Part II – Lyon

Water, climate and resilient urban systems — 3 ECTS

Lecturers: **E. Mignot, M. Poulain-Zarcos, P. Salizzoni, N. Farges et al.**

Lectures: 5h | Tutorials: 0h | Labs: 10h | Project: 15h | Autonomy : 15h | Lang. :

Objectives

This course aims to provide students with an integrated understanding of:

- A systemic understanding of the global and urban water cycles;
- Insight into planetary boundaries and climate-driven disruptions;
- Knowledge of water scarcity, drought and access challenges;
- Advanced understanding of integrated rainwater management;
- Technical knowledge on wastewater treatment and reuse;
- Awareness of emerging pollutants and water quality risks;
- Capacity to analyse urban flooding and drainage failures..

The module broadens the technological perspective developed in Part I by embedding energy and industrial systems within climate, hydrological and territorial dynamics.

Keywords: Climate adaptation, Urban water systems, Watershed management, Water quality

Programme

Week 1 – Academic courses & conferences

A. From Global Water Cycle to Urban Systems

- **Lecture 1 – From the Large Water Cycle to the Urban Water Cycle**
  - Hydrological fundamentals
  - Urban modification of water flows
- **Lecture 2 – Planetary Boundaries and Disruptions to the Water Cycle**
  - Climate change
  - Urbanisation and soil sealing
  - Resource consumption impacts

B. Water Scarcity and Resource Pressure

- **Lecture 3 – Low Water Levels, Water Shortages and Drinking Water Access**
  - Drought mechanisms
  - Resource allocation conflicts
  - Adaptation strategies

C. Integrated Rainwater Management

- **Lecture 4 – Historical Evolution of Integrated Rainwater Management**
  - Sewer systems history
  - Limitations of conventional approaches
  - Nature-based solutions
- **Lecture 5 – Eco-campus Visit**
  - Practical demonstration of sustainable water management systems
- **Lecture 6 – Practical Application of Integrated Rainwater Management**
  - Design principles & Case studies
  - Performance assessment
- **Lecture 8 – Failure of Rainwater Management: Combined Sewer Overflows & Urban Flooding**

- Hydraulic overload & Flood risk
- Infrastructure resilience

D. Water Treatment and Emerging Pollutants

- **Lecture 7 – Treatment and Reuse of Wastewater**
  - Treatment technologies
  - Reuse strategies
  - Industrial and urban reuse
- **Lecture 9 – Impact on Water Quality and New Pollutants**
  - Microplastics & PFAS
  - Pharmaceutical residues
  - Monitoring and mitigation

Week 2 - Applied case studies & projects

Students work in multidisciplinary and international teams on applied territorial case studies such as:

- Urban adaptation plan under water scarcity
- Redesign of a stormwater management system
- Flood risk assessment
- Water reuse strategy for industrial zones
- Integrated territorial resilience planning

Projects integrate technical, environmental and governance dimensions and conclude with:

- A structured technical report
- A collective oral presentation and discussion

Prerequisites

- Basic knowledge of environmental sciences or fluid mechanics
- Introductory understanding of sustainability challenges
- Ability to follow technical courses in English.

Learning outcomes

At the end of the module, students will be able to:

- Explain interactions between climate change and hydrological systems.
- Analyse urban impacts on water cycles.
- Evaluate risks related to water scarcity and flooding.
- Compare traditional and integrated rainwater management approaches.
- Assess wastewater treatment and reuse strategies.
- Identify emerging water pollutants and associated risks.
- Propose resilient water management solutions for urban environments.

Assessment

Assessment is based on:

- Continuous participation in lectures and seminars
- Group project evaluation (technical quality, innovation, sustainability integration)
- Written technical report
- Final oral presentation

Indicative weighting:

- Project report: 40%
- Oral presentation: 30%
- Continuous assessment / engagement: 30%

(Weighting can be adjusted depending on institutional requirements.)

References

IPCC AR6 Synthesis Report. Climate Change 2023
Chow, V.T., Maidment, D.R., Mays, L.W. Applied Hydrology.
Dingman, S.L. Physical Hydrology.
EPA. Urban Stormwater Management Guidance.
OECD. Water Governance Principles.