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Special Issue on Coastal and Maritime Hydraulics

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IAHR AIRH
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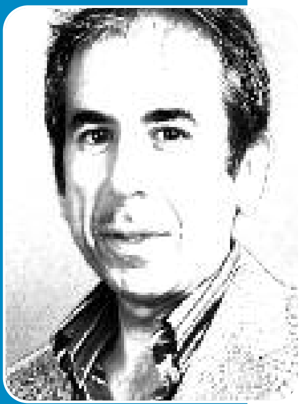
Editorial by **Michele Mossa**



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THE SEA, OUR LIFE

The sea plays a vital role in everyday life both directly and indirectly. Consider, for example, its influence and importance on climate and temperature, tourism, fisheries and important natural resources contained in the sea, such as oil and minerals.

The sea has always played an important role in history. For example, the Mediterranean Sea, the "Mare Nostrum" of the ancient Romans was for centuries the cradle of civilization. In fact, some of the greatest civilizations of the ancient world have grown and flourished on it shores: the Egyptians (even though their civilization grew also on the banks of the Nile), the Phoenicians, the Mycenaeans and Greeks, especially in their maximum expansion of Graecia Magna, the Middle East (the Persians, Assyrians and Babylonians), the Chinese Han dynasty, and finally the Romans and Arabs.
The sea has also been increasingly used for centuries for trade and cultural relations between the West and the East. It is also a major economic resource. Many activities are based on the sea and its products. Just think of the fishing and service industries, such as tourism, whose existence rely heavily on the sea.

Considering the sea as a huge natural resource, often taken as such by coastal communities, it is clear that research topics related to maritime hydraulics and coastal defense are fundamental. However, it should also be noted that coastal communities have used the sea also for flushing waste under the mistaken belief that the scale of the sea permits an unlimited and indiscriminate discharge.
Therefore, there is a great need to safeguard the sea and its coastline and, with this aim, it is necessary to study ocean currents and wave fields in order to understand their influence on hydrodynamic and biological processes, their contribution to the dispersion of pollutant loads the relationship between them and the weather, and more recently as an energy source. For example, a rational planning of waste water disposal must avoid eutrophication, the accumulation of heavy metals and toxic compounds which, assimilated by marine organisms, may enter the human food chain. In addition, special care must also be taken to avoid damage to the ecosystem that could make whole stretches of coastline unsuitable for bathing.

Today, another much-debated and pressing issue is coastal defense from erosion and, in general, risks to the marine environment and to areas close to the sea. This issue receives constant public attention, especially during the summer, when many swimmers can directly observe the damage done to many beaches.
All the topics mentioned above deserve special attention from the scientific community and require the development of specific research programs using experimental, numerical and field monitoring approaches, avoiding a sterile debate between these schools of thought, and considering the positive aspects of each one. The scientific and technical contribution to these problems is very useful also for local governments which are responsible for coastal management and for the proper protection of the sea environment. In fact, local authorities must also consider careful and rigorous scientific preliminary studies before any construction work and management in coastal areas is carried out, analyzing all the possible side effects that may result from careless design or maintenance.

In other words, human impact on coastal areas must combine both environmental and socio-economic aspects, taking into account the conflicting economic and ecological points of view.

This is why this issue of Hydrolink is devoted to coastal and maritime hydraulics.

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in this issue

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Cover picture:
Photo by MDK-Afdeling KUST
Beach nourishment near Knokke along Belgian coastline. Sand dredged in front of coast is nourished on beach to restore initial beach profile and to increase safety of the coastal defence chain composed of beach and dike system.

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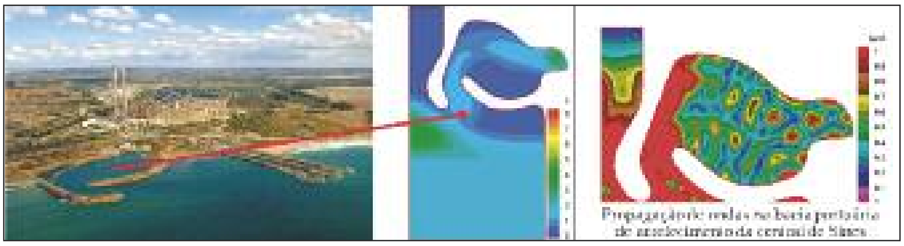
Special Issue on Coastal and Maritime Hydraulics



"Maritime hydraulics is an important field within civil engineering and others scientific areas that can use several tools to resolve complex problems. Within the scope of IAHR it is an increasing area of interest and establishment that can only go further if all members have an active participation and collaboration in the CM Committee"

F. Taveira Pinto

10 QUESTIONS TO...
Prof. Francisco Taveira Pinto

Interviewed by Michele Mossa, Editor of Hydrolink and Council Member

1

The history of the world has been marked by the continuous migration of its inhabitants towards the coastal zones, which very often offered more favourable conditions for economic growth. How do you think it is possible to protect the environment in a coastal zone from the impact of human activities?

The need for better management of coastal areas has led to political commitments, measures and policies to improve the relations between human occupation and the coastal environment. In general this has resulted in specific legislation and national strategies, regional management plans, studies and research, where coastal protection issues are included. A considerable number of laws and instruments already exist which, if applied, should help to protect coastal environments more efficiently. However, this has not happened in many cases. Existing legislation and instruments are quite complete but they are not as effective as they could be due to the lack of coordination between the parties involved and with no-one sharing the environment risk of some interventions. This lack of coordination is related not only to the horizontal relations between sectors of activity, but also the interconnection of the policies and actions carried out at different levels of territorial authority (local, regional or national). The complex relationships between human activities and the coastal environment are sometimes neglected, and some measures often fail to achieve their goal or may even be contradictory.

Despite the need for environmental risk assessment, in many countries no special attention has yet been given to this important subject, with the exception of the elaboration of some risk maps, although often with limited information. The uncertainties involved and lack of good science to forecast extreme coastal-forcing events (storms, abnormal sea levels, tsunamis), the "non-tangible" and cumulative environmental evolution and impacts, and the lack of quantification of the needs, values and aspirations of coastal communities are some of the limitations to assessing environmental risk.

2

Coastal erosion can result in: loss of land (due to many causes, such as storms, subsidence, etc.), destruction of natural sea defences, and for undermining of artificial sea defences. In your opinion, which of these different impacts is more present and critical?

It is not straightforward to say which of these three different impacts is more present and critical, as they are related and in some cases reversible, especially, for instance, immediately after a storm event when erosion is more evident. There is little public awareness of the physics behind coastal processes which describes the difference between structural and episodic erosion or between winter and summer profiles. Few know how natural coasts change due to fluctuations in forcing, nor that erosion can be followed by coastal accretion when boundary conditions change, either at a seasonal, annual or much longer, geological time scale.

However some events are really irreversible due to a long term deficit sediment supply and in that case undermining of artificial sea defences can lead to its destruction and higher levels of erosion. On the contrary loss of land and destruction of natural sea defences may need artificial sea defences to stop "dangerous" erosion rates especially near important assets.

3

Your main research activities are in Maritime Hydraulics. What is your opinion on the level of this research now in the world and which areas should be studied much in more depth?

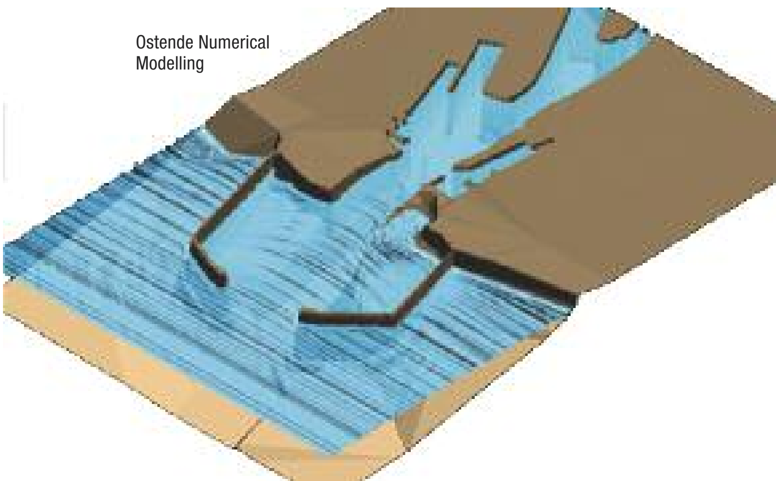
Physical and numerical modelling tools have developed enormously during the last years. However several issues need still further developments, namely the physics and modelling of sediment transport, the wave-structure interaction analysis and loads determination, erosion and scour near coastal structures as well as medium to long term accurate simulation tools.

From the management side, plans should be based on an adequate understanding of coastal dynamics. It is necessary to continue research on many aspects of coastal dynamics in order to better assess and understand erosion and sedimentation problems, predictions of shoreline positions for various scenarios and timescales of climate variability and direct human influence, the vulnerability of beaches, dunes and costal structures to storms and other extreme events, the impact of artificial coastal structures and ecological changes.

4

Your research topics involve also hydraulic laboratories and physical models. Sometimes they are expensive, but also irreplaceable. What is your opinion on the future role of large maritime hydraulics laboratories?

As Hughes[1] states in his book physical models have played a pivotal role in the growth of coastal engineering as a profession. Physical models have given us insight into the complex hydrodynamic regime of the nearshore region, and they have provided us with reliable and economic design solutions to support man's activities in the coastal zone. Many of our present-day engineering design techniques were developed using laboratory measurements, and numerous theoretical developments have relied on



Ostende Numerical Modelling

Francisco Taveira Pinto is Chair of theIAHR Coastal and Maritime Hydraulics Committee. He is a Civil Engineer (Hydraulics) with a PhD in Coastal Engineering and is Full Professor of Hydraulics in the Faculty of Engineering of the University of Porto (FEUP), Hydraulics and Water Resources Institute (IHRH). He is a Board Member and International Secretary of the European Union for Coastal Conservation (EUCC - Coastal & Marine) and Director of the Hydraulics, Water Resources and Environment Division of FEUP.

laboratory experiments for validation. However, many of us can still list some of the limitations of those design approaches, being in some case considered as empirical formulations. This means further tests and measurements are needed to increase the reliability of those formulations, specially performed at scales closer to the prototype, avoiding scale effects and testing new forcing situations. Especially due to the climate change and the demand for bigger structures located at higher depths more accurate design formulations are needed and this will be the most important role of large laboratories of maritime hydraulics. However, as these large tests in large facilities are more expensive they need to work in close relation with other small/medium facilities for preliminary/cheaper analyses. This is the objective of The European Union Hydralab in which many of European members of IAHR are involved.

5

Do you think that large coastal engineering laboratories around the world are sufficiently linked or should we have a bigger cooperation between them, to avoid duplication?

In some respects yes, and there's a big effort on this made through Hydralab project, but it is not possible to avoid completely duplication of work. Another important aspect is related with the exchange of information as each laboratory has their particular method for conducting model studies that sometimes makes difficult the comparison of results and data transfer.

6

Another approach to coastal engineering problems consists of using numerical models. What is your opinion on the contribution of numerical models in Maritime Hydraulics? Could you highlight the advantages and disadvantages of these two approaches to the same environmental risk?

Numerical models represent the real problem but with some simplifications. Thus, the modeller is forced to make a compromise between the details of the model and the prototype. Several advantages and disadvantages of physical model testing are usually reported.

An incorrectly designed model always provides wrong predictions, independently of the sophistication of the instrumentation and measuring methods.

The cost of physical modelling is often more than that of numerical modelling, and less than that of major field experiments, but this depends on the exact nature of the problem being studied.

Physical modelling has gathered new perspectives due to the development of new sophisticated equipment, allowing the measurement of variables in complex flows, which was previously impossible. New experimental techniques, automated data acquisition and analysis systems, rapid processing and increased data storage capabilities also provide useful information for the validation of numerical models, as stated in the recently published "Users Guide to Physical Modelling and Experimentation, IAHR 2011".

Other advantages of physical models are the study of new phenomena, the lower level of simplification, to confirm through measurements theoretical results, to obtain measurements from complex phenomena inaccessible from theory, to test extreme conditions, to test a wide variety of environmental conditions and the immediate visual feedback. Despite all these advantages there are still some problems of physical model to solve such as the scale effects, the incomplete modelling, the laboratory effects and the costs of installation and maintenance.

With relation to numerical models it can be said that despite the huge developments made they still exhibit deficiencies and limitations when applied to complex flows and situations like breaking, overtopping, wave structure interaction, etc. However, recent developments such as SPH and in computing capacity have made these tools more powerful than even before, leading to a better description of the complexity of the hydraulic phenomena (physical environment and borders as well as non-linear aspects of the equations used). From another perspective this tool is in general more attractive to researchers and practitioners.

To obtain theoretical solutions simplifications of the physical environment (especially the boundaries) are needed as well as of the equations that govern the phenomena. As a result of that mathematical solutions may have lower quantitative value, and therefore could be more useful for qualitative or comparative analyses.

The geometry can be reproduced with the desired detail but it is not enough to ensure a correct reproduction of the reality in the model as this can generate behavior sometimes different from the prototype. So calibration is needed. Physical modeling reproduces both linear and nonlinear aspects of the phenomena, avoiding the simplifications of the numerical modeling that simplifies not only the geometry but also fundamental equations.

Other advantages of physical modeling are intermediate and controllable cost; they represent reality at a certain scale; the involved variables and

[1] Physical Models and Laboratory Techniques in Coastal Engineering. Steven A. Hughes. Advanced Series on Ocean Engineering – Volume 7, World Scientific, 1995, Singapore, ISBN 981-02-1540-1.

boundaries can be controlled; measurements are in general easy to perform and the comprehension of the processes is facilitated.
Other disadvantages of physical modeling are the time spent and the cost of building alternatives, the particle similarity, the partial control of boundaries and the difficulty in measuring parameters in some model areas.

7 What do you think about the future of research in Maritime Hydraulics? Will numerical and physical models continue to coexist, or do you think that one will dominate?

The actual level of research leads to the need for common efforts between the various available tools namely physical and numerical modelling in order to decrease the lack of knowledge in some areas of Maritime Hydraulics. The problems to solve or which are not solved yet are so complex that only this integrated approach is feasible in order to obtain better accurate results not only for researchers but also for designers and practitioners.
There is still a need to design and construct new more advanced laboratory facilities (which is happening), develop new reliable measuring instruments and techniques, minimize laboratory effects, and understand the scale effects that arise from incomplete modelling.
Physical and numerical model input conditions can be controlled and systematically varied, whereas field studies have no such control. However, many problems in coastal engineering are not amenable to mathematical analysis because of the nonlinear character of the governing equations of motion, lack of information on wave breaking, turbulence or bottom friction, or numerous connected water channels. In these cases it is often necessary to use physical models for predicting prototype behaviour or observing results not readily examined in nature. The growing use of numerical models in coastal engineering has not stopped the use of physical models and in some cases they made progress in conjunction with each other. Recent trends have included the concept of "hybrid modelling" where results from a physical model of complex region are used as input or boundary conditions for a comprehensive numerical model covering a wider region of interest. Alternatively, numerical model results may be used to provide input conditions at the boundaries of the physical model.
The rationale for continued support of physical modelling in support of project design is that "Theory cannot cover all the complications that are encountered in practice. Consequently, most major hydraulics projects are model tested to optimize design".
Due to the quantitative deficiencies and limitations of predictive numerical models when applied to complex flows, the need for physical modelling still remains and investments in laboratory facilities, equipment and new techniques are more and more needed. The EU Hydralab projects highlighted the need for synergies between the various research tools, physical and numerical modelling included, not only because of the actual complexity of the maritime hydraulics problems, but also to improve some design approaches. The Hydralab project CoMIBBS that worked on the Composite Modelling tool is a good example as the laboratory data inform the theoretical model development and the theoretical model generates questions requiring laboratory intervention and investigation. The Coastlab initiatives (conferences and courses) supported by IAHR have also contributed to highlight the importance of physical modelling on applications to port and coastal protection design.

8 In order to reduce coastal erosion many countries have sustained a strong scientific and technological effort for developing new defence systems. We must consider also the economic importance of the coastal area (i.e. 16% of the EU population live in coastal municipalities). Do you think that the role of the Hydraulic community is adequate?

The principles contained in the EU Recommendation (2002/413/EC) to achieve a good Integrated Coastal Zone Management are relevant to the implementation of a sustainable approach to erosion management. These principles do not sustain a strong scientific and technological effort for developing new defence systems, but include taking a long term perspective, local specificity, involving all the relevant parties and working with natural processes. Therefore, management plans for coastal erosion should be part of a broader policy on Integrated Coastal Zone Management (ICZM). Such policy provides the objectives for coastal erosion management, such as whether or not to hold the line, or to allow some coastline retreat to a certain extent, based also on four concepts to assist in making these principles operational: the consideration of coastal sediment cells as management unit; consider coastal resilience; consider the favourable sediment status; and consider strategic sediment reservoirs. As this approach involves planners, politicians, managers, port authorities, ecologists, biologist, end-users, river authorities, etc, the efforts of the hydraulic engineering community will be not sufficient. An integrated approach will be need.

9 Do you think that political authorities and administrations have sufficient sensibility on the coastal erosion problem and, generally speaking, on coastal engineering themes?

Coastal or political authorities are faced with the increasingly complex task of balancing development and managing costal risks. Given the combined effects of further human encroachment on the coast and impacts of climate change, coastal erosion and flooding are problems of growing intensity. It has been highly recommended the restoration of the sediment balance and to enhance costal resilience. This requires achieving a favourable sediment status in vulnerable coastal sediment cells and the designation of strategic sediment reservoirs to replenish the coastal zone in case of extreme events and to accommodate for sea level rise. The implementation of this strategy is a great challenge for the coastal practitioner as well as for policy makers at national and European level. It puts a high demand on the knowledge of coastal processes, data availability as well as stakeholders involvement. Although scientific knowledge is rather well advanced, sophisticated monitoring technology is available and models become more accurate, much of this is underutilised in day-to-day coastal management. There still remains a dire need for applied research and collaboration between experts and managers to close the gap in the science-policy interface, although political authorities and administrations have more sensibility now rather than in the past on coastal engineering themes.

- For more information on the activities of the IAHR Coastal & Maritime Hydraulic Committee (CMH) visit the IAHR Website www.iahr.org/about IAHR/organisation/technical divisions
- The next Coastlab Symposium, sponsored by CMH will take place in Ghent, Belgium. For more information: http://www.coastlab12.com/
- Some of the research areas discussed in this article are being addressed in the EU Hydralab project in which Prof. Pinto and IAHR are partners. For more information go to http://www.hydralab.eu/
- IAHR Design Manual "Users Guide to Physical Modelling and Experimentation – Experience of the HYDRALAB Network". For more information go the IAHR e-shop

10

Is the increasing size of ships especially with the building of the Panama Canal resulting in interesting new problems for hydraulic engineers who design harbours?

This is a very interesting question. For several reasons the volume of goods actually transported by ships is increasing, and in order to optimize this, the size of ships has also been increasing. The new configuration and dimensions of the Panama Canal is an example of adaptation to these changes, but, however, the main changes can occur in the harbours.

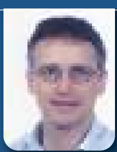
These bigger ships need bigger water depths for their pathways that can only be obtained, in general, further away the coast. This leads also, in general, to higher wave design conditions and other safety problems related with the foundations, currents, scour, breaking, etc. Many new harbour facilities are reaching dimensions never reached before and several examples could be referred. It is interesting to see in these examples the harbour area evolution from the very beginning as a small town harbour to areas of several hectares. Taking in mind all this it will result in new interesting problems for hydraulic engineers namely for the development of design tools for these new sea conditions and harbour structures' dimensions.

COASTLAB12

17-20 September 2012 - Ghent University - Belgium

4th International Conference on the Application of Physical Modelling to Port and Coastal Protection

Abstracts to be submitted by March 1st, 2012



Written by:
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Ghent University and the Coastlab 2012 Organizing and Scientific Committees warmly invite you to attend Coastlab12, the fourth edition of the Coastlab series of international conferences, after Porto (2006), Bari (2008) and Barcelona (2010). For the first time the Coastlab conference will be held in Central Europe. The host city of Ghent is a historic and at the same time, modern vibrant Belgian city close to the North Sea. Coastlab12 will take place on 17-20 September 2012. A PhD Master Class will be organized on Sunday 16 September 2012 prior to the conference. Online information is available at the conference website www.coastlab12.com!

The Coastlab12 conference covers a wide spectrum of topics on physical modelling for coastal and harbour engineering and provides a unique opportunity for the participants to present and discuss about recent research activities, the latest developments and engineering innovations related to experimental modelling techniques, equipment and instrumentation, including the intercomparison of physical and numerical modelling tools.

A characteristic feature of the Coastlab series is the simultaneous scientific, engineering and industrial participation, establishing exchange of knowledge between academia and industry.

Researchers and professionals active in coastal and harbour engineering are invited to submit papers dealing with the following topics:

- **Waves: generation, theories, prediction**
- **Currents: generation, transport**
- **Erosion and scour: assessment, control**
- **Sediment transport**
- **Structures: types, interactions and structural responses**
- **Wave-vegetation interaction**
- **Ocean renewable energy: wave/tidal energy converters**
- **Measuring techniques and instrumentation (both in the field and the laboratory): application, development, validation**
- **Scale effects: control, techniques**
- **Large scale experiments: laboratory studies and field campaigns (in relation to smaller scale tests, complementarities and compatibility)**
- **Result interpretation (uncertainty intervals, hazard assessment, functional failure and other engineering applications)**
- **Intercomparison of physical and numerical modelling tools**
- **Natural hazards assessment (oil spills and barriers, extreme conditions analysis)**

It is our great pleasure to invite sponsors and exhibitors to participate actively in the Coastlab12 event! A sponsorship document describing opportunities for your active involvement is available from the conference secretariat.

The deadline for abstract submission is March 1st, 2012. A poster session will be organised during the conference. A Book of Abstracts will be available at the conference, and a Book of Proceedings will be produced afterwards.

Deltares is an Institute Member of IAHR

Approaching software with an open mind

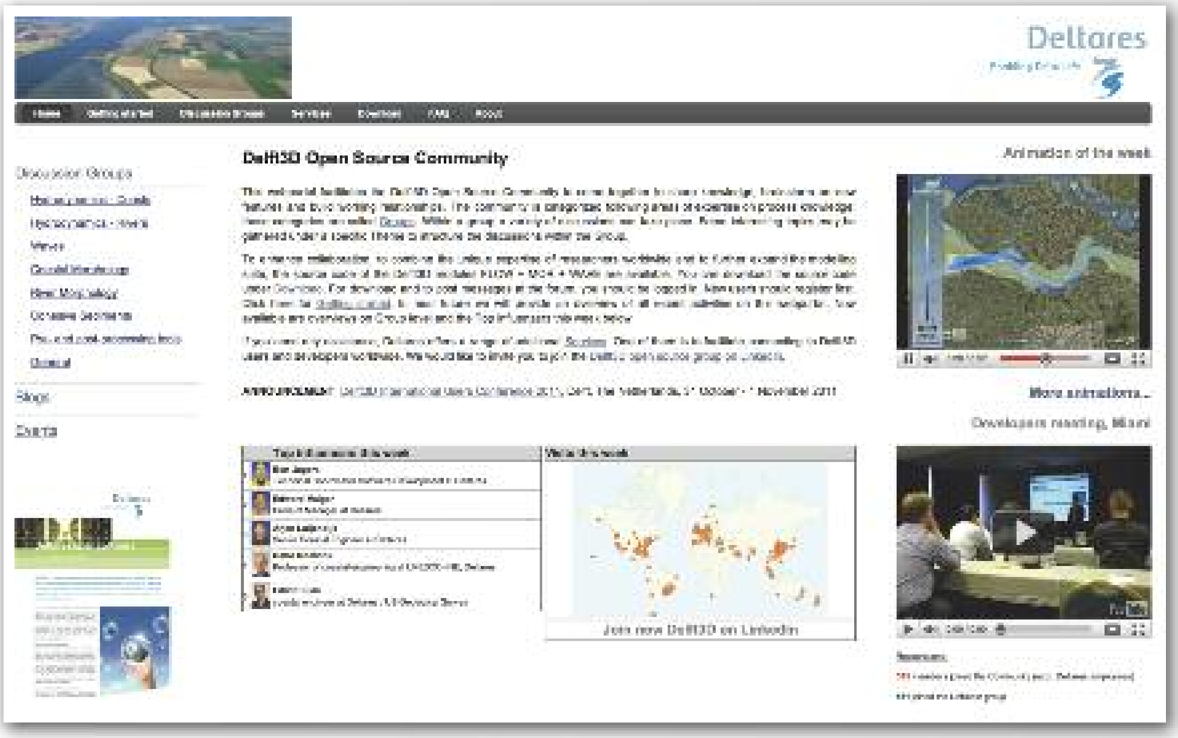
Article published in Views, N°5 2011. Deltares magazine. Reprinted with permission

An item high on Deltares' agenda is the dissemination of knowledge for use in the management of river basins and coasts. Software is one of the means by which Deltares achieves this. Deltares has over twenty years' experience in developing scientific software. The software covers a broad range of expertise: hydrology, hydraulics, morphology and geotechnics. This year Deltares has embarked on a new strategy: open software.

"We live in a high-tech global community. Information sharing is more important now than ever before. Deltares promotes the exchange of information by sharing software and working together with other people. The common ground is a shared interest in sustainable enhancement of the living environment in deltas. The integration of data, software, research and practical knowledge forms the basis for our work in the field of 'delta technology'.
So says Frank Hoozemans, director of Deltares Software Centre. All around the world, in over 100 different countries, organisations are using Deltares software. User groups come in all shapes and sizes: government authorities and NGOs; consulting engineers using the software in short-term projects and academics conducting long-term research. "Some users are pushing the boundaries of its potential application, while others just want a quick calculation and a nice graph for their report. High-quality software stimulates the use and development of 'delta technology' worldwide."
To make this knowledge more accessible and encourage people to share it, Deltares has started to provide open access to its software from the beginning of this year. "With our knowledge and experience, we can help users and colleagues around the world to make productive use of it."

Advantages

From the user's point of view, 'open software' has major advantages. New knowledge and functionalities can be added by many and opportunities for cooperation are increased. Hoozemans: "The scientific quality of the Deltares software is internationally unrivalled. To continue this reputation, we are looking to join forces with the best leading scientists from all over the world. Modules within a package can



Robustness and usability

Chris Sherwood, oceanographer at the US Geological Survey…

…on cooperation

"Cooperation with Deltares goes back more than ten years. We have established a solid working relationship which includes various exchange visits by scientists and also software experts. It works both ways. Dutch scientists are among the world's leading experts on coastal management and modelling. To US scientists, cooperation has brought the advantage of being able to get into contact with Dutch counterparts, discuss shared problems and learn from Dutch expertise. I think Dutch students have particularly benefited from the opportunity to come to the USA and participate in extensive field programmes where they can use Delft3D in natural conditions very different from those in the Netherlands."

… on Delft3D going open source

"Going open source is not just a good business idea, but also a tremendous benefit to scientists working on hydrodynamics, sediment transport, morphology or water quality in estuarine and coastal environments. To a scientist, a computer model represents a hypothesis of the real world that he would like to be as exact as possible. By having access to computer code, he can actually improve the hypothesis according to his own insights, based on observation or measurements. All of us at the USGS, working across the USA, can now apply Delft3D to our own specific research needs. We can share our experiences with students or colleagues from other organisations, without practical impediments such as a limited user licence. Certainly, for me, this is a huge stimulus to take a fresh look at how I can apply the software in my own work.
Every model has its strengths and weaknesses. I think Delft3D combines cutting-edge science with robustness and usability. Not all models cover both aspects and I regard Delft3D as one of the best packages in its field."

Pushing boundaries in Singapore

The Singapore-Delft Water Alliance (SDWA) is a multinational, interdisciplinary research Centre of Excellence for Water Knowledge initiated by the National University of Singapore, Singapore's national water agency and Deltares. It unites scientists and engineers from both the Netherlands and South-East Asia. SDWA director Vladan Babovic strongly supports the open software initiative.

"This is a major step forward in the advancement of scientific knowledge. As a research community, we are constantly pushing the boundaries of software application. We have thirty PhD students developing groundbreaking knowledge on a variety of subjects, from the transport of suspended sediments in East-Asian coastal waters to ecosystem services delivered by mangroves. Most of these students would like to extend the possibilities of the software in order to meet their own particular requirements. A small example is the modelling of how mangrove seeds are distributed by water flows. No existing hydrosoftware includes a module for this purpose. The fact that researchers now have access to the source code of Delft3D means they can extend its horizon. Furthermore, they don't have to start from scratch. They can build on thousands of invested man-hours."

"Open software gives us the opportunity for increased interaction with other research communities across the globe. Suspended sediments and turbidity are a hot item worldwide. Being able to use a package such as Delft3D almost as a platform on which to share the newest insights is a great aid to the advancement and application of science. As the community grows, the impact of this particular mode of information exchange will increase. Various specialists will add particular qualities to the basic package. We can benefit more easily from other people's activities and experience, just as other people can profit from what we are doing. All-in-all, a most promising development."

be constructed in such a way that they are interchangeable. By using an open architecture and open standards, Deltares is making its software more accessible. Users need to be able to couple our software with someone else's simulation software, database system, GIS or forecasting system."
Flexibility is now a given. "People can obtain the morphological module, without necessarily also purchasing a hydrodynamic module", says Hoozemans. For Deltares, open software is a means of promoting the integrated use of information. "In densely populated delta areas, coastal zones and river basins, issues are becoming ever more complex", explains product manager Edward Melger. "The underlying information is often interdisciplinary. Hydrological, morphological, ecological and non-physical data and models all need to be combined. To satisfy that demand, we offer software that can easily fit into a bigger system."

Open source
Another, related development is the provision of open source software. This makes it possible for the user community to collaborate in enhancing the software and makes its further development a shared goal. "Universities and research institutes will be particularly keen to take this opportunity to modify existing software to meet their own needs and wishes, and to add new elements to it", says Hoozemans. "We are giving them that freedom. That way, we can all benefit from each other's expertise and achieve a better overall result."
The first step has been taken. Since January 2011, Delft3D flow, morphology and waves modules have been available open source. Melger: "More than 600 people worldwide have registered on the Delft3D open source community website that integrates features for downloading source code, discussion forum and blogs. They all have access to daily updates of the source code." Deltares offers a range of additional services. One of them is to facilitate connecting to Delft3D users and developers worldwide via LinkedIn. Another is to organize Delft3D developers meetings. "We received very positive response at our Delft3D developers meeting during Coastal Sediments 2011 conference, in Miami, USA, in May."

Hoozemans offers this final, cogent summing up of the impact of the open software strategy: "People who just want to use pre-compiled software can still do so. Deltares is continuing to offer its software as stand-alone products, supported by a good distribution system and made-to-measure service, including fully validated high quality Delft3D distributions. But people who want the freedom to participate in its development can now do so."

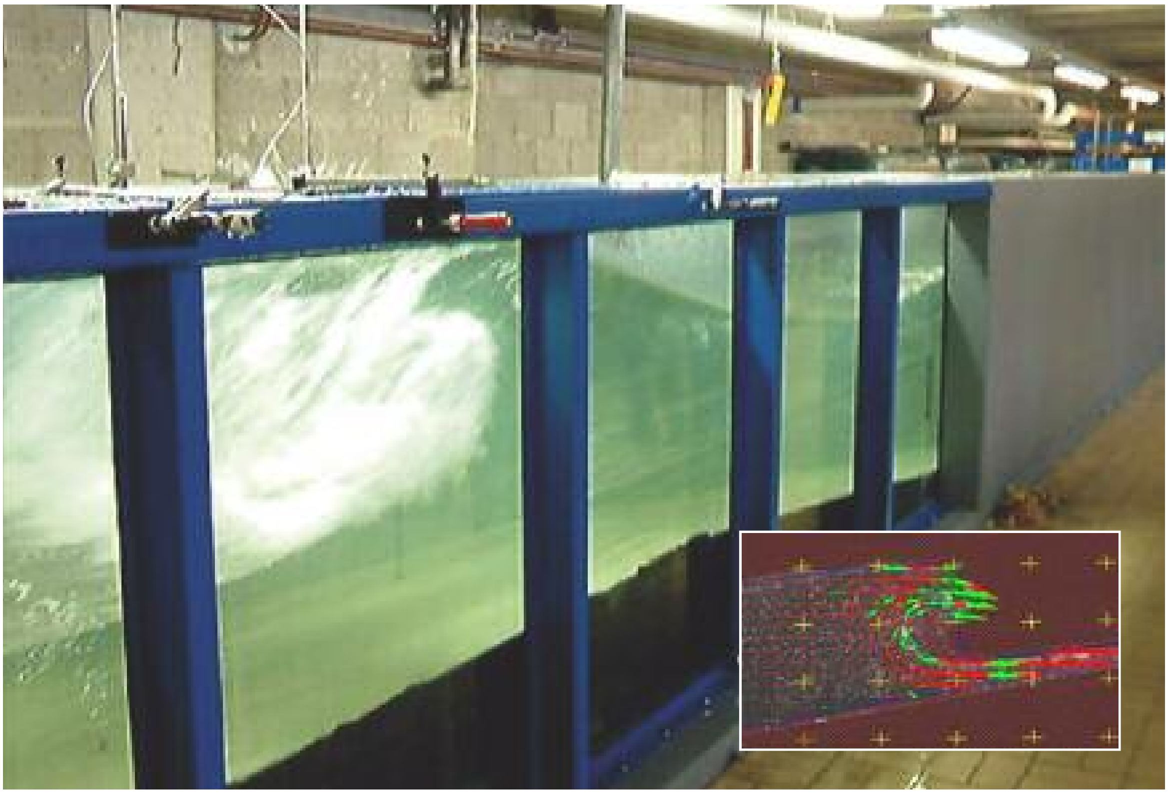
For more information:
Delft3D Open Source Community website
http://oss.delft3d.nl

Composite Modelling - linking

Report of the Composite Modelling Working Group Coastal and Maritime Hydraulics Committee

Composite modelling involves using a combination of physical and numerical models to address a problem. The potential advantages of composite modelling include:

- Extending the range of application of a model;
- Reducing the cost of modelling;
- Optimising the solution, thereby reducing uncertainty.



Picture by Peter Troch

Written by:
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Dr. James Sutherland is a principal scientist at HR Wallingford in the UK. He has been project manager of consultancy and research projects both in the UK and abroad. Research experience including contributions to EPSRC, Defra, Environment Agency and EC-funded research projects including work on coastal hydrodynamics, scour, broad-scale sediment transport and morphology, the development of physical modelling techniques and beach management.

It is a relatively new topic in hydraulic engineering and was the subject of HYDRALAB research project on the composite modelling of beaches and structures (2006-2010). This project produced a set of guidelines , which were edited and included in a recent IAHR design guide and have been summarised in a paper in JHR . In 2009, the IAHR set up a composite modelling working group to extend the subject to all areas of hydraulics. Members are sharing their experience, seeking to characterise the techniques used and developing best practice of combining physical and numerical models. The Working Group has collected some new test cases (including modelling a dam spillway and various aspects of lock design) and has made an initial characterisation of the composite modelling approaches used .

We have found that composite modelling provides a unique opportunity for researchers and engineers to understand the uncertainties and limitations of both the physical model and the numerical model, since their parallel operation allows for direct comparison and calibration. When complex three-dimensional flow conditions are being modelled, numerical models are often limited in their ability to simulate the flow field in all regions as compared to the physical model. Composite modelling allows for the verification and validation of flow rates, water surface profiles and point velocities within the flow domain and consequently determines specific regions within the numerical model that are not being simulated accurately.

physical and numerical models

There is a range of ways in which physical and numerical models can be combined, including:

- Traditional nesting where a physical model is a detailed representation of a system, which is modelled at a larger scale (and at a more general level) in a numerical model;
- Numerical modelling can assist in the design of physical models by helping to set the location and type of boundary conditions that are to be applied;
- Numerical pre-modelling also provides information about potential problems associated with the theoretical design or proposed design changes to the structure, thereby reducing the number of physical modelling configurations necessary during the physical modelling portion of the study. This pre-modelling effort saves time and money once the physical modelling has commenced.
- Modelling the model can allow a numerical model to be calibrated or corrected using the physical model results. The calibrated or corrected numerical model is then available to undertake additional model runs that would be too time consuming in a physical model or were only considered after the physical model has been decommissioned.
- Physical modelling of hydraulic stability combined with geotechnical numerical modelling of soil strength to determine to extent of a rock scour protection layer around a monopile.

We believe that these techniques should be developed and disseminated. The quantification of the strengths and weaknesses of physical and numerical models should also be encouraged, to replace the usual subjective standards. More and more complex problems are being modelled using physical and numerical models of increasing complexity. However, advantages can still be found in utilizing the complementary strengths of each.

The IAHR working group on Composite Modelling is seeking active members and new case studies on how physical and numerical models can be linked to address problems. We invite anyone interested in finding out more to contact the group coordinator, James Sutherland at j.sutherland@hrwallingford.com

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1st IAHR-WMO Short course on

The first edition of the IAHR-WMO Short course on Stream gauging was held last September 6 to 9 at the University of Brescia, in Italy. Stream gauging is one of the critical areas for both routine monitoring of catchment and estuarine environments and for the provision of essential information for hydrological and hydraulic modelling of these environments.

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Preparation of an Acoustic Doppler Current Profiler measurement in the field survey during the course.

It is recognized that continued education and training on methods for hydrometric data collection, validation and publication are the backbone for the consolidation and dissemination of a 'hydrological culture'. For this reason at the XIII Session of the Hydrology Commission held in Geneva in November 2008, IAHR and WMO agreed to cooperate in the development of a course on stream gauging. The course was based principally on the 2nd edition of the Manual of Stream Gauging (WMO N° 1044), published in 2010 and on recent advancements in research, technology and instrumentation for hydrometry also IAHR contributed to.

Trainers were professors of hydraulics and hydrology and officers of hydrological services in Italy, Claudio Caponi, from WMO, and Marian Muste, Michele Mossa, Roberto Ranzi and Boosik Kang as IAHR experts from the Working Group on Applied Hydrology and the Committee on Experimental Methods and Instrumentation. The 50 registered participants included officers and technicians of hydrological and hydro-meteorological services, water engineers, staff of public water authorities, hydropower companies, Master and PhD students. Both traditional methods of hydrometry, including mechanical current-meters and precalibrated measurement structures and advanced technologies based on ultrasonic, laser and Doppler velocimetry were the subject of the course, which included also one day of field work (see the photo). The programme can be found at http://dicata.ing.unibs.it/waterengineering/Events/2011-Stream-Gauging/.

The use of ultrasonic flowmeters and acoustic Doppler current profilers, as ADCP, is becoming a standard practice in several countries

The course started with an introduction on WMO's activities in hydrology and water resources, focused also on the standardisation efforts: five manuals and guides were prepared since 2008, including the Manual on Stream Gauging. After a review of open channel hydraulics, principles of stage and velocity measurements and of their traceability according to standardised protocols were described. It was pointed out how the difference between an ordinary calibration process and a procedure according to a protocol, is that in the first the instrument or the measurement are calibrated by comparison with a standard reference (supplied by a national or international agency), in the second all the laboratory, including the operators, is calibrated by comparison with a standard reference. Then an example on how the Hydrological Service in Korea is organised was presented.

In the following day, the principles of discharge measurements by conventional current meter methods, according to WMO and ISO 748 standards, were presented. Mechanical current meters are still widely used in the hydrologicial practice for point velocity measurements, but electromagnetic and acoustic velocimeters, as ADV, are widely used in the recent years. Also the use of ultrasonic flowmeters and acoustic Doppler current profilers, as ADCP, is becoming a standard practice in several countries. In 2009, for example, 67% of streamflow measurements were made with hydroacoustics

Stream gauging held in Brescia, Italy

by USGS. Advantages and shortcomings of time of flight vs. ultrasonic Doppler flowmeters were reviewed in the course. Also measurement problems due to clear water or moving riverbed geomorphological conditions were pointed out. The LDV systems were also presented mainly for laboratory experiments. This optical technique is ideal for non-intrusive 1D, 2D and 3D point measurement of velocity and turbulence distribution also in free flows. Science and industry apply LDV systems to gain a clearer understanding of fluid mechanics. The measurement results are important steps in fine-tuning product designs to improve efficiency, quality and safety also in river hydrology research and engineering.

The third day was dedicated mainly to uncertainty assessment. Rigorous uncertainty analyses (UA) are relatively new research endeavours in various schools. Currently, various fora (such as WMO and ISO) look for evaluation and unification of the UA approaches over instruments, research tools, and areas of implementation. The reference framework set by the ISO 25377 Hydrometric Uncertainty Guidance and the way it is implemented in the WMO manual for discharge uncertainty assessment with current meters was first presented. The following lectures pointed out the value and importance of hydraulic control devices, as weir and flumes, as reference standards for uncertainty analyses. In case direct measurements cannot be made, especially during large floods, indirect methods, based on water marks, hydraulic controls and modelling, provide a valuable information. Concerning the assessment of uncertainty in ADCP measurements, in the course it was recognised that, because of the numerous sources of uncertainty, a detailed uncertainty procedure for ADCP is not yet available, although progresses in the recent years are reported in the literature.

Classroom exercises and a one-day field work aiming at presenting an automatic hydrometric real-time station, an ultrasonic discharge measurement installation, ADV and ADCP measures, a mechanical current meter and a hydraulic control measure completed the course programme.

The course passed the Quality Check as more than 95% of the anonymous evaluations on quality of teaching and organisation were either 'good' or 'very good' on a four-levels scale including also 'insufficient' and ' fair'. The course can serve as a basis to strengthen a long-term cooperation between IAHR and WMO and a second edition is already planned to be organised in Korea, in August 2012.

Gerhard H. Jirka Memorial Colloquium on Environmental Fluid Mechanics

June 3 – 4, 2011, Karlsruhe Institute of Technology (KIT) Karlsruhe, Germany

Professor Gerhard H. Jirka

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The Gerhard H. Jirka Memorial Colloquium on Environmental Fluid Mechanics was held at the Karlsruhe Institute of Technology (KIT), Germany on June 3 and 4, 2011, in honour of Professor Gerhard H. Jirka who passed away unexpectedly on February 14, 2010. Prof. Jirka was widely known for his outstanding work in the area of Environmental Fluid Mechanics. 23 invited world-leading experts in this field presented keynote lectures in appreciation and recognition of Prof. Jirka's work and achievements. The lectures provided high-level state-of-the-art scientific information on several key areas of Environmental Fluid Mechanics such as Fluvial Hydraulics, Shallow Flows, Buoyant/Stratified Flows, Gravity Currents, Mass Transfer and Small Scale Phenomena and included experimental, theoretical and numerical studies. A list of the lectures can be found in http://jirka-colloq2011.ifh.kit.edu/, and Memorial Proceedings containing the written papers will be published by CRC Press/Balkema (Taylor & Francis Group) in the IAHR series. In opening addresses before the scientific keynote lectures, Prof. D. Löhe, Vice President of KIT, acknowledged the important role which Gerhard Jirka played at KIT, in particular his engagement in the formation process of KIT (merging of University of Karlsruhe with the Karlsruhe Research Center), Prof. H. Kobus, University of Stuttgart, reviewed his contributions to German water research, J. Stocker, Technical Head of the Consorzio Venezia Nuova, reported on his advisory role in the Venice Lagoon project and Prof. N. Tamai, President of IAHR, recalled Gerhard Jirka's activities in IAHR, in particular as Vice President during 2005-2009 and his lasting impact in introducing a new, modern structure in IAHR. Dr. Bleninger, presently at the University of Parana, Brazil, gave an overview of some of Gerhard Jirka's main scientific achievements. At the conference dinner, Dr. John Fenton, TU Vienna, presented personal reminiscences of Gerhard Jirka which, in a very entertaining way, highlighted the great human side of Gerhard.

120 participants (see group photo) from all around the world, with strong representation of former and present IAHR officials, attended the colloquium, paying tribute to the late Gerhard Jirka and his scientific achievements and learning a lot about recent developments in Environmental Fluid Mechanics.

Invitation for Nominations
5th Award (2012)

Prince Sultan Bin Abdulaziz
International Prize for Water

Recognizing Innovation

Nominations open online from 1 May 2011 to 31 January 2012

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