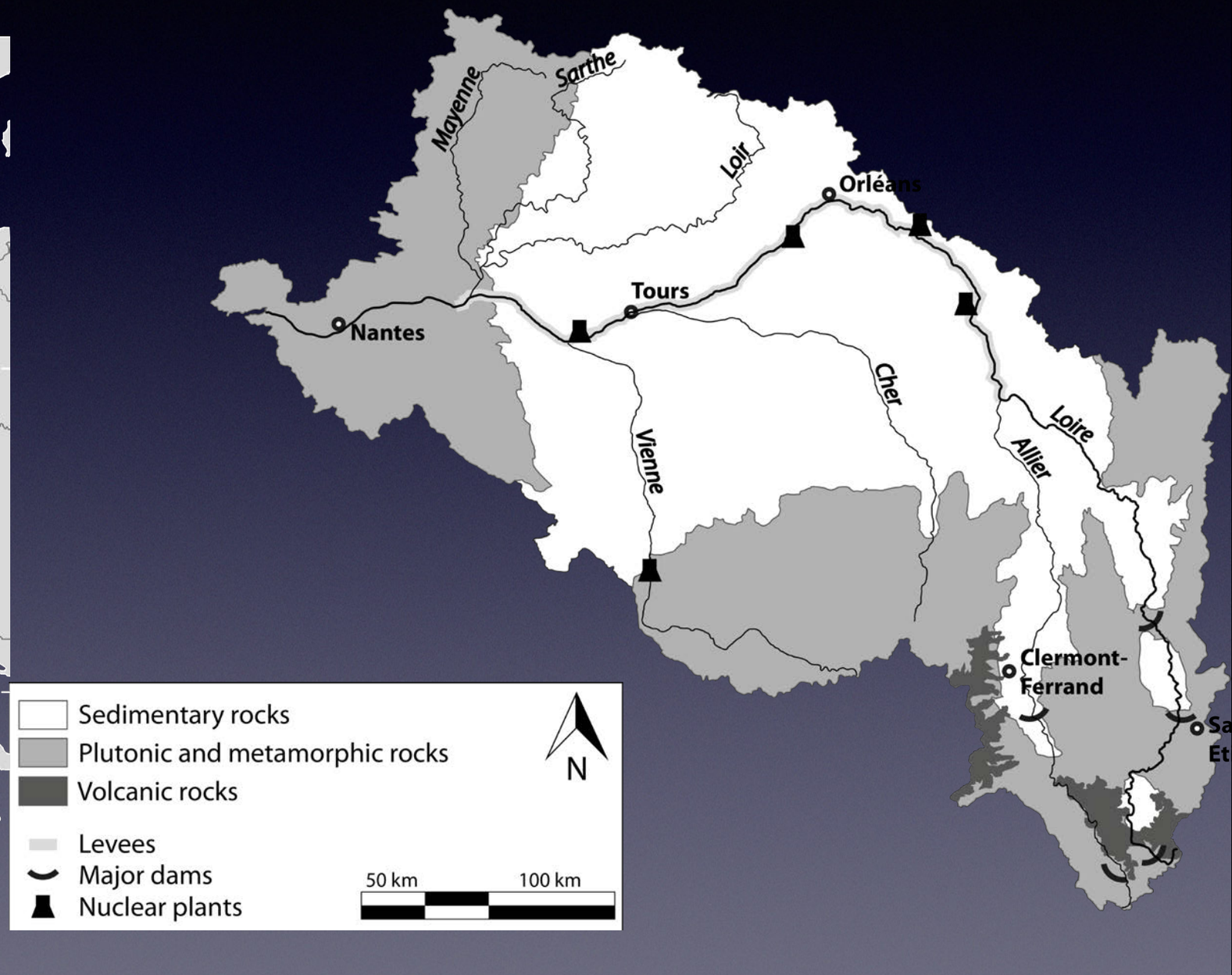
OSLA

The Observation Network of the Loire river basin Sediments

Lauren Valverde, University of Tours, France - 8th International SedNet Conference, 6th-9th November 2013 - Integrated sediment management

The Loire river basin



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OSLA Network
























14 research actions

1

Sediment transport and geomorphological evolutions

2

Fluxes and stocks of pollutants

3

Sediments and ecological interactions

4 Tools for sediments management

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Variations of grain size in relation with cross section hydrodynamics and tributary confluences in a large sand-gravel bed river: the Loire (France)

Valverde L.[1], Rodrigues S.[1], Jugé Ph.[1], Desmet M.[1], Recking A.[2], Pene I.[1], Rincel M.[1], Delancret R.[1], Bakyono J-P.[1]
[1] E.A. 6293 GéHCO, Géo-Hydrosystèmes COntinentaux,Tours University, France
[2] UR ETNA, IRSTEA, Grenoble, France
Contact: lauren.valverde@univ-tours.fr

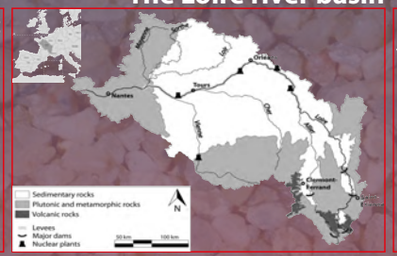
Study area

Aim of the study:

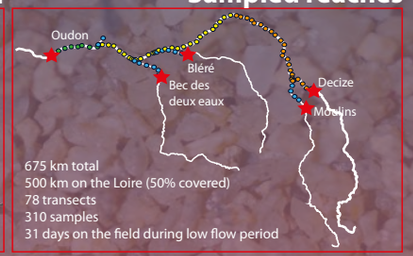
Many current management issues are linked to the natural processes of fluvial dynamics, such as sediment transport, erosion and deposition.

This study aimed at better understanding the behavior of one of the key factors in sediment transport: grain size.

The Loire river basin



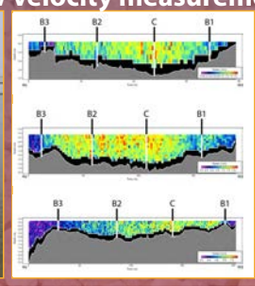
Sampled reaches



Among the ten largest West-European rivers and the largest French basin: 117,000 km2 - Average discharge: 374 m3/s at Tours gauging station

Methods

Flow velocity measurements



4 samples per cross-section in the main channel only:

C : main sample at maximum speed

B1, B2, B3: additional samples to assess transversal variability

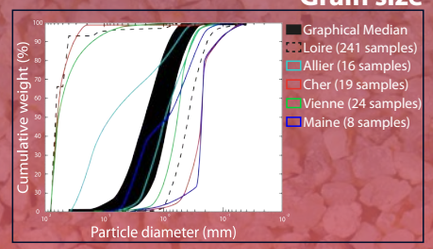
Mean flow velocity varied from 0.18 to 0.94 m/s

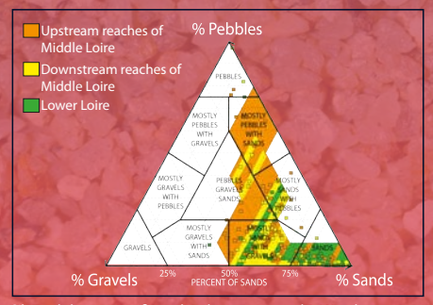
Mean measured depth varied from 0.48 to 2.84 m

Sediment sampling

First results

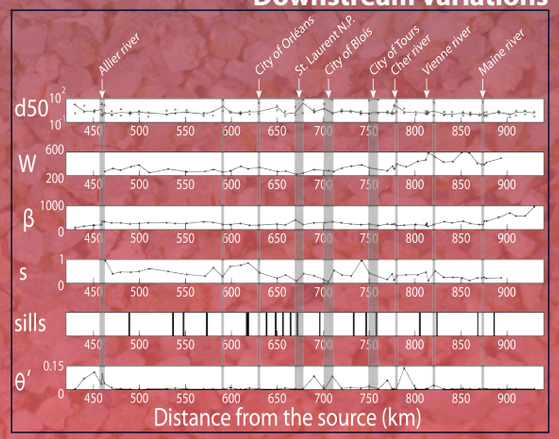
Grain size



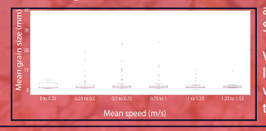


Silts and clays are not figured as they represented 0.1% or less.

Downstream variations



Averaged d50 variations (median, min and max) compared to river bankfull width (W), aspect ratio (β), slope (s), major sills, and critical Shields parameter ($\theta' = \tilde{u}^2 / (C'^2 \times 1.65 \times d_{50})$).



Variability is much greater transversally than longitudinally, but mean grain size did not vary with flow velocity, the median ranging from 1.35 to 1.71 mm.

Perspectives:

① comprehend sediment transport processes during low flow (see Claude, 2012)
② refine a large scale 1-D model on hydaulics and sediment transport (Latapie, 2011)
③ define tributary inputs and signatures through petrological analyses (see Macaire et al, 2013)

INFO-sed 2

The VERSEAU – TRACKSED Project:
Origin of Loire River basin sediments

Rosalie Vandromme[1], Olivier Cerdan[1], Aurore Gay[1], Anthony Foucher[2], Sébastien Salvador-Blanes[2], Valentin Landemaine[3], Marc Desmet[2]

[1] BRGM, Orléans, France, r.vandromme@brgm.fr
[2] GéHCo, Université de Tours, France
[3] M2C, Université de Rouen, France

INTRODUCTION

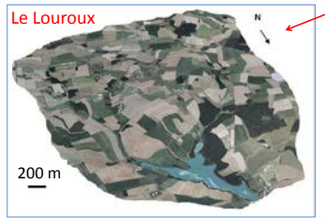
In France, since the beginning of 20th century, rural landscapes have been completely modified by human activities. These practices have resulted in profound sedimentary and morphological alterations (channel bed incision, deposition of fine sediment, bank erosion, etc.), detrimental to the achievement of good water status [1]. Several research efforts have already investigated either global budgets at the river basin or continental scale or local detailed budgets at the plot to the field scale. However, very few studies have tried to analyze the connectivity between fluxes and storages and to draw the links between the different scales. The purpose of this study is to examine source-to-sink dynamic of the sediment cycle for the Loire River Basin. This project is broken down into two steps :

1. **Understand poorly studied processes such as sediment production by agricultural drainage or bank erosion through catchment monitoring.**
2. **Elaborate a distributed model of sediment connectivity from hillslopes to basin outlet.**

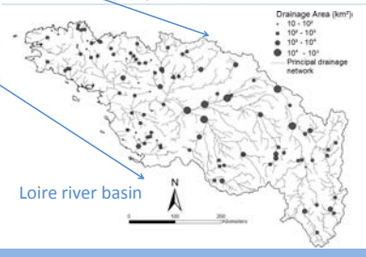
MATERIAL AND METHODS

1. for the first step, two catchment sites are studied, using historical data or monitoring:
- the linear (21 km) of two small streams ("La Ligoire")
- the Louroux pond catchment.

Those two catchments are for the most part intensively cultivated and have been extensively submitted to subsurface drainage using drain tiles. The objectives of this part are :
1. quantify incision and deposition processes since the channelization of the streams (1970 and 1945),
2. quantify in-channel deposition rates of fine sediments,
3. explain the spatial distribution of these deposits.

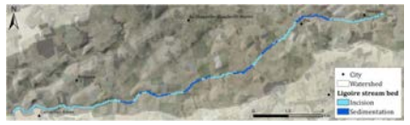


2. For the second step, the modeling approach is based on the use of indicators to describe hillslope processes, potential downstream retention, attempting to link river basin characteristics to a prediction of sediment exports in rivers. It provides insight in the identification of the most influent sediment redistribution processes on the total sediment fluxes and on the differences between various basin typologies [2] [3].



FIRST RESULTS

The Ligoire study shows an important stream incision (around 30 cm in 40 years) and the influence of water obstacles on sediment distribution.

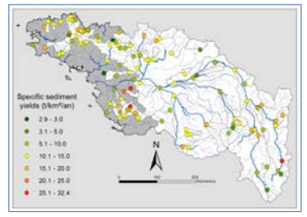


The Louroux monitoring should allow a better understanding of the origin and dynamics of sediment transport within small intensively cultivated plain catchments.

Le Louroux

✓ Estimation of sediment stock deposited in the pond (coring, geophysical prospections)
✓ Source to sink estimation of sediment pathway (connectivity model)

The first results from the second step on mean annual suspended sediment loads, show that catchments contribute from $4.8.10^2$ to $3.7.10^5$ t.yr^{-1} to the overall Loire river sediment exports (which equals $8.6.10^5$ t.yr^{-1}) and area-specific suspended sediment yields have been calculated .



CONCLUSION AND PERSPECTIVES

Investigations on catchments global characteristics should then allow the identification of dominant processes of sediment redistribution and help to draw local then regional distributed sediment budgets to bridge the gap between the different spatial scales. Contribution of hillslopes to the overall catchment budget should finally help to assess in-stream contributions and redistribution processes.

References:
[1] Aarts et al., (2004) Food ans ChemicalToxicology 42:45-49;
[2] Cerdan et al. (2012) Comptes Rendus Geoscience 344:636-645;
[3] Delmas et al. (2012) Journal of Hydrology 420-421:255-263

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(c) LAUREN VALVERDE - STUDIO PIERRE

Techniques de carottage et premières analyses - Projets MetOrg 1, Verseau, MetMines et Dynamics

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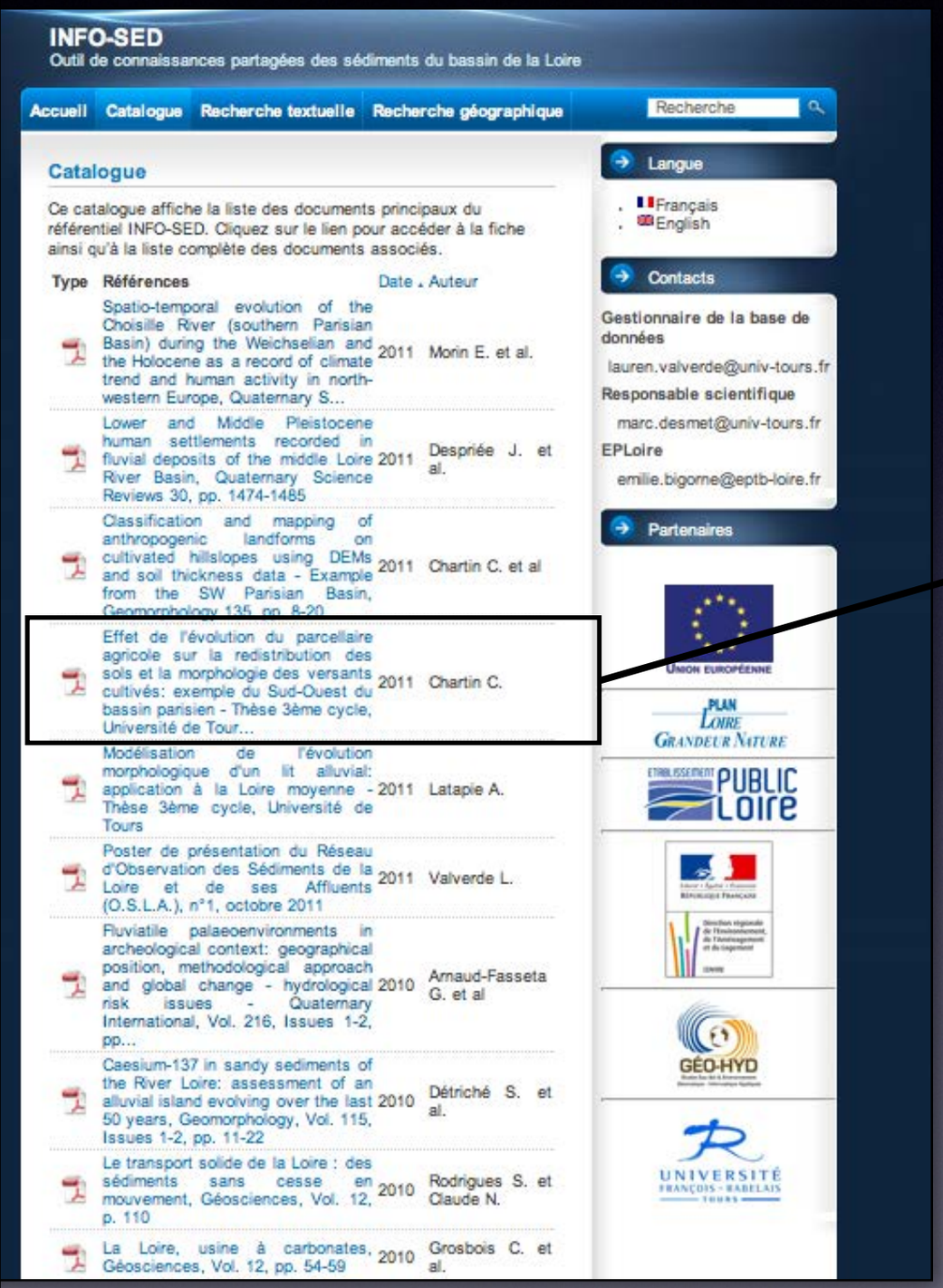

2015

1. Booklets for decision makers

2. International seminar

Bringing operational knowledge to Loire basin decision makers

Exchanging experiences with researchers and stakeholders from other similar basins

Conclusion

Before OSLA		NOW
Scale of the site	→	Scale of the basin
One study : One discipline	→	Pluridisciplinary research
Each team has its own tools	→	Tools are shared

Doing more with less

No communication between researchers, no link between science and policy	→	Networking

Priority : financing coordination / communication