EH demosite in Lyon periurban area

IRSTEA-Lyon,
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University – Lyon2 (now University of Strasbourg)
Laurent Schmitt, Hydro-Geomorphology, Oldrich Navratil, Hydro-Geomorphology
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Bernard Chocat, Urban hydrology...... Jen Yves Perrodin, Ecotoxicology

Ecohydrology Workshop - 30-31/01/2019 – Univ. Birmingham, UK
Where?

Lugdunum.....Lyon city

Why?

1- How does the peri-urbanization process impact the flow regime in quality & quantity of water?

2- How can we mitigate these (-) impacts?

The Yzeron watershed has been an experimental site for Irstea-Lyon since 1994
(I) Watershed scale approach to understand the hydrological and ecological templates
Objective: Describe components and model their relationships
Hydrological fluxes

Urban flow modeling
CANOE model

Flood & Low flows simulation
Wistoo; J2000 spatial models

Landuse change modeling

Intense Overland Runoff Prediction, IRIP spatial model

Genesis
...nutrients & pollution sources

Transfer
...erosion

Accumulation
...wetlands & rivers

Ottelu
CEMACREP
SAGVREC
DREN
GL

L'OCUPATION DU SOL EN 2008

SIMULER L'EFFET DES OUTILS DE PLANIFICATION À HORIZON 2030
Evolution tendancielle avec zonage réglementaire de la planification

Assessing impact of global change on flood regimes
Biljana D. Radojevic,
Natural Science Sector, MAB and BIP Programme, UNESCO, Paris, France
Pascal Brel

EVIDENCE OF COMBINED SEWER OVERFLOWS ON A PERIURBAN STREAM ECOSYSTEM: Methodological approach
P. Breil1, M. Lafin1, A. Verrier2, A. Pt, Nasvargi1 and L. Schirin1

Evidence of the impact of urbanization on the hydrological regime of a medium-sized periurban catchment in France
L. Brandt1, P. Breil1, F. Thollier1, M. Lagooy2, F. Boanger2, C. Jachemint3, S. Kermadi3, K. Michel3

International Symposium on New Directions in Urban Water Management

4th International Symposium on New Directions in Urban Water Management
Winnipeg, Manitoba, Canada, May 15-18, 2009
Hydro-geomorphological typology

Test of three methods to detect the overbank flow from water level time-series analysis

Using hydro-geomorphological typologies in functional ecology: Preliminary results in contrasting ecosystems
Stream pollution concentration in riffle geomorphic units (Yzeron basin, France)

Philippe Namour, Laurent Schmitt, David Eschbach, Bertrand Moulin, Guillaume Fantino, Claire Bordes, Pascal Breil

Nitrogen patterns in subsurface waters of the Yzeron stream: effect of combined sewer overflows and subsurface–surface water mixing

A. M. Aukou, T. Baric, P. Breil, P. Namour, L. Schmitt, R. Gnozina

and P. Zudias

The role of organisms in hyporheic processes: gaps in current knowledge, needs for future research and applications

After a decade of research in the Yzeron watershed, we reached the following conclusions:

• The self-purification capacity of a river system is unequally distributed;

• In our lotic system, the main bioreactor is the hyporheic zone;

• The main drivers are (I) the river geomorphology and (II) the connection to a ground water table;
(II) Problem solving approach
Low dilution capacity rivers, headwaters, seasonal, intermittent..
Increase the self purification capacity
....artificial riffle
Monitoring design

10 minutes time step
Multi-parameters loggers:
- Electrical conductivity
- Temperature
- pH & redox potential
- Dissolved oxygen
- Water pressure

Weekly sampling for water quality analysis of
- NH4 > CSOs source
- NO3 > NH4 nitrification or fertilizer origin
- NO2 > NO3 denitrification
- DOC > Dissolved Organic Carbon (CSOs & nat.)
- PO4 > Phosphate (CSO, agriculture)

Sampling & monitoring wells
- P0
- P1
- P2
- P3
- P4
- P5
- P6

Natural sand filling

Impervious granite bedrock

Concrete pavement

CSOs

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CSOs
Proof of concept....
biodegradation process / uptake..

Nitrogen amount (mg/L)

Carbone Organique dissoud

Phosphate

Figure 2: System in operation on the field.
Implementation strategy with the support of the river basin managers

Missions since 2000:
- Flood, Drought, river resource management
- WFD objectives / good ecological status...

Replication site planned on 2019 for proof of transferability

Demosite – proof of concept running since 2006

Missions since 1974:
- Sewer and waste water system planning and management.
The Lyon’ EH demosite and research networks

A research items Federation
- Climate and Environment Systems
- Hydrology and Hydrogeology
- Water Chemistry
- Water Quality

A long-term and multidisciplinary approach
- Climate, hydrology, hydrogeology, water chemistry, water quality

Research actions linked to end-users needs
- Identification and prioritization of urban and natural water quality issues
- Development of strategies for sustainable urban water management

An original instrument of observation
- Long-term monitoring systems with real-time monitoring of the global assessment of water quality

A strong effort devoted to results dissemination

Les Zones Ateliers
Les Zones Ateliers (ZA) se focalisent autour d’une utile fonctionnelle (un fleuve et ses bassins versants, biodiversité, du cœur géologique de nos territoires, ou le littoral, ou encore les sites dans des contextes chronologiques d’origine naturelle ou naturelle modifiée) et y développent une démarche scientifique et opérationnelle de conception de sites d’ateliers pour y mener des recherches interdisciplinaires et participatives sur le long terme.

OZCAR
(Observatoire des Zones Critiques et des Ateliers de Recherches)

(FCAR - French Centre for the Study of Critical Zones)

What is OZCAR research infrastructure?

OZCAR (Critical Zone Observatories: Research and Application) is a national distributed research infrastructure associating most of the French observation sites dedicated to the observation and monitoring of the Critical Zone (CZ). It is the outer layer of Earth's continents extending from the top of the vegetation canopy down to groundwater.
Porous ramp principle

Interception complète des faibles débits
Régénération à débit $\geq$ débit moyen

(Breil, 2018)