

université
PARIS-SACLAY



FINAL PROGRAMME

Thematic School

TRACING 2021

Emerging strategies of sediment and contaminant tracing in catchments and river systems



3 – 7 October 2021

Meeting place : Centre Port-Royal, Saint-Lambert-des-Bois, France

Main organizer: Olivier Evrard, Laboratoire des Sciences du Climat et de l'Environnement (LSCE)

Local organization committee : Sophie Ayrault (LSCE), Cécile Quantin (Géosciences Paris-Sud)

**International support organization committee: Allen Gellis (USGS), Jean Minella (UFSM, Brazil),
Tales Tiecher (UFRGS, Brazil)**

Context and objectives of the School

Soil and water resources that are essential to human and aquatic life are increasingly threatened by human activities and the impacts of land use and climate change. Sediment and sediment-associated constituents, in particular, can contribute substantially to water-quality impairment. In order to take effective conservation measures to protect these resources from erosion and alteration, and use them in a more sustainable way, a preliminary assessment is needed to: (1) quantify soil losses; (2) identify the sources and the pathways of runoff and sediment across the landscapes to the river systems; and (3) calculate the transfer and residence times of sediment and particle-bound contaminants in the river network.

Several innovative techniques have been developed recently opening up new avenues to establish this assessment of sediment flux in the critical zone. These innovative techniques include the tracing or “fingerprinting” methods to identify the sources and quantify the dynamics of sediment and particle-bound contaminants, high resolution topographic mapping using various emerging technologies (i.e. Lidar) to map connectivity and sediment pathways, the development and installation of multiple low-cost sensors in the rivers. However, the use of these techniques is often associated with several methodological and statistical limitations, that are often reported although rarely addressed in the framework of concerted actions taken at the level of the international scientific community. Among the main methodological difficulties associated with these techniques are the following:

- conservativeness of tracers during the erosion to delivery cycle;
- collection and representativeness of sampling in the field;
- use of correction factors to remove the effect associated with differences in particle size or organic matter content between source and target samples;
- Bayesian versus multivariate statistical analyses;
- calibration of sensors/samplers installed in the field/in rivers;
- validation and uncertainty of model results.

In this context, the objective of this Thematic School workshop is to bring together French and international experts working on these topics together to develop the critical guidance and standardization needed so that sediment fingerprinting and ancillary approaches can be adopted as a utilitarian and readily applicable sediment management and academic tool. Thematic workshops will be organised, drawing on the varied expertise, to set-up a concerted strategy to develop methodological approaches to apportion sediment to its source(s). Original and international experiments will be designed, and an initiative (clearinghouse) will be presented for data sharing. A potential practical contribution of the School could be the publication of dataset(s) in open access to test/calibrate/validate sediment tracing approaches in contrasted environments across the world.

This Thematic School is organised to follow-up the discussions initiated during specifically dedicated sessions organised during the last years at the General Assembly of the *European Geoscience Union* (EGU) and the *American Geophysical Union* (AGU). **Because of the covid-19 pandemic, this event initially scheduled to take place during the week after the 2020 edition of the EGU was postponed to early October, 2021.**

In the future, we hope that other similar events will be organised in the framework of international conferences (e.g. EGU 2022) to continue stimulating discussions about this topic in coming years.

Audience

Researchers/lecturers, postdoctoral fellows, PhD students.

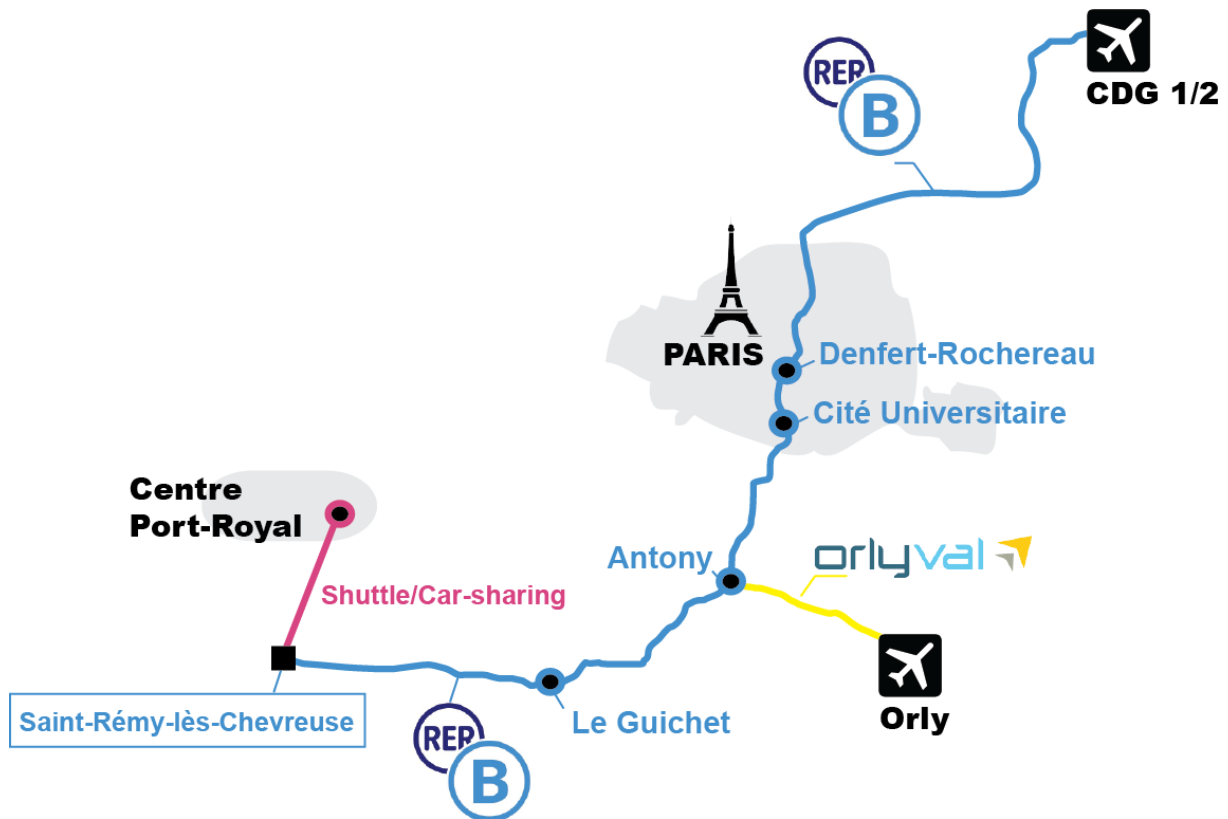
The official language of the Thematic School will be English.

Logistics

The Thematic School will take place in the convention centre of *Port-Royal* (Saint-Lambert-des-Bois, France). More information is available on the following website:

<https://www.centreportroyal.com/>

Access by train is possible via the RER B suburban train line (terminus station Saint-Rémy-lès-Chevreuse), directly connected to both airports of Paris (Charles-de-Gaulle and Orly) and easily accessible from the City of Paris (and its railway stations) and the high-speed train/TGV station of 'Massy-TGV'. A shuttle service will be organised from the station.



All transport itineraries can be found on the following link:

<https://www.iledefrance-mobilites.fr/en>

Participation cost

Thanks to the sponsors, the participation to the Thematic School (including accommodation and lunch) will be **free of charge** for those selected/invited participants. **Only the transport cost to/back from Saint-Rémy-lès-Chevreuse will have to be supported by the participants.**

Training format of the Thematic School

The main objective is to update the participant knowledge of all the state-of-the-art techniques/methodological issues associated with sediment/particle-bound tracing. Most of the experienced researchers (including postdocs) participating to the Thematic School will therefore be invited to share their knowledge in their primary field of expertise through the preparation of specifically dedicated lectures.

Modelling exercises will be proposed to the participants during the School.

All participants will be invited to prepare two slides to present them and their research/background at the beginning of the School.

Significant time slots will also be devoted to additional practical workshops and discussions on the potential solutions that could be found to address the methodological problems associated with tracing and design concerted strategies for future research.

Provisional programme and sessions

For the presentations, the recommended format will be ~60% of presentation followed by ~40% of exchanges and discussion with the participants.

Sunday 3 October 2021

From 17:00: arrival, installation and welcome drink (at 19:00)

20:00-21:30 Dinner

Monday 4 October 2021

Session 0 – General introduction on sediment tracing

8:30-9:30 General introduction of the School: sediment as a global pollutant and the need for robust sediment source –apportionment approaches and tools **O. Evrard**

9:30-10:30 Welcome speech/ presentation of each participant (2 min. each) **2-slide template provided to all participants**

Coffee break (20 min.)

10:50-11:40 History of sediment apportionment: challenges and prospects (the example of ¹³⁷Cs) **O. Evrard**

11:40-12:30 Revisiting source sampling techniques, e.g. through the use of the knowledge of local populations – experience of a case study in New Caledonia, South Pacific Islands **O. Navratil**

12:30 -14:00 Lunch break

Session 1 – Innovative techniques in the field

14:00-15:00 Tracing the pulse of the city from sewer sediments **J. Jacob**

15:00-15:20 *Break*

15:20-16:20 Development of low cost sensors and open source river monitoring: which prospects for sediment fingerprinting? **O. Navratil**

16:20-17:00 How to trace sediment sources in burned catchments? **Julián García**

17:00-18:00 Multi-proxy tracing of sediment sources in a lowland catchment: the case of the Louroux Pond catchment (Central France) **S. Salvador-Blanes**

18:00-18:30 Wrap-up session

20:00 – 21:30 Dinner

Tuesday 5 October 2021

Session 2 – Today's and tomorrow's tracers

8:30-10:30 Tracing the lithologies and the soil types: the relevance of 'pedosignatures'

- Applications from the French Alps **O. Evrard/O. Navratil**
- Applications from tropical catchments in Brazil **P. Batista**
- The use of the residual metal fraction for tracing **A. Dabrin**

Coffee break (15 min.)

10:45 – 12:30 Tracing the land use sources

- Organic matter properties (TOC, TN, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) **A. Foucher**
- Biomarkers: potential for tracing studies **A Huguet**
- Fatty acid isotopes and $\delta^{15}\text{N}$ offset, less is more? **T. Cox**
- Environmental DNA **A. Foucher (general) /A. Frankl (mountain environments)**

12:30 -13:45 Lunch break

13:45-15:00 Using the low-cost tracing techniques (colour, infrared,...) (**N. Martinez-Carreras**)

15:00-15:20 *Break*

15:20-17:00 Workshop/discussion/practical work: how to design a sampling scheme? How to harmonise the practices/guidelines at the global scale? Defining new tracing strategies and properties.

17:00-18:00 Fingerprinting, age dating and residence times **O. Evrard**

18:00-18:30 *Wrap-up session*

20:00-21:30 Dinner

Wednesday 6 October 2021

Session 2 – Tomorrow's tracers (continued)

8:30-10:15 Post-accidental case studies: how to implement a sediment/contaminant tracing framework after an accident? Examples from the latest floods of the Seine River in 2016/2020/2021 and the redistribution of radioactive fallout in Fukushima coastal rivers **S. Ayrault, O. Evrard, R. Bizeul**

Coffee break (15 min.)

Session 3 – The statistical/modelling procedure: from the measurements to the un-mixing model results

10:30-12:30 Workshop/discussion/practical work: The tracer selection at the centre of the debate: novel methods and their effect on Frequentist and Bayesian models **I. Lizaga**

Effectiveness of different tracer selection methodologies to deal with corrupted and non-conservative tracers in un-mixing: practical cases testing different models **I. Lizaga**

12:30-14:00 *Lunch break*

14:00-16:30 **Cultural visit at the historical Abbey of Port-Royal** (confirmed)

17:00-18:00 Assessing laboratory and mathematical mixtures for model testing (**P. Batista**)

18:00-18:30 *Wrap-up session*

Feedback on designing a model inter-comparison exercise and strategies for future research

20:00-21:30 Dinner

Thursday 7 October 2021

Session 4 – International and open access strategy for the future

8:30-10:00 General feedback from the participants on the Thematic School **2-slide template provided to all participants**

Coffee break (15 min.)

10:00-12:15 Conclusions and perspectives, e.g. interconnecting with the other communities (e.g. contaminant chemistry, biology, ...), organisation of a Tracing side-event at EGU 2022 **O. Evrard and others**

12:15-13:30 *Lunch break*

13:30-15:00 International data repositories and sample registering strategies; open access publications and data papers **C. Pignol**

15:00-16:00: Workshop/discussion/practical work: data management / field tools to register samples in international databases

16:00-17:00 Workshop/discussion/practical work: compiling an international dataset for testing/comparing tracing strategies

17:00 *Closing of the School*
