

# THE PROJECT RADE

The project RADE (**R**emote **A**ccess to **D**ata and **E**xperiments) is a Joint Research Activity of HYDRALAB IV – More than Water. Its aim is to develop a robust set of information systems to improve access to experiments and data through innovative use of modern data management, curation and communication technologies.

Traditionally, the hydraulic research community is accustomed to exchanging the results of their experiments through papers and conferences. The direct exchange of data is limited to partners cooperating in projects. The objectives of RADE are to allow research partners to access and input laboratory experiment data (including video and imagery) remotely, thereby saving on costs and on the environmental impacts of long distance travel, and also making the results of experiments more easily accessible for researchers beyond the HYDRALAB community, thus realizing synergy between different partners in Europe and around the world, while at the same time creating a climate for further innovations.

Within this framework, two methodologies are being developed by LNEC and Deltares as partners in the HYDRALAB consortium. LNEC's methodology is based upon low cost hardware and either open source software or free software, in order to be easily accessible and portable to different laboratories and universities. Deltares' methodology is more involved. It gives project teams a visual impression of a hydraulic exper-

iment by means of a camera system that can be operated by the project leader. In addition to the visual impression, a specialized version of Delft FEWS is used as a server-client system, by means of which the measurements taken during the experiment (data) can be visualized real-time and distributed among all project members at once.

### LNEC's methodology

The objective of the work performed at the National Laboratory for Civil Engineering (LNEC) is to develop simple procedures/methodologies to enable remote video access and experimental data access to laboratory experiences in LNEC's wave flumes and basins, located in the maritime and hydraulics installations of the Harbours and Maritime Division (NPE). Visualization of real-time acquisition data coming from physical experiments and online communication between partners to share results are the ultimate goals of the work being developed.

#### The remote video access – Image Streaming

The methodology is based on the use of a fairly

simple scheme (Figure 1), composed of a low cost consumer SLR camera installed at the flume, connected to a PC computer on which the software "Microsoft Expression Encoder" resides and video (or images) is stored, decoded and sent to a streaming web server. This server will then enable real-time streaming over the internet, enabling a direct, quasi-real-time, access to video and data. This work involved the collaboration of FCCN ([www.fccn.pt](http://www.fccn.pt)), the Portuguese Foundation for Scientific Computing. Figure 2 shows some aspects of the experiences obtained in the wave flume. Results from the wave basin are shown in Figure 3, which shows a Windows Media Player session on a client's computer of live video of the experiment. Clients were invited to access the video stream through the address <http://wms.fccn.pt/lneccanal>.

#### Remote visualisation of data acquisition

The methodology for remote visualisation of data acquisition is based on the use of free version of TeamViewer© ([www.teamviewer.com](http://www.teamviewer.com)). This software, besides enabling online meetings, also

Figure 1 – General scheme of a remote access experiment

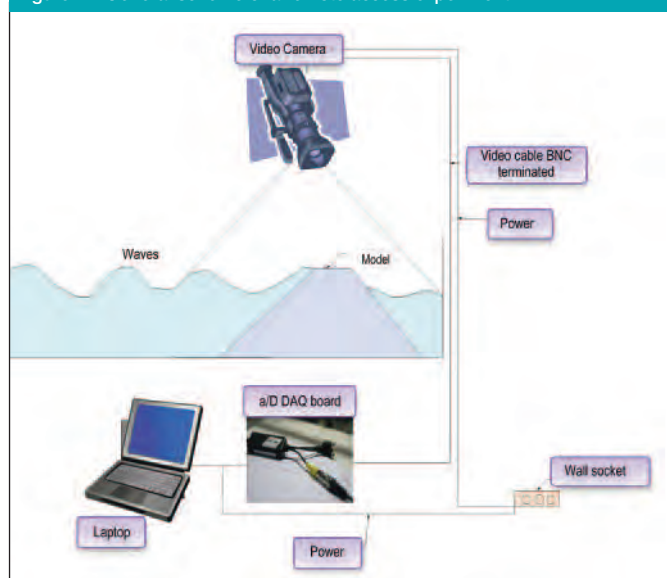


Figure 2 - Installed setup in a wave flume (left) and in a wave basin (right)





Figure 3 - Windows Media Player playing a live stream video on a client's computer

supports the remote control of client computers via internet, through a password-coded session provided by the client (see Figure 4). Therefore, project team members in a given experiment are invited to join the meeting and to remotely access experimental data, using the "Remote Control" feature. At the same time, the "Online Meeting" feature enables chat, VOIP, video and file transfer, amongst many other features, therefore avoiding time consuming and expensive travel.



**Rui Capitão** is a research officer at the Harbors and Maritime Structures Division, Hydraulic and Environmental Department of LNEC with 24 years of experience in statistical analyses of sea wave climates and short-term analyses of wave records for numerical and physical simulations in laboratory environments.



**Conceição Fortes** is a research officer at the Harbors and Maritime Structures Division, Hydraulic and Environmental Department of LNEC with 25 years of experience in numerical modeling of wave propagation of coastal and harbor areas.



**Rute Lemos** is a Research Technician at the Harbors and Maritime Structures Division, Hydraulic and Environmental Department of LNEC with 20 years of experience in physical modeling of hydraulics structures. Main research interests are: inspection of coastal structures and analysis of the collected data; photogrammetric methods for damage progression in scale model tests of rubble-mound breakwaters.



**Peter Wellens** is a researcher at Deltares. His background is in Civil Engineering and he holds a PhD in numerics. His main field of research has been the development and validation of numerical techniques for simulating wave impacts on structures. Recently, he has become head of the instrumentation department. As such he works on experimental modelling and is part of the coordination group for HYDRALAB.

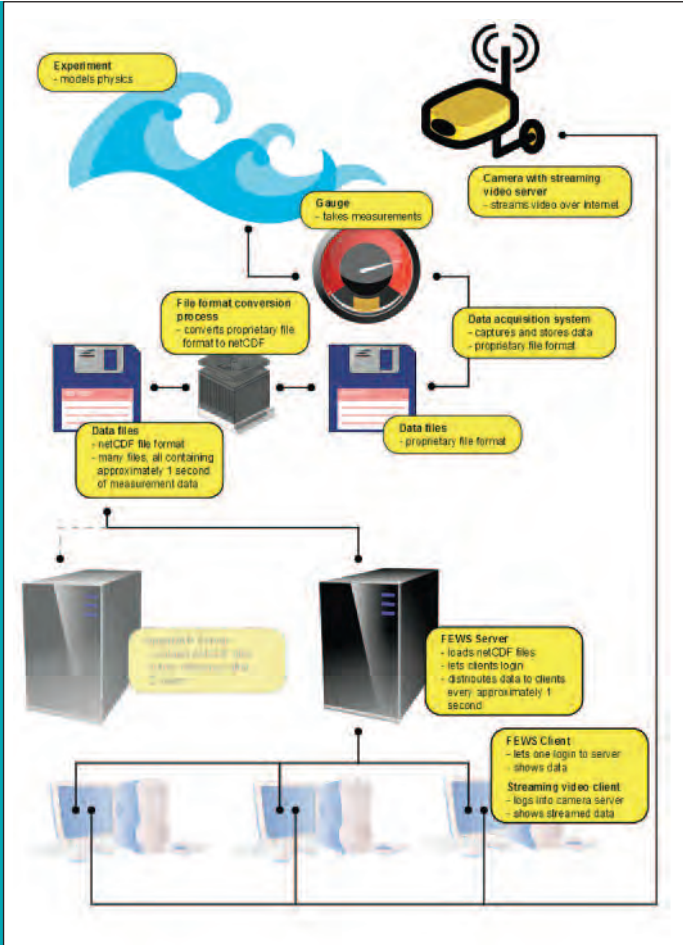


Figure 4 - Remote support and online meeting software showing the initial window and session panel

### DELTAIRES' methodologies

While the system setup of LNEC was designed as a low cost system, Deltares worked on a more involved approach to visualize the experiment and also to distribute the data at the same time. Deltares bought a professional camera with high quality hardware, such as lens, CCD-chip and servo motors for motion control, with an internal server. Project team members of an experiment receive a user name and password to log on to the server. The project team leader has a special account that enables him to control the camera position (roll, pitch and yaw) within a pre-configured range. In this way, the project team is free to focus on that aspect of the experiment that they find relevant at that moment.

Figure 5: Deltares' system setup for remote access and exchanging data.



When the experiment commences, and the data acquisition system starts taking measurements, an additional process is started to distribute the data among the project team members. The process on the data acquisition system converts the data to the open NetCDF format, sends it to a server, which then synchronizes the data between the server and the clients, which are running on the computers of the team members. While the experiment is going, the data is distributed to the clients in real-time and can also be visualized real-time. The setup of the system of distributing data is shown in Figure 5. The server-client system at Deltares is based on Delft FEWS. Delft FEWS is originally a operational flood forecasting system, but is flexible enough by design to be configured as a server-client system for sharing hydraulic experimental data. The biggest challenge for Delft FEWS was the sample rate of the measurements that is orders of magnitude higher in the laboratory (between 25 and 100Hz) than in field stations (between 0.1 and 1Hz). But we dealt with this issue and the delay now was less than half a minute after a 25 minute experiment.

### Applications

To test both the remote video access and the remote visualisation of data acquisition, nine experiences using LNEC's methodology were carried out at LNEC's wave flumes and tanks, involving several institutions national and abroad, including University of São Paulo (Brazil), the Federal University of Rio Grande do Norte (Brazil), the University of Rio Grande do Sul (Brazil), the Lisbon Superior Engineering Institute (Portugal) and the consultant companies DELTARES in Delft (The Netherlands), CONSULMAR in Lisbon (Portugal), Ports of Azores (Pico island, Azores) and GestMarina in Luanda (Angola). Figure 6 shows a map with the locations of those institutions.

The main conclusions arisen from this first set of tests were that the methodology is appropriate both for 2D and 3D scale model tests and is very simple, easily portable and quite cheap to implement. However, some problems were identified such as incidental image freezing occurrences and delays.

Deltares' system was tested at Deltares. Colleagues at the premises and a colleague in the United Kingdom were asked to act as a test users. During the experiment the delay was tested by keeping a telephone connection open and mentioning every five minutes how far the experiment was in the lab. At the end of the 25-minute test the delay was less than half a

Figure 6: Map location of connected institutions to remote access experiments at LNEC

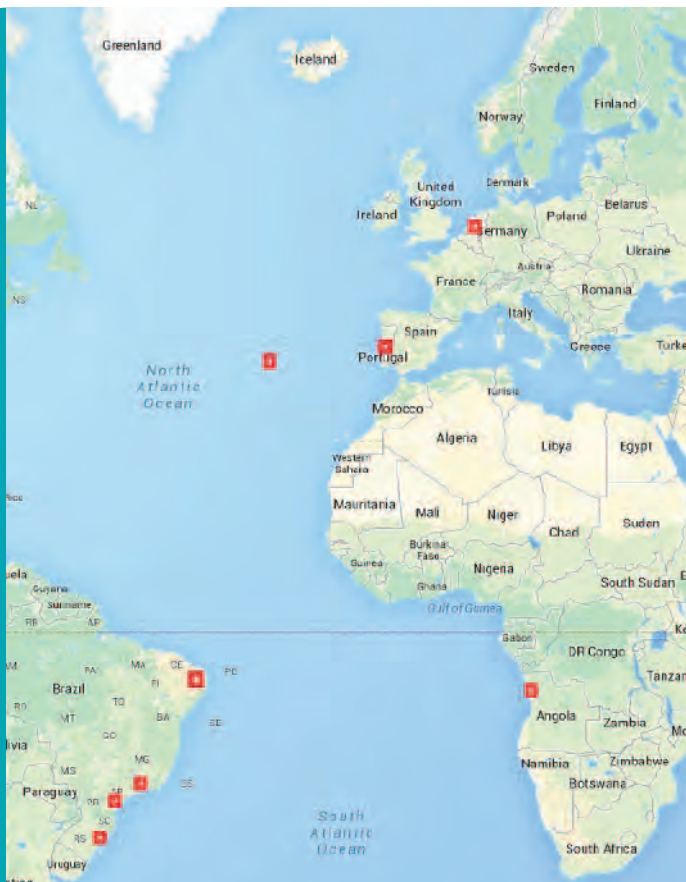
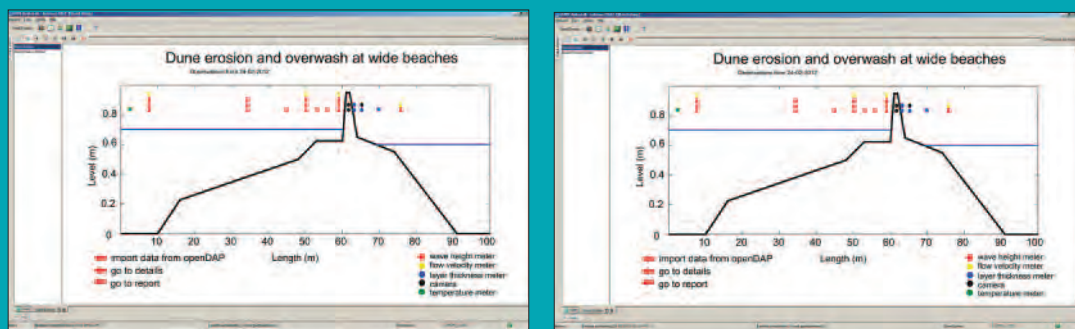


Figure 7:  
Screen shots of the client  
software for remote access  
and data distribution



minute. Figure 7 gives some screenshot of the client software running at the remote locations. One screen shows a drawing of the setup of the experiment. In this screen project team members can click the locations of the instruments to see the measurements that they are interested in. After the experiment (or during) the data can be processed within the client software, because it contains many statistical functions by default. Or the data can be exported to almost any format to be processed by means of other software.

#### Future Developments

More experiences with European and non-European countries are planned, in order to test

the methodology with partners with different network and computer characteristics. Some aspects of the methodology are planned to be improved, as to optimize the video transmission bitrate in order to maximize image quality and at the same time avoid dropped frames, to increase LNEC's internal network speed as well as changing the server live streaming, in order to keep long-term records.

Deltares will setup their system during one of the Transnational Access experiments, in which a selected international research group received access time to conduct an experiment in one of the large facilities associated with HYDRALAB. During this experiment, experiences will be collected which we will communicate through the consortiums website at [www.hydralab.eu](http://www.hydralab.eu).

**Issue 3, 2014 will be devoted to**  
**Hydralab V**