

## Impact Objectives

- Structure the access to unique and costly environmental hydraulic and ice engineering research infrastructures in the European Research Area
- Improve infrastructures to facilitate progress in experimental hydraulic research and better address climate change adaptation issues

# Europe's focused approach to environmental hydraulic research

*The HYDRALAB+ project is facilitating cooperation in environmental hydraulic research across Europe to meet new challenges from the changing climate. Project Coordinator Frans Hamer discusses the importance of the research and building strong collaborations*



**In your opinion what are some of the most urgent technical challenges facing Europe's rivers and coasts from climate**

**change? How is it hoped the HYDRALAB+ network will address some of these?**

Due to climate change many countries worldwide are faced with extreme river discharges and higher sea water levels with more frequent storm events and changing wave and river flow conditions along their coasts and riparian margins. New approaches and nature-based solutions are needed to avoid high-risk erosion and inundation events. Environmental hydraulic research from our project will provide new and more sustainable solutions to manage these problems more effectively. Experimental research, particularly at large scales, is an indispensable step to provide sound and sustainable solutions due to the limitations present in numerical models and field data. One of the most urgent technical challenges facing Europe's rivers and coasts is to extend the traditional research focusing on hydraulics and morphology with additional knowledge of eco-hydraulics to better understand the biological and ecological environment. Through joint research activities the HYDRALAB+ project, funded by the European Commission Horizon 2020 Programme, is facilitating progress in the discipline

as well as strengthening the coherence of experimental environmental hydraulic research infrastructure. Europe's most advanced institutes and universities are cooperating in joint research activities and exchanging data to accelerate the necessary developments.

**Why is a multidisciplinary approach essential for developing comprehensive environmental hydraulic modelling?**

Traditional disciplines like hydraulics and morphology have been dominating research disciplines in river and coastal engineering for decades. As nature-based solutions are likely to be more sustainable and promising, a multidisciplinary approach that incorporates biology, ecology and the complexities of the natural environment is essential. This is necessary for effective management of the natural environment under changing climatic conditions.

**In what ways are you building networking activities to include the wider hydraulic community in the project?**

The project is organising half yearly HYDRALAB+ Workshop Events throughout Europe, to which key stakeholders are invited, including policy makers, coastal/river managers, manufacturers of hi-tech measurement technics, contractors and end users of technological developments. Invited researchers have been working together in various research projects in the

largest and most specialised experimental facilities of Europe. Each 'transnational access' project has on average 10 researchers from 5 different countries, and the majority of researchers have never used the facility before.

**How are you working with industry? Why is this important and what has been the benefit of having this level of knowledge available to the project?**

HYDRALAB+ works together with industry both to improve the use of our facilities and to develop new measurement techniques and sensors that improve data capture and interoperability. Representatives of industry are invited to attend the experiments and to obtain a fruitful two-way interaction. To target wider interactions, a set of thematic workshops for European industries relevant to environmental hydraulic facilities are organized during the half yearly HYDRALAB+ Workshop Events. Bridging the gap between scientists, who are working on new developments, and European industries (consultants, contractors) that can use the project achievements, is very important. These scientific achievements should be used in practice so that the general society can benefit from them. New developments by instrument manufacturers can open further possibilities in research and application. Bringing the manufacturers in contact with the researchers will also give the manufacturers' insight in what is needed in future applications.

# Bridging the gap between research and societies

*The HYDRALAB+ project brings together European researchers, industry and stakeholders to improve experimental hydraulic research aimed at adapting to climate change. Greater access to top research facilities, knowledge sharing and multi-disciplinary teamwork is helping societies adapt to climate change*

Europe's waterways and coastal regions are extremely vulnerable to the changing climate. Increased water levels and storms threaten erosion and destruction to riparian and coastal regions. Understanding the potential impacts of climate change on these ecosystems will help countries and citizens adapt to these changes and protect coastlines and rivers. However, in order to meet this challenge and generate the required data experimental research will need new approaches and focus. Due to climate change ice engineering is included in HYDRALAB+ as well.

Improved experimental facilities and techniques are needed to fill in the gaps left by limitations in numerical models and field data.

## IMPROVING RESEARCH AND COLLABORATION

The Infrastructure Network HYDRALAB+ project, funded by the European Commission Horizon 2020 Programme, is designed to make this type of collaboration possible. There is a long history of work that has gone into this network, which started with HYDRALAB in 1997 and the forth project in this group, HYDRALAB IV, ending in 2014. Project Coordinator Frans Hamer, who is a Senior Advisor at Deltares in The Netherlands, explains that HYDRALAB+ focuses on adaptation to climate change.

## WORKING AS A TEAM

The project, which started in September 2015 and runs until August 2019, has brought together 24 partners and nine associated partners selected on the basis of

their specialism and ability to contribute to the various tasks and deliverables.

A project of this scope requires excellent teamwork and a diverse team has been put in place to oversee and foster these relationships. A group of five experts make up the HYDRALAB+ Management Team, spanning four countries and both academia and industry. Hamer is working alongside Professor Agustín Sánchez-Arcilla, from the Universitat Politècnica de Catalunya who is also the Director of

*Changes in climate, rising sea levels and a desire for more environmentally-friendly, adaptable risk-mitigation measures are driving the development of a more inter-disciplinary research framework*

the Laboratori d'Enginyeria Marítima at LIM/UPC International Center Coastal Resources Research in Spain, and Dr James Sutherland, Technical Director, Coasts & Oceans, HR Wallingford in the UK. Also on the team is Dr Stuart McLelland, Head of Geography, at University of Hull's School of Environmental Sciences, and Dr Björn Elsässer, a Senior Project Engineer and Project Manager with DHI's Ports and Offshore Technology team in Denmark. 'A multidisciplinary process is critical to hydraulic research because nature-based solutions are likely to be more sustainable and promising, therefore a multidisciplinary teamwork approach that incorporates biology, ecology and the complexities of the

natural environment is essential,' observes Hamer.

Through half yearly HYDRALAB+ Workshop Events and collaborative research projects HYDRALAB+ contributes to the development of experimental capabilities in Europe and strengthens the networks of scientists and researchers. 'For collaborative projects research groups get access to the HYDRALAB+ facilities, giving a new generation of researchers access to some of Europe's top institutes and experimental

facilities,' says Hamer. 'Industry professionals are also invited to attend experiments so they can work with scientists to improve the use of experimental facilities and develop new measurement techniques and sensors that improve data capture and interoperability.' The research institutes, universities and manufacturers all have a common interest in developing the best techniques to apply to the various experiments.

## ACTIONABLE RESEARCH RESULTS

With the project at its halfway point experimental results are beginning to come in and have already helped inform on-going and future research projects. The

challenges associated with coordinating such a broad array of individuals spread over 15 countries is not easy but regular meetings and communication ensure that targets and deliverables are being met. Within the HYDRALAB+ project many experiments have been selected to deal with the interaction of vegetation and sediment transport/erosion, the increasing wave overtopping of structures and considering new threats like tsunami effects due to falling ice walls.

Special attention has also been paid to the hi-tech optical and acoustic measurement techniques that can be used across a range of laboratory facilities. From 'new data on damage and wave overtopping experiments under variable and unsteady test conditions have enabled us to develop guidance to accelerate model testing,' says Hamer. 'Plus new experiments with cohesive chemical additives have provided important insights and knowledge to better represent morphological and biological processes in physical models and new techniques in acoustic flow measurements have been developed to provide higher spatial and temporal resolution measurements of complex turbulent flow fields.'

In keeping with the goals of collaboration and teamwork HYDRALAB+ has also established a strong track record of dissemination and engagement with the next generation of researchers to communicate best-practice in experimental protocols and experimental measurements. The project is also using social media, conferences and publications to make available the data that will be most useful to managers and stakeholders. More specific themed workshops with policy makers, industry, the environmental community and facility owners are also organised to

exchange the insights and results. This helps to bridge the gap between scientists and those using the results from scientific progress. Among those using the results are a HYDRALAB+ established 'group of coastal/river managers who will be the necessary decision makers for the actual implementation of our experimental results leading to more sustainable interventions'.

## IMPACTING CLIMATE CHANGE PROJECTS

New research techniques and collaborations among the HYDRALAB+ partners are growing but the impacts from HYDRALAB+ are extending well beyond the labs involved as well. Project representatives are being regularly invited to EU workshops to evaluate and discuss future programming in the sector and routinely key scientists from other climate projects are invited to HYDRALAB+ workshops. Perhaps most importantly, HYDRALAB+ participants are involved themselves in other climate related projects and participate in the associated conferences, by which direct exchange of information and ideas is taking place. According to Hamer we live at a time when 'changes in climate, rising sea levels and a desire for more environmentally-friendly, adaptable risk-mitigation measures are driving the development of a more inter-disciplinary research framework'.

These drivers along with the enthusiasm of the HYDRALAB+ researchers' community and the support of many stakeholders are contributing to the continued development of the project. How countries and their citizens are able to adapt to changing climates will be directly impacted by the research going on in HYDRALAB+ facilities and the project's ability to disseminate this knowledge to policy makers, industry and managers.

## Project Insights

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### ASSOCIATED PARTNERS

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