Adaptive Water Resources Management Under Global Change

Explore this IDIL Master's track in detail, including its academic objectives, curriculum, research opportunities, admission requirements and career prospects.

TRACK OVERVIEW & LEARNING OBJECTIVES

The principal themes of this international, interdisciplinary in-lab programme are the challenges of managing water resources in the face of climate change and societal shifts. From coping with increasingly frequent and ever-more severe hydrological extremes, to the large variety of differing and often conflicting stakeholder interests, water resources management is facing a multi-faceted set of pressures.

This degree programme aims to prepare graduates to navigate these pressures, and to pursue further research to address these challenges. Courses are geared towards familiarising students with:

- understanding hydrological processes and how human activities impact
- leveraging different approaches to further analyse these processes (remote sensing, modelling, field work, data analysis, surveys, and participative methods)
- situating water resources management at the interface of science, policy, and society

The principal pedagogical objective of this degree is to prepare students to understand the varying pressures on water resources, the complex nexus of interests that surrounds them, and the tools at the disposal of researchers to increase our understanding and communicate our insights. They will be able to critically engage with different stakeholders, pursue research independently, and harness the interdisciplinary knowledge they have acquired to address real-world challenges.

KNOWLEDGE, SKILLS & COMPETENCIES

The competences students are expected to develop during this degree are the following:

Scientific:

- advanced knowledge in hydrology
- understanding of water cycle components and their interactions with anthropogenic activities
- insights of primary challenges for water resource management arising from climate change and diverging stakeholder interests
- bibliometric analysis and literature review
- definition of research questions and hypotheses
- selection and testing of appropriate methods to pursue research goals
- presentation of results and critical engagement through discussion and self-reflection
- relation of overarching conclusions to larger objectives and disciplinary challenges

Methodological & Technical:

- planetary remote sensing using satellite data
- data assimilation, integration, and analysis
- numerical modelling of hydrological and hydraulic processes in languages such as R and Python and advanced, specialised softwares
- fieldwork
- hydrogeophysical, chemical, and microbial analyses of water resources
- engagement with social sciences methods, including participative approaches, surveys, and narrative approaches

Transversal:

- scientific writing and communication - production of technical reports, academic papers, conference contributions etc.
- public-facing communication for broader outreach and stakeholder communication
- public speaking and oral communication
- critical thinking
- assessment and critical engagement with technological tools available for scientific pursuits, including generative AI
- navigation of interdisciplinary research contexts
- project and team management and leadership
- research integrity and scientific best-practices

DETAILED CURRICULUM

- **Semester 1 (S7)**
  - Hydrology in the anthropocene: natural processes and water resource management (4 ECTS)
  - Hydrological modelling and climate change (2 ECTS)
  - Critical data management in hydrology (2 ECTS)
  - Spatial information for hydrology (2 ECTS)
  - Research in-labs (choice within 10 topics - see below) (2 ECTS)
  - Non-core unit (4 ECTS)
  - Personal project (10 ECTS)

- **Semester 2 (S8)**
  - Research Internship (30 ECTS)

- **Semester 3 (S9)**
  - Field training in hydrology (3 ECTS)
  - Water and the Global South (3 ECTS)
  - New narratives in social sciences about water governance (2 ECTS)
  - Hydraulic modelling (2 ECTS)
  - Numerical methods: sensitivity analysis, calibration, data assimilation (2 ECTS)
  - Distributed hydrological modelling (2 ECTS)
  - Chemicals and ecological risk (2 ECTS)
  - Public policies and institutional english skills (4 ECTS)
  - Multidisciplinary project (10 ECTS)

- **Semester 4 (S10)**
  - Research Internship (30 ECTS)

In-Labs [updated on an annual basis] :

- Multi scale monitoring for hydrogeological and hydrochemical characterization of karst
- Introduction to isotope hydrology
- Flood impact observatory

- Testing of a participatory setting
- Wastewater reuse for agriculture: methods for fundamental processes characterization
- Satellite observation for large river characterization
- DEM4GeoSc : Advanced Earth surface Geomorphometry from high resolution DEMs
- Remote sensing methods applied to soil moisture mapping
- Forests and hydrology
- GIS, remote sensing, and cloud computing

ADMISSION REQUIREMENTS & STUDENT PROFILE

Applicants are expected to have thorough expertise in environmental sciences and/or water sciences as well as an interest in societal issues related to these fields. They must have methodological, argumentative, and scientific writing skills as well as demonstrating dynamism, intellectual curiosity, and autonomy. In addition, an aptitude for scientific approaches and critical thinking is expected.

Ideally, applicants have already completed one or more research internships. They must, in any case, have an aspiration to work in research, or at the science/policy interface. A C1 level of English is required.

CAREER OPPORTUNITIES

The principal career paths graduates are expected to pursue lie within research, as this is a research-oriented degree, with the summer semester in both its first and second year dedicated to internships in scientific laboratories. Students will be well-equipped to further pursue a PhD, or to apply for positions as research engineers or scientific support staff in the public or private sector.

The large spectrum of water science disciplines covered by this degree also allows students to gain expertise in their chosen fields so they can also pursue employment opportunities requiring skills in environmental/water sciences in public administration, associations, engineering consultancies and companies.

As the track requires an excellent level in professional English, it also facilitates the pursuit of an international career. The transversal skills acquired, including scientific and broad public communication, and project management further prepare graduates to take on leadership positions.

RESEARCH LABORATORIES & ACADEMIC PARTNERS

Main laboratories:

- UMR G-EAU (Gestion Eau, Acteurs, Usages)
- UMR HSM (HydroSciences Montpellier)
- UMR LISAH (Laboratoire d'Étude des Interactions Sol-AgroSystème-Hydrosys)
- UMR TETIS (Territoires, environnement, télédétection et information spatiale)

Academic partnerships:

- Institut Agro Montpellier
- University of Barcelona (double degree)
- Tokyo Metropolitan University