km$^{-2}$.yr$^{-1}$

Mass movement
Mean = 6 t.km$^{-2}$.yr$^{-1}$

The local sources
Need of connectivity

=> To explain the difference between hillslopes and rivers

Borselli et al. (2008), Gay et al. (2016) Journal of Soil and Sediments
The Loire basin has a low connected erosion comparing to other French basins.
Conclusion: A large homogeneous database

Low values of SSY (2.9 – 32.4 t.km\(^{-2}\).yr\(^{-1}\))

- Strong interannual variability but homogeneous trend in this variability (with a major influence of rainfall, min = 18 years of data)
- Hillslope erosion, transfer limited (SDR 5%)

Perspectives: Towards a distributive approach...

- Soil production map for the river basin
- Quantification of drain tiles erosion
Thank you for your attention