

Université				
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Thesis proposal 2025

Titre : Modeling non-conventional water infiltration strategies for groundwater refill considering global change in urban environments

Topics	Urban hydrology – Ecological engineering – sustainable stormwater management –
	groundwater refill – Protection, preservation of water and soil resources
Thesis	Adrien Wanko (ICube/ENGEES)
supervisor	
Supervisory	Loïc Maurer (ICube/ENGEES),
team	
Skills	Numerical modeling, coding, urban hydrology, sewer network, field skills
Duration	36 months
Workplace	ICUBE – Laboratoire des sciences de l'Ingénierie, de l'Imagerie et de l'Informatique
	1 cour des cigarières 67000 Strasbourg
Related partners	Agence de l'eau, Eurométropole de Strasbourg, Région Grand Est
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Context

The alarming fact that 65,000 hectares of land are lost every year in France - the equivalent of one département every 10 years - cannot be ignored. This urban expansion considerably worsens the consequences of rainwater runoff on our water regimes and quality, as well as on public safety. Soil sealing, by limiting infiltration, leads to an increase in runoff, higher flows at outlets, lower water tables, more severe low-water levels in our rivers, and often saturated sewer systems, resulting in pollution discharges into our ecosystems. These infiltration problems are associated with climate change, which is having an impact on water resource management. To preserve our water resources, mitigate the effects of climate change, and guarantee a sustainable future for our territories, it is imperative to initiate profound changes (reuse of treated wastewater (REUT) and groundwater recharge and management at source). Developing our knowledge of hydrological phenomena and soil management is essential if we are to meet today's challenges of decentralized water management that aims to meet quantitative challenges while limiting the spread of pollution. This optimization requires the implementation of nature-based solutions and transfer mechanisms within numerical models such as the Storm Water Management Model (SWMM).

Translated with DeepL.com (free version) Thesis proposal

Aims

This thesis aims to: i) develop hydrological models to assess the impact of urbanized areas on runoff, infiltration and groundwater recharge volume flows, and to forecast dynamics in the context of global change; ii) assess the impact of land-use change scenarios on contaminant volume flows and transfer through the soil, subsoil and groundwater resource compartments, iii) evaluate the benefits of new, rational infiltration strategies in urban environments at field scale. In situ (field) experimental campaigns will be carried out to measure the impacts of rational urban stormwater infiltration strategies.

Thesis project proposal







The project has 3 main axes :

a. Assessement of water and soil resources and the impact of global change

- i. Selection and characterization of the initial state of study sites
- ii. Pressure scenarios- global changes
- iii. Unconventional water infiltration scenarios
- iv. Numerical modeling of crossed scenarios
- b. Impacts of infiltrated stormwater
 - i. Evaluation of SUDS (sustanaible urban drainage systems) performance, water balance on soil-plant-atmosphere system
 - ii. Modeling groundwater refill
- iii. Modeling SUDS aging considering urban footprint
- c. Identification of risks associated with stormwater infiltration
 - i. Study of associated risks for water and soil
 - ii. Recommendation for best practices

Lab

The thesis will be carried out within Icube laboratory (UMR 7357), more precisely in Mécaflu team. ICube is well known nationally and internationally for developing transdisciplinary research in the fields of engineering of health, environment and sustainable management (<u>https://icube.unistra.fr/</u>). Mécaflu team is recognized for its expertise in fluids dynamics and reactive transfers through environmental process.

Profile

- Master or engineer on water science or geoscience,
- Programing/ modeling (i.e. Python)
- Fields skills
- Work independently
- English speaker, French speaker would be a plus

Key words :

Stormwater management, infiltration, modeling, nature-based solutions, ecological engineering, contaminant transfer

Required documents :

CV, cover letter, master I and master II transcripts of records, diploma of master

Deadlines : All submission have to be done before March 31st