Special Issue on Europe

hydrolink

number 2 2010

First IAHR European Division Congress, Edinburgh

Towards a European Higher Education Area

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Modelling in Europe: the Importance of Environmental Hydraulics

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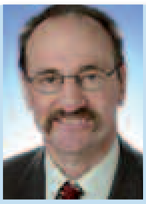

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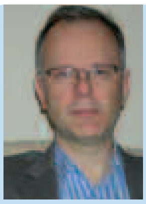

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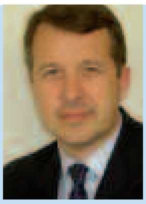

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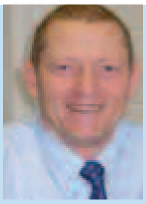

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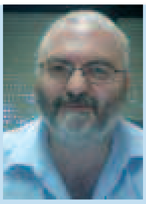

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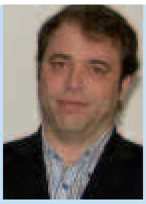

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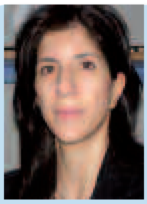

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Introducing Programme Officer for IAHR IPD (Innovation and Professional Development Division)

Estibaliz Serrano is a graduate in Journalism from the Complutense University in Madrid (home of the Secretariat) and she also holds a Masters degree in Business Communications. Estibaliz was born in Cadiz in Spain, and is married with three children. Before joining IAHR she worked for eight years in the communication and marketing departments of several companies and associations.
Since joining IAHR in 2004 she is Publications Manager responsible for all our publications.

Estibaliz has also assumed the new task of Programme Officer for IAHR IPD in which role she will provide support to the Division through the Chair Prof. Jean Paul Chabard and Secretary Angelos Findikakis. This includes support to the IAHR Regional Divisions

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in this issue

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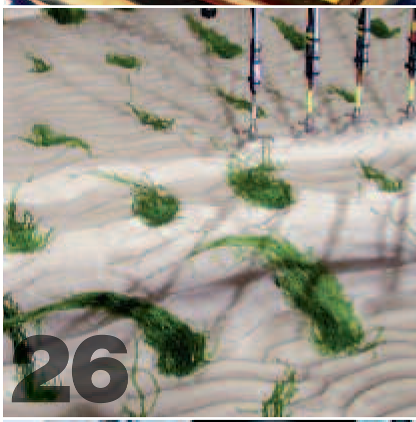

Inaugural Editorial by **Michele Mossa**

Pressing and fascinating

Prof. Michele Mossa is professor at the Technical University of Bari, Italy and has been appointed first Editor of Hydrolink by the IAHR Council as part of the process of restructuring approved in Vancouver.

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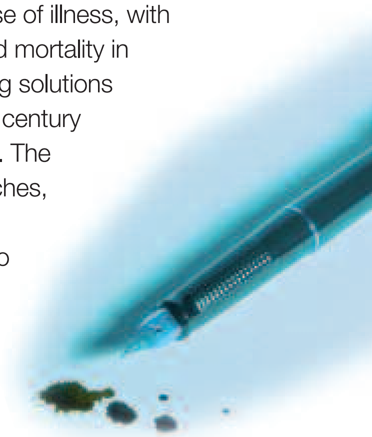
This issue of the IAHR members magazine - Hydrolink - represents another step in the renewal policy of the entire association, approved in last year's Council meeting and symbolised by its name change to the International Association for Hydro-Environment Engineering and Research. Regarding these fundamental changes underway I would like to draw your attention to the article published in Hydrolink, Issue 3, 2008 by Prof. Roger Falconer of the Hydro-environmental Research Centre at the University of Cardiff (UK), in which he observed that IAHR membership has shifted in recent years from Europe and N. America towards Asia (especially China), that the word "hydraulics" has been substituted by "water management", "river basin management" etc…, implying a more interdisciplinary approach to water issues, and that all research in hydraulics is now linked with environmental concerns.

To the observations made by Prof. Falconer I would add that in the latest conferences the term "environment" is used more and more together with that of "hydraulics", as in the recent "Fifth International Symposium of Environmental Hydraulics", held in Tempe, Arizona, in December 2007. This congress was preceded by a workshop entitled "Hydro-Epidemiological Futures Workshop", the publicity for which observed that "contaminated water and poor sanitation is still a major cause of illness, with diarrhoeal disease being the principal cause of morbidity and mortality in children under 5 years in developing nations. […] Engineering solutions drove the reduction of water-related illness in the nineteenth century emergent conurbations of the industrialized nations of today. The on-going problems of the 21st Century require new approaches, which are inherently inter-disciplinary and inter-agency and operating at the river basin scale to effect the commitment to the implementation of further health improvements."



The European Union funded Hydralab Concerted Action (a network of research institutes started in 1997, in the context of the EU Research Framework Programme, to enhance access to physical modelling laboratories in hydraulics, geophysical fluid dynamics, ship and ice engineering), recently organized a workshop on the theme of Ecology (Toulouse, 2008), highlighting the need for a programmed plan of research and environmental development in sectors such as flows with vegetated boundaries, flow models with the presence of bivalves and micro-invertebrates, numerical models which simulate also the presence of algae and eutrophication phenomena.

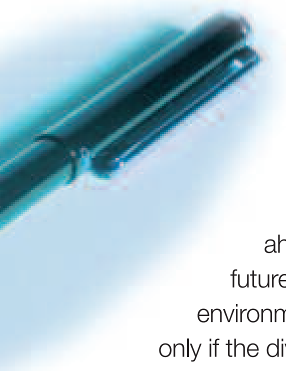
Themes which are ever more current and complex, also linked to climate change and the recent debate on this topic, "climate controversy", together with social pressure on water quantity, to an ever greater demand for new sources of energy, result in the organization of regular congresses, workshops, partnerships or the constitution of new agencies and boards. For example, consider the congresses of UNEP, of UNESCO, of the World Water Council, of the Global Water Partnership or the World Water Day on 22 March each year, which are organized all over the world dedicated to Water as a resource for human kind.

Prof. Robert T. Watson, Chief Scientist and Senior Scientific Advisor of ESSD, The Environmentally and Socially Sustainable Development Network of the World Bank, in his speech at the International Congress of IAHR in 2003, Thessaloniki, highlighted that

challenges

the challenge of the new development cannot ignore the problems of climate change, observing that in this context, at the World Summit on the Sustainable Development held in Johannesburg, the General Secretary of ONU Kofi Annan proposed 5 areas of intervention, summarized in the acronym WEHAB, which stands for:

- **W**e should be able to help at least one billion people without drinking water and two billion without sanitation.
- **E**lectricity and other modern energy services should reach the more than two billion without them, while reducing over-consumption, promoting renewable energy and addressing climate change through a ratified Kyoto Protocol
- **H**alt the deaths of three million people each year from air pollution, addressing effects of toxic and hazardous materials, and lower the incidence of malaria and African guinea worm-spread through polluted water and poor sanitation.
- **A**ssure protection to two thirds of the world's agricultural lands affected by land degradation by reversing it.
- **B**uild "a new ethic of global stewardship", challenging processes that have destroyed about half of the world's tropical rainforest and mangroves, threatened more than two thirds of the world's coral reefs and decimated the planet's fisheries.



Furthermore on the consequences of environmental disasters we should remember also the enormous economic commitment made by the USA which has dedicated around 20 billion dollars to redevelopment and protection of New Orleans and the coast of Louisiana following the devastating floods of hurricane Katrina in 2005. In his speech at the International Congress of IAHR in Venice, 2007. Gerald Galloway, Professor at the University of Maryland and former General US Corps of Engineers, underlined that: "Retrospectives have indicated the friction that has existed over the years among engineers, physical scientists, social scientists, the public, special interest groups, and politicians in setting goals for use of this landscape. The challenge ahead is to develop processes that will enable these diverse groups to harmonize their visions of a future in a science-based approach to restoration and protection of coastal Louisiana that will be environmentally sustainable, financially supportable, and risk manageable. Such harmonization will occur only if the diverse groups are brought together and are willing to deal with the stark realities of the challenges they will face in solving the problems of this fragile physical and cultural environment."

The present and future challenge of our Association consists in taking into account these changes and requirements from all over the world and in developing activities set against the background of a "globalized" world. The role of our association must take into account two main lines of (interconnected) activity: one which is largely professional and political linked to the needs of society, and the other which is largely scientific and linked with research. Therefore, in this context, the IAHR community needs to reply promptly to new pressing and fascinating challenges, in which each IAHR Technical Committee, local Chapter, Regional Division plays the main role of promoting a greater involvement of its member group, whose knowledge and interactions with our association are a vital and unavoidable resource. Our magazine Hydrolink is changing in order to help to respond to these new challenges.

For this reason in the new Hydrolink we plan to increase the number of articles devoted to up-to-date news regarding different aspects of the research and engineering in hydraulics, hydrology, fluid mechanics and water engineering fields. Generally, in each issue there will be a technical and/or a scientific main article, linked to the main event of the previous two months, and articles such as "Ten questions to...", where a researcher, an engineer or a politician will be invited to comment on overriding issues. In this issue "ten questions" are addressed to Prof. Jean Paul Chabard, IAHR Vice-President, and Senior Manager in the Research Division of EDF, France.

Furthermore, the present issue is mainly dedicated to identify relevant features and people carrying on highlighted initiatives related to water in Europe – coinciding with the first IAHR Europe Congress which takes place in Edinburgh in May!

I would like to conclude this first editorial of Hydrolink by sending my warmest greetings to all our readers.

Bologna Process - 10 years later: Towards a European Hi

The overarching aim of the Bologna Process is to create a European Higher Education Area (EHEA) based on international cooperation and academic exchange that is attractive to European students and staff as well as to students and staff from other parts of the world.

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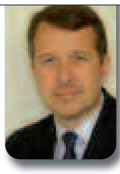

On 12 March 2010, the 10th anniversary of the Bologna Process has been celebrated by 47 participating countries. The 47 ministers of education have adopted the Budapest-Vienna Declaration and officially launched the European Higher Education Area according to the agenda already defined in 1999. The “Conference of the European Higher Education Area Ministers” was followed by a meeting with ministers from different parts of the world in the “Second Bologna Policy Forum on Building the Global Knowledge Society: Systemic and Institutional Change in Higher Education" that was concluded with the Vienna Bologna Policy Forum Statement.

The ministers have expressed their vision for the future as:
"In the decade up to 2020 European higher education has a vital contribution to make in realising a Europe of knowledge that is highly creative and innovative... Europe can only succeed in this endeavour if it maximises the talents and capacities of all its citizens and fully engages in lifelong learning as well as in widening participation in higher education."

This declaration follows a decade of intense reforms in the higher education environment based on the Bologna Process. This European strategy is named after the Bologna Declaration, which was signed in the Italian city of Bologna on 19 June 1999 by ministers in charge of higher education from 29 European countries. Today, the Process unites 47 countries, all party to the European Cultural Convention and committed to the goals of the European Higher Education Area. The overarching aim of the Bologna Process is to create a European Higher Education Area (EHEA) based on international cooperation and academic exchange that is attractive to European students and staff as well as to students and staff from other parts of the world. The envisaged European Higher Education Area will:

- facilitate mobility of students, graduates and higher education staff;
- prepare students for their future careers and for life as active citizens in democratic societies, and support their personal development;
- offer broad access to high-quality higher education, based on democratic principles and academic freedom.

On 28 and 29 April 2009, the Ministers responsible for higher education in the 46 countries of the Bologna Process have met in Leuven and Louvain-la-Neuve to establish the priorities for the European Higher Education Area until 2020. They have highlighted in particular the importance of lifelong learning, widening access to higher education, and mobility. By 2020, at least 20% of those graduating in the European Higher Education Area should have had a study or training period abroad.

The reforms introduced by the Bologna Process are about:

- Easily readable and comparable degrees organised in a three-cycle structure (e.g. bachelor-master-doctorate): Countries are currently setting up national qualifications frameworks that are compatible with the overarching framework of qualifications for the European Higher Education Area and define learning outcomes for each of the three cycles.
- Quality assurance in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).
- Fair recognition of foreign degrees and other higher education qualifications in accordance with the Council of Europe/UNESCO Recognition Convention.

Work is also undertaken in areas of broader societal relevance, such as the links between higher education, research and innovation; equitable participation and lifelong learning. The ongoing reforms will have a strong impact on how European higher education relates to higher education in other parts of the world, which is why Ministers have adopted a Strategy for the European Higher Education Area in a Global Setting.

Since 2000, the Bologna Process has been efficiently supported by European tools like the Erasmus and Erasmus Mundus framework and by the strong willingness of the member states to achieve this global vision expressed initially in Lisbon. However, these efforts are not always concluded with significant results. The European Student's Union has clearly underlined the process of commercialisation of the

gher Education Area

higher education, the introduction of high level tuition fees generating social inequities and the limited results in increasing the mobility of the students. Until now, the Bologna Process could be seen as a half success by targeting mainly the teaching activities.

The need is now for a more holistic view of higher education within the Bologna Process and that would inevitably mean more attention paid to the research dimension. A good example is the necessity to develop joint doctoral programmes which are already existing de facto in research activities like those supported by the European Research Framework Programme (FP7). All universities, and most other higher education institutions, engage in research as part of their core mission, even if what they mean by "research" may vary. A majority of teachers in higher education are also engaged in research and, conversely, many researchers are also involved in teaching. Admittedly this has begun to be reflected in the Bologna process since its extension to cover the doctoral phase of study; after all, today's PhD students are not only tomorrow's researchers but also tomorrow's higher education teachers. Finally, the global standard in higher education is of institutions that both provide advanced education but also engage in research.

The challenge for the next decade will be to integrate both aspects – teaching and research - in a comprehensive vision based on a "quality culture". In parallel, the research paradigm has to evolve: research has now to embrace so-called applied and translational research and even to extend, through various forms of consultancy, to technology transfer and even knowledge management. These radical changes, associated to long-term significance, are strongly needed in order to achieve a sustainable higher education and research environment.

10 QUESTIONS TO...

Dr. Jean Paul Chabard IAHR Vice-President

Interviewed by Michele Mossa and Corrado Gisonni

1

***Mossa/Gisonni:* What do you think about the future development of research in hydraulics in the near future?**

Chabard: In the future, research in hydraulics will become more and more trans/pluridisciplinary and will integrate more and more sophisticated modeling. These models will require improvement of numerical models as well as experimental studies and field measurements.

Moreover new applications will develop due to the need for CO_2 free electricity production and climate change. Already, research on marine energies is developing very rapidly.

As research is becoming more and more transdisciplinary, IAHR should probably develop stronger relationships and partnerships with other water associations.

"IAHR has to develop stronger regional events"

2

Over the past 30 years our membership has remained fairly constant at just over 2,000, but the centre of mass of membership has shifted significantly from USA and Europe. Even if it is important that IAHR membership has expanded so much in the Far East, and particularly China, many of us are concerned about the decline in members from the U.S.A. and Northern Europe. What is your opinion on this point?

It is a real problem. Even if new markets for hydraulic applications are mainly in Far East, I think that IAHR has to work to develope the membership in USA and European countries. Membership expectations can be different according to the countries and IAHR has to develop stronger regional events. The IAHR European Congress for instance is a very good opportunity.

3

The world of hydraulics has moved on since the early 1980s; we have the EU Water Framework Directive, the World Water Forum, Environment Agencies etc, all dealing with water. In many countries, particularly northern europe and the USA, our profession has also moved on and changed with the times. How can the research community drive and give directions for the environmental legislation of the future?

Research people can be more proactive. They should establish research agenda documents on water research, which can be sent to the decision-makers. IAHR can help in establishing the link between the various share-holders.

4

Research areas in hydraulics include "water management", "river basin management", "coastal zone management", "environmental risk protection", "classic hydraulics", etc. In your opinion, which of these hydraulic branches will have a major development and interest in the next years?

In my opinion, climate change will probably be one of the main drivers for research in the next 10 years. This is why I think that the fields which will have major developments are "water management" and "river basin management". But Climate Change will also need to reinforce research on "coastal zone management" and "environmental risk protection".

5

Contaminated water and poor sanitation is still a major cause of illness, with diarrheal disease being the principal cause of morbidity and mortality in children under 5 years in developing nations. […] Engineering solutions drove the reduction of water-related illness in the emerging nineteenth century conurbations of the industrialized nations of today. In your opinion how can the hydraulic community help to solve this worldwide problem? Which are the IAHR steps in this direction?

IAHR can help in promoting efficient technologies in the developing countries. For that, the association has to bridge the gap between

Dr. Jean Paul Chabard is currently IAHR Vice-President and he is the Chair of IAHR Division IPD (Innovation and Professional Development). Jean Paul Chabard s professional background is in fluid mechanics and thermal transfer. From 1984 he worked in the Research and Development Division of EDF (EDF &RD) where he was successively Director of the Laboratoire National d'Hydraulique Department and of the Thermal Transfer and Aerodynamics Department.

research and practice more efficiently. We should be in a situation to innovate more and helping transferring new ideas in applications. IAHR has created a new division named "Innovation and Professional Development". In this framework, we can launch new initiatives, for instance in the field of water desalination. The question is to find for each of them a champion who is in a good position for managing them! This is always a key point in an association – which is based on volunteers.

6

Climate change has been called "an inconvenient truth". What is your opinion on this point?

As I mentioned before, I am really thinking that Climate Change will modify in depth our relationship to our world. With overpopulation and primary resource scarcity, they are the 3 main challenges for the next century!

"I cannot imagine a hydraulics research laboratory which is only "virtual""

7

IAHR has recently updated its by-laws, including the name and some organizational rules. What is your personal feedback in this regard?

IAHR is moving and changing and it is absolutely necessary in a changing world. But the change of by-laws and the change of name are not enough. We have to be sure that every member is also changing in his/her relation to the association. This is expected through the fact that each member has to elect a preferred committee and feel personally engaged in its activities. We still need to promote that idea.

8

Typical expensive research topics involve physical hydraulic laboratories. What future do you expect for these large laboratories? Do you have any suggestion for their rationalization?

Experimental work is absolutely necessary in order to understand the physics of flows. I cannot imagine a hydraulics research laboratory which is only "virtual". Nevertheless, it is true that very large facilities can be shared between several institutes. In the past the European Community launched several projects for encouraging that. I think that they were quite a success.

9

Could you tell us your future move to reach the main goals of your IAHR vice-presidency?

A. Well, as IAHR Vice –President, I am also chair of the IPD Division. My purpose is to work with the Division Secretary, Angelos Findikakis, and all the people involved in the activities of the Division for developing its activities and especially for the benefit of our corporate and institute members. This will be accomplished through a better understanding of their expectations. In the IPD workplan, we have also the goal of establishing a new strategic plan for IAHR.

10

The last question is not exactly a question. You are free to direct to our readers a message of yours on a topic that is dear to your heart.

My message would be: "Move fast, be imaginative and creative. Nothing is impossible, just try it!"

Ecological Modelling

Over the past four years the HYDRALAB III project (http:\\www.hydralab.eu) has tackled many of the difficult issues associated with simulating the interactions of plants and animals with hydraulics and sediment transport in physical models. Eco-hydraulic experimentation is an emerging field for hydraulic facilities and it introduces experimental complexities that are at the forefront of physical modelling research.

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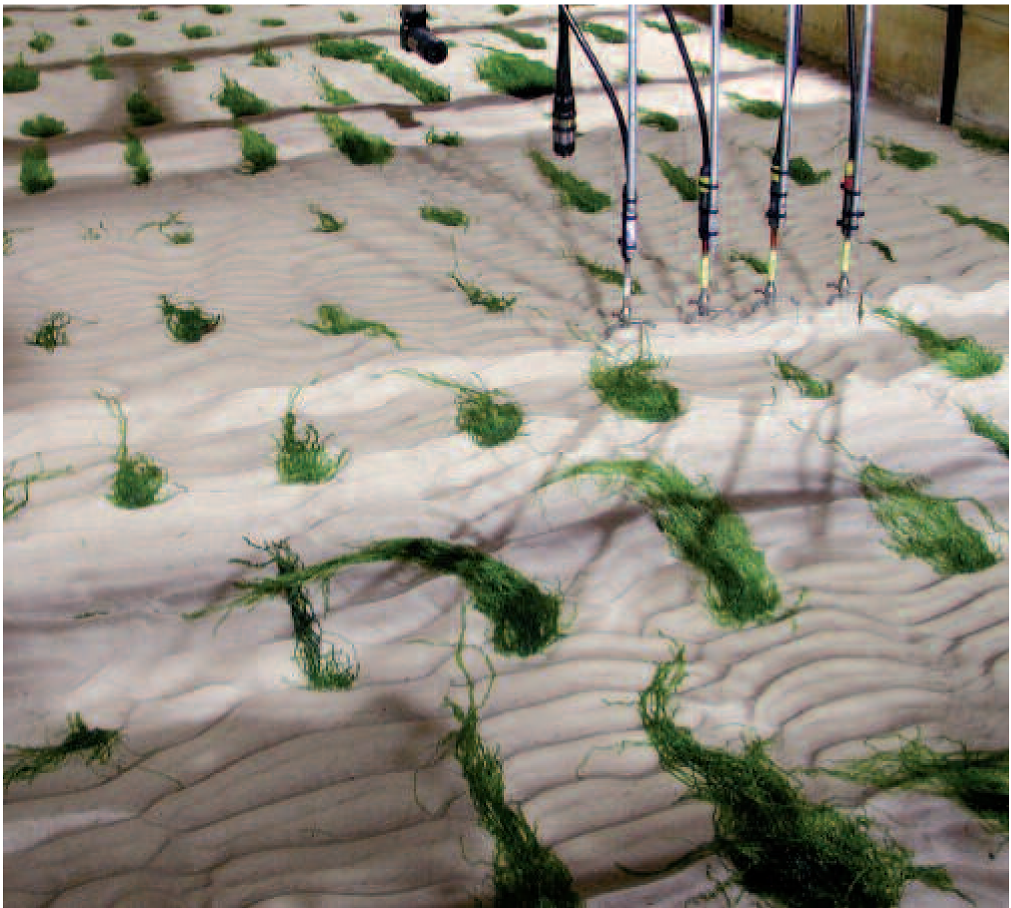
In a changing environment there is an urgent need to improve our understanding of both the impact of environmental factors on biota and the impact of biota on their environment. Research on the interaction amongst water flow, morphology, sediment transport and biological processes is therefore essential if we are to improve the management of the natural environment. This is a very new area of research and the challenges associated with it are many. In addition to all of the well established problems of hydraulic experimentation (scale effects, boundary conditions, etc.) there are issues of plant and animal health, response to transfer into the modelling environment and (for animals) ethical considerations. Some of these problems may be circumvented through the use of inert surrogate materials (e.g. plastics, wooden dowling etc) but these may not adequately simulate the live prototypes. Researchers within HYDRALAB have made great strides towards improving the knowledge and understanding of this type of experimentation over the past 4 years as part of the EU Integrated Infrastructure project HYDRALAB III. Through a number of ecologically oriented Access projects, trans-national teams have worked in our laboratories to solve some of the problems of this type of experimentation. We have also worked together to establish guidelines for future researchers. These will be dissimenated as part of a laboratory manual entitled HYDRALAB Users Guide Book to be published by IAHR this year. Some of the main issues for vegetation and animal hydraulic research are outlined briefly below.

Vegetation has a complex effect on flow roughness particularly since it can respond to the flow field itself, hence the roughness due to vegetation is variable due to plants being able to bend and change their shape. Roughness can also be dynamic since the vegetation can move with a wave like motion which introduces a time-varying component to the roughness (e.g. Stephan & Gutknect, 2002). Water velocities under the vegetation canopy can be considerably reduced compared to the flow above, for example Gambi et al. (1990) measured velocity reduction of 2-10 times lower within the canopy compared to upstream of a seagrass bed. This low energy microenvironment can increase suspended sediment deposition and is important for benthic community structure (e.g. Peterson et al., 1984). The hydraulic characteristics of flow within and around vegetation depends upon a number of factors such as the shoot density (e.g. Gambi et al. 1990; Peterson et al., 2004), shoot thickness (Bouma et al. 2005), and patchiness (Folkard, 2005). This means that any inert surrogates used must be very carefully selected and manufactured if they are to the effects of replicate faithfully the interactions between plants and flow.

Figure 1: Measuring the effect of macroalgae on sediment transport and flow structure.



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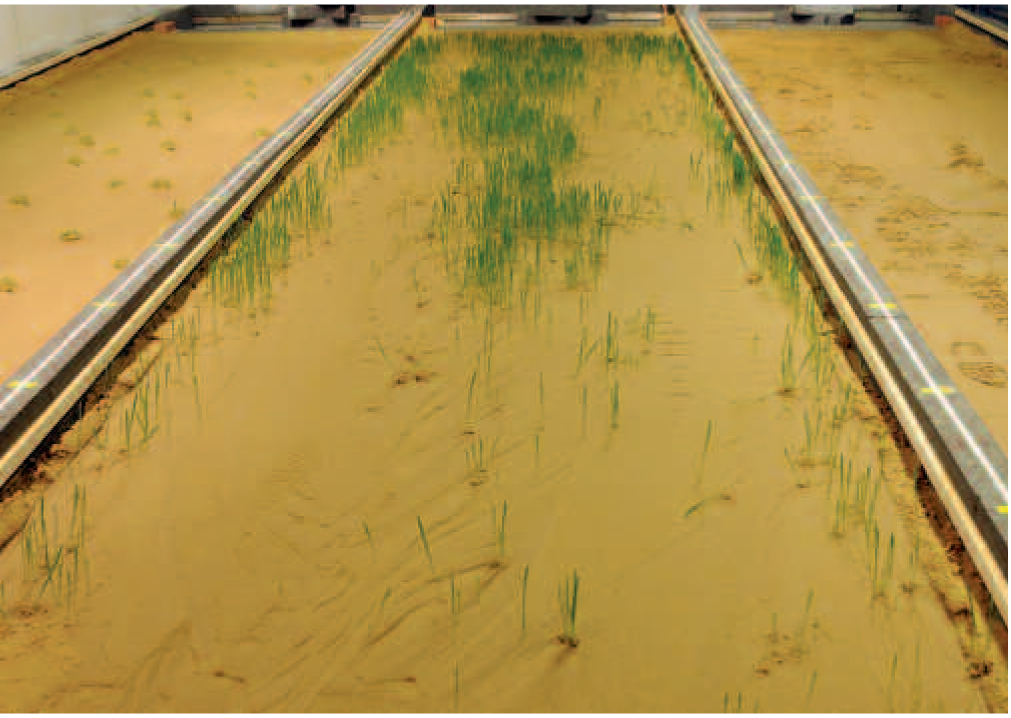


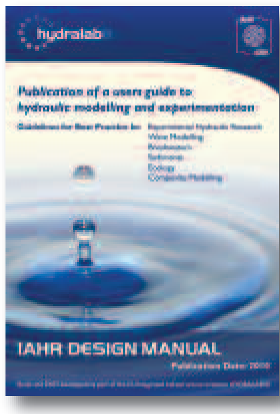
Figure 2: Studying the interaction between vegetation growth and channel development in response to flow events.

Where plants have some flexibility it is essential to ensure that the biomechanical properties of the plant are reproduced in the surrogate that is chosen. Several studies have used strips of different plastic materials (e.g. PVC) to represent blade-like vegetation (e.g. Sand-Jensen, 2003; Folkard, 2005). Folkard (2005) chose a polyethylene sheeting (Decco) as a surrogate that closely replicated the density and modulus of elasticity of natural seagrass plants. However using natural plants is not without problems. They are highly variable and this may make it necessary to carry out replicate experiments. Additional issues that may arise are the fixing of the plants within the flume and the need to maintain their state of health during the experiments. This can be problematic particularly for marine species which require saline water which cannot be used in many hydraulic facilities. Incorporating **animals** into physical hydraulic models is a very new area of research but one that is developing rapidly. An excellent summary of best practice in this field is given in Rice et al. (2010). The interactions between flow and animals are complex since animal response is active not passive, animals can move independently and take action to modify their immediate environment.

A full report on the Hydralab Project was published in Hydrolink 1, 2009 page 6.

In both marine and freshwater systems, benthic organisms depend on hydraulic and sedimentological conditions for the supply of oxygen and food as well as the removal of waste products, therefore flow conditions at the grain/bedform scale and through the water column may be important for animal growth and development as well as the behaviour and spatio-temporal distribution of both individuals and populations or communities. Changes in bed roughness due animals for example in mussel beds can alter the near bed flow structure (e.g. Huttel & Gust, 1992; Friedrichs & Graf, 2009) and the resulting patterns of flow acceleration and deceleration, flow separation and vortex development affect the ability of organisms to capture food (e.g. pathways and residence times for food particles), alter the exchange of gasses and potentially increase solute fluxes in surrounding permeable bed material.

Decisions on whether to use artificial surrogates (casts or plastic replicas) or living organisms will depend on the purpose of the study. Surrogates can only represent passive interactions with flow, not active responses. However experimentation with living organisms is problematic requiring careful maintenance of water quality and temperature which may not be possible in traditional wave tanks and re-circulating flumes. Added to this transfer of animals into the experimental environment may cause shock which modifies behaviour and making robust hydraulic measurements close to small animals is challenging, especially where it is necessary to acquire spatially distributed information at relatively high resolution. For example particle Image Velocimetry (PIV) is widely used for global flow field measurements and provides high-resolution information but seeding materials and laser emissions may have adverse behavioural effects, cause tissue damage or death.



There is a need for greater interaction and collaboration between hydraulic engineers and ecologists. Combining the expertise of researchers from different disciplines is essential to improve the realism of physical models both in terms of their simulation of simple and complex flow and wave environments and the incorporation of plants and animals into those models. Through improved physical modelling that captures both the hydraulic and biological processes, we can develop a better understanding of the interactions between biota and their environment and the effect of the environment on the biota.

The National Telford Institute

Fluid mechanics, hydraulics and hydraulic engineering have a long and distinguished history in the universities of Scotland, dating from the glorious age of Kelvin, Rankine and Scott Russell, through to more modern times where strong groups have been established across the country in the *Hydro-Environment* fields recognised recently by IAHR. The excellent IAHR monographs by Willi Hager on *Hydraulicians in Europe* give full details of the breadth and depth of contributions emanating from the Scottish universities in this field.

In spite of these achievements, there was a recognition in recent years (at least within the contexts of civil engineering and environmental sciences) that the country's research expertise had become scattered too thinly across its 10 or more separate universities and that investment in so-called pooling arrangements offered the prospects of added value and greater international and national impact. In order to facilitate this development, the Scottish Funding Council invested over £26.5 million (with a further £100 million co-invested over five years by the 10 collaborating Scottish universities) to establish the Scottish Research Partnership in Engineering (SRPe) identifying research strengths and opportunities across its university sector, creating new academic positions to support these strengths and establishing structures to encourage collaboration

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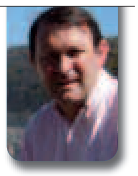


and coordination of research. One of these structures, The National Telford Institute (www.nationaltelfordinstitute.org.uk) was formed to promote the interests of civil engineering.

The National Telford Institute (NTI) is an alliance of Scottish universities, formed in 2007 to facilitate and promote pan-Scottish research collaborations in Civil, Structural and Environmental Engineering. The principal purpose of the Institute is to exploit such collaborations to enrich the quality, breadth and applicability of research in Scotland and, thereby, to enhance the position of Scotland as a world class centre for engineering research. It acts to identify research problems that will benefit from a pan-Scottish approach. The Institute aims to develop a national research resource that can provide expertise to Government and industry, as well as to the wider international research community.

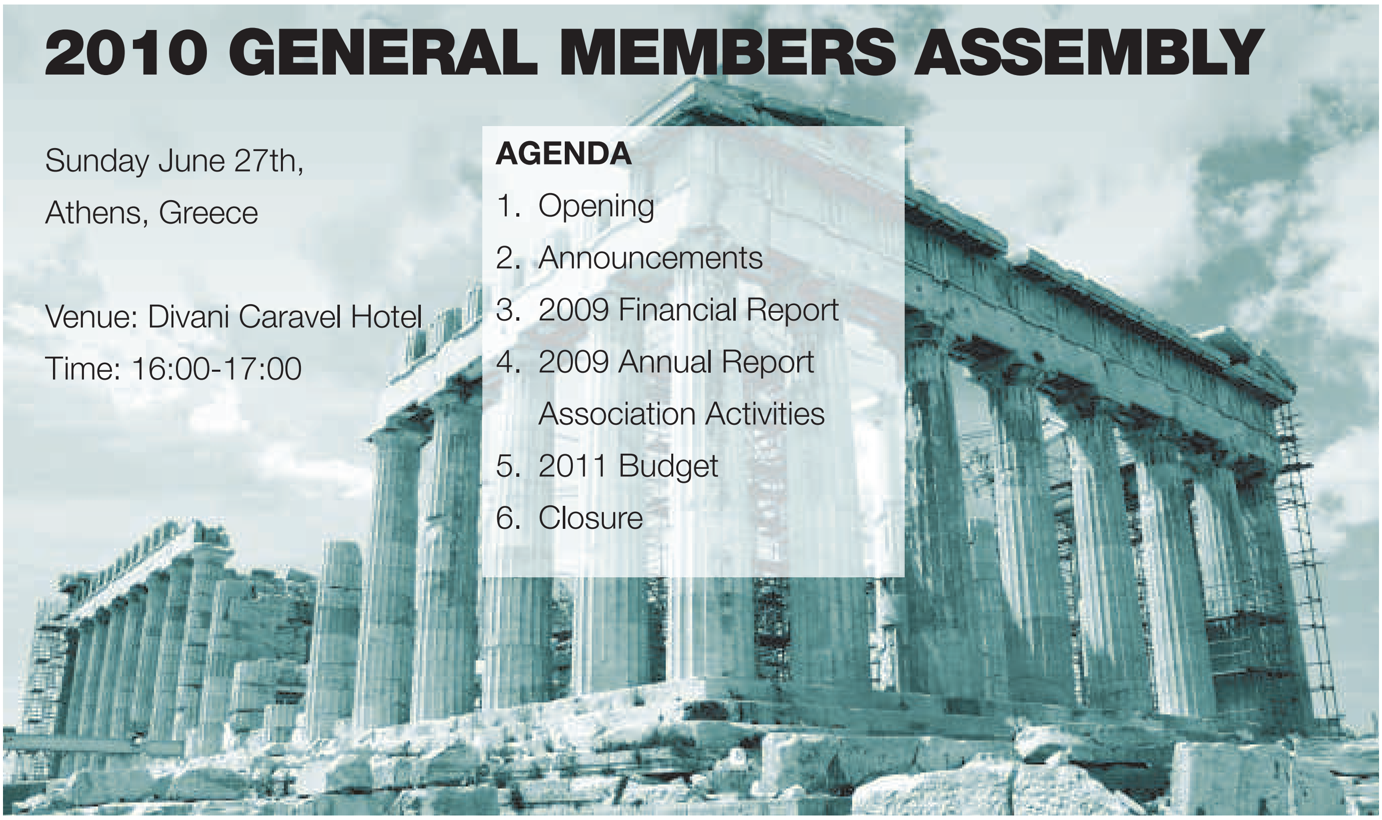
Close involvement between industry, government and the universities is an essential step in enhancing the Scottish research base, to ensure relevance of the research to national economic and environmental priorities and to provide knowledge transfer to improve engineering practice. The NTI is playing an important role in this process. Its scope covers all of the "traditional" research strengths of Scottish universities in civil engineering (particularly in hydraulics and environmental fluid mechanics) as well as relevant cross-cutting themes such as *Sustainable Infrastructure and Transportation, Flooding, Geohazards and Climate Change, Extreme Environments and Events, Renewable Energy, Innovative Design and Construction and Water Resources and Waste Management.*

An important recent initiative has been the holding of a joint Orientation Workshop on *Strategic Developments in Aquaculture*, with joint sponsorship by the NTI and the Scottish Aquaculture Research Forum (SARF), to identify areas of research where contributions from the Scottish universities civil engineering community (particularly in hydrodynamics, wave mechanics, fluid-structure interaction and water quality disciplines) can aid the development of the aquaculture and biofuel production industries (and, by implication, the renewable energy sector) as operations extend into exposed, unsheltered marine environments. A proposal for a *Scottish Centre for Water Environment and Resource Management Research* emerging from the NTI water-related research community and led by Garry Pender at Heriot Watt University has been submitted recently for funding.

The Falkirk Wheel: photo courtesy SRPe

A programme of NTI *Advanced Research Workshops* is the core vehicle for exploiting research strengths within the Scottish universities civil engineering community. Proposals are submitted to the Management Committee of the NTI and, if approved, full funding is provided to enable either scoping-type Workshops to be held to identify critical mass activity in a particular discipline area or full Workshops in known areas of strength to advance the state of the subject and generate collaborative research initiatives. An important component of the Workshop is the involvement of an exclusive group of external international experts invited with full financial support to advise on the most recent significant developments in the topic in question. Advanced Research Workshops on *"Offshore Wind Energy", "Sustainable Urban Water Management", "Advances in Flow and Density Measurement Techniques in the Laboratory and the Field"*(sponsored by IAHR) and *"Applied Sediment Dynamics-Scaling Issues in Fluvial, Estuarine & Coastal Research"* have already been held.

The current membership of the NTI Management Committee includes IAHR members Peter Davies (Director), Garry Pender and Vlad Nikora, with an International Advisory Board that includes IAHR Council Member Arthur Mynett (Deltares) with specialised knowledge of the fluid mechanics, hydraulics and hydraulic engineering research aspects of NTI activities.



2010 GENERAL MEMBERS ASSEMBLY

Sunday June 27th,
Athens, Greece

Venue: Divani Caravel Hotel
Time: 16:00-17:00

AGENDA

1. Opening
2. Announcements
3. 2009 Financial Report
4. 2009 Annual Report Association Activities
5. 2011 Budget
6. Closure

Modelling in Europe: the Importance of Environ

Nowadays society faces important and global environmental problems. Many of them relate to fluid dynamics which can be parameterized by hydraulic variables. The analysis of these problems related to environmental hydraulics has as a common topic, the need to solve complex non linear equations, which are time dependent. And the solution of these complex problems requires accurate modelling techniques.

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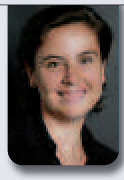
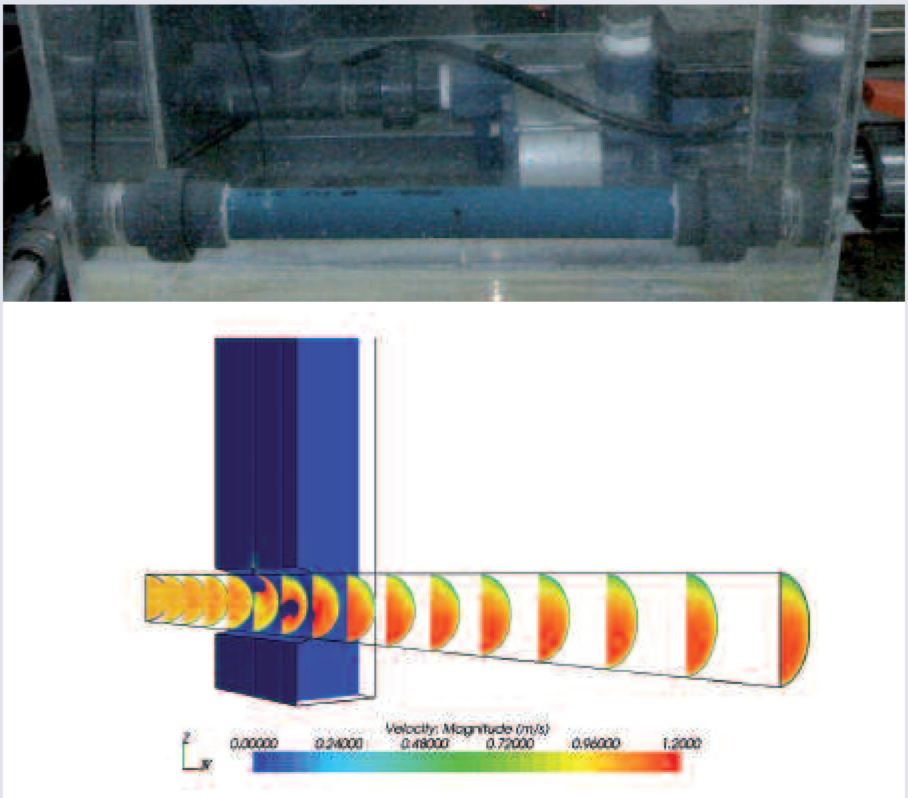


Hydraulic and environmental research is directly linked with modelling. There are some powerful reasons behind this fact: On the one hand, the investigated problems have such a complexity that their study requires models to represent the reality. On the other hand, environmental problems sometimes simply cannot be represented by reality (let´s imagine dispersion of a particularly dangerous pollutant in a river) and numerical models are then the more suitable process to study these possible effects.
Our research deals with fundamental aspects of life. Water and its contamination are present in many of our daily actions. Thus, the representation of phenomena related to water movement and the transport of pollutants covers a wide range of impacts over life and the environment. The problems faced by enviro-hydraulic models generally involve extreme complexity, and typically characterized by strongly nonlinear evolution dynamics. The systems have many degrees of freedom; this makes them complicated and implies nonlinear interactions of several different components taking place on a vast range of time-space scales: continuum considerations and turbulence implications are required for solving resultant equations systems. Theoretical, experimental and computational solutions must be combined to obtain simple answers for complex questions.
In past centuries these problems were studied by considering mostly physical or theoretical approximations. In some particular cases theoretical solutions can be applied. Nevertheless, the presence of strong variability of both the outputs of theoretical models and of the real systems in many cases contributes to difficulties in the applicability of such analytical solutions in terms of model reliability. Therefore, there are some problems which are not suitable to be represented by any theoretical analysis, while their modelling becomes of a paramount importance. Unfortunately, only too often, the theories relevant for the study of systems having a lower degree of complexity cannot be applied to real, non-steady and turbulent problems such as those related to environmental hydraulics modelling.
Furthermore, hydraulic and environmental research are also strongly based on physical models. They play a fundamental role in current and past investigations. Physical models reproduce real phenomena at reduced scale by using dynamical similarity. Large hydraulic facilities are particularly indicated for natural representations without distortions. But also engineered applications of hydraulic modelling are particularly recommended by experimental devices. In real environments, field data are especially difficult to be used to draw conclusions because of uncontrolled natural perturbations. In contrast, the predictive capability of models is increased by laboratory experiments: in this case measurements are performed under controlled circumstances and the uncertainty confidence intervals of predictions are considerably reduced.
Nowadays, computer simulations have become a useful part of enviro-hydraulics research. The development of numerical techniques for solving equations and the increasing capability of computers to provide prediction in a detailed, continuum, cheaper, visual and easy manner has contributed very much to this fact.
Computational models provide a perfect complement for experimental facilities.
Computer simulations vary from computer programs that run in a few minutes, to network-based systems that can calculate complex problems iterating over hours or days.
Nevertheless, numerical models are only approximations to processes. Uncertainty analysis, calibration and validation techniques must be carefully applied. This phase is decisive for using the model predictions to represent the future behavior of real systems. The final objective of modelling is attempting to find solutions to real problems and thereby enable the prediction of the system from a set of parameters and initial conditions. Therefore, the model has to be consistent. It requires a compromise between detail and simplification: as many points as possible should be taken into account; while an appropriate treatment of the data should be considered, so that reality is simulated in the most simple and appropriate possible way. Nowadays, CFD (Computational Fluid Dynamics) techniques have become a more precise tool even for non-expert modellers. Many commercial codes are easily available for researchers and many applications are arising with them.
It must be considered that modelling entailed in solving enviro-hydraulics problems is a simplified representation of complex turbulent processes and boundary conditions; therefore, the calibration, validation and testing of simulations becomes of paramount importance in the whole modelling process. Especially in the case

mental Hydraulics



of numerical simulations, where beautiful coloured representation of results could hide inaccuracies, validation is a crucial task for researchers! Actually, optimization techniques are being developed quickly and even procedures such as genetic algorithms, neural networks, fuzzy logic and any sort of statistical evolutionary algorithms are the future of numerical model modelling and calibration with experimental contrasted results: No validated model will enable us to take decisions about real systems behaviour.

No simple technique is perfect for every kind of modelling. Redundancy and combination of strategies is the better solution for simulating real environmental and hydraulic problems. A good proof of this synergic combination of solutions for modelling has been achieved in Valencia (Spain) last October. IWEH09, a Workshop sponsored by IAHR (International Workshop of Environmental Hydraulics: Theoretical, Experimental and Computational Solutions) has been an excellent opportunity to present, demonstrate and discuss research, development, applications, and the latest innovations and results in this important field. Very important examples of the capacity of modelling for enviro-hydraulic problems can be found in Europe, i.e.: Deltares in Delft (Netherlands), DHI research group in Denmark, CEDEX in Spain, Institute for Hydromechanics in Karlsruhe, Germany, among many others. Some brilliant computational codes and numerical techniques have been developed using the combined efforts of the researchers involved in these groups, widely used in Europe and all around the world.

The future of environmental hydraulic simulations was foreseen in the 82 contributions presented in this workshop. A wide range of aspects were covered, regarding environmental and hydraulic simulations, i.e.:

- *Mathematical and numerical modelling;* presenting models covering such different aspects as optimization designs in open channels, simulation of flows in river and basins, and simulation of engineered devices as membrane reactor models based on neural networks
- *Turbulence modelling:* modelling in meanders, viscous models, swirling strength analysis, groined fields.
- *Dispersion and transport:* solute transport modelling, effects of sedimentation, bed river interactions.
- *Experimental experiences:* river biofilm growth, flow and deposit patterns in reservoirs, biological and ecological experiences, biofilm stabilization of non-cohesive sediment, air-water flow modelling in pipes.
- *Water andnvironmental engineering and hydroinformatics:* of pipelines and valves models, disinfectant simulation in reservoirs and pipes, fuzzy models for hydraulic applications, modelling of urban growth and risk analysis in enviro-hydraulic systems, watershed models.

We had the enormous privilege to count upon the presence of Dr. Gerhard Jirka opening our workshop with his keynote: "Environmental Fluid Mechanics: Definition, Methods and Applications". He reminded us how physical models can simulate real phenomena such as jets, atmospheric turbulence and dispersion, and sending us his always encouraging message to combine theoretical, experimental and numerical techniques for giving solution to future enviro-hydraulics models. Citing his words prefacing our Workshop *"Environmental hydraulics" with its focus on the flow-associated mass and heat transport processes and on the flow interaction with the biological and ecological components of our water systems, transcends the traditional hydraulic approach"*. I specially would like to acknowledge him and all the other prominent researchers in our field like him, who generously open research doors for the future in environmental and hydraulic modelling. Sadly Prof Jirka is no longer with us – but he will be remembered always for the fundamental contribution he made to our subject!