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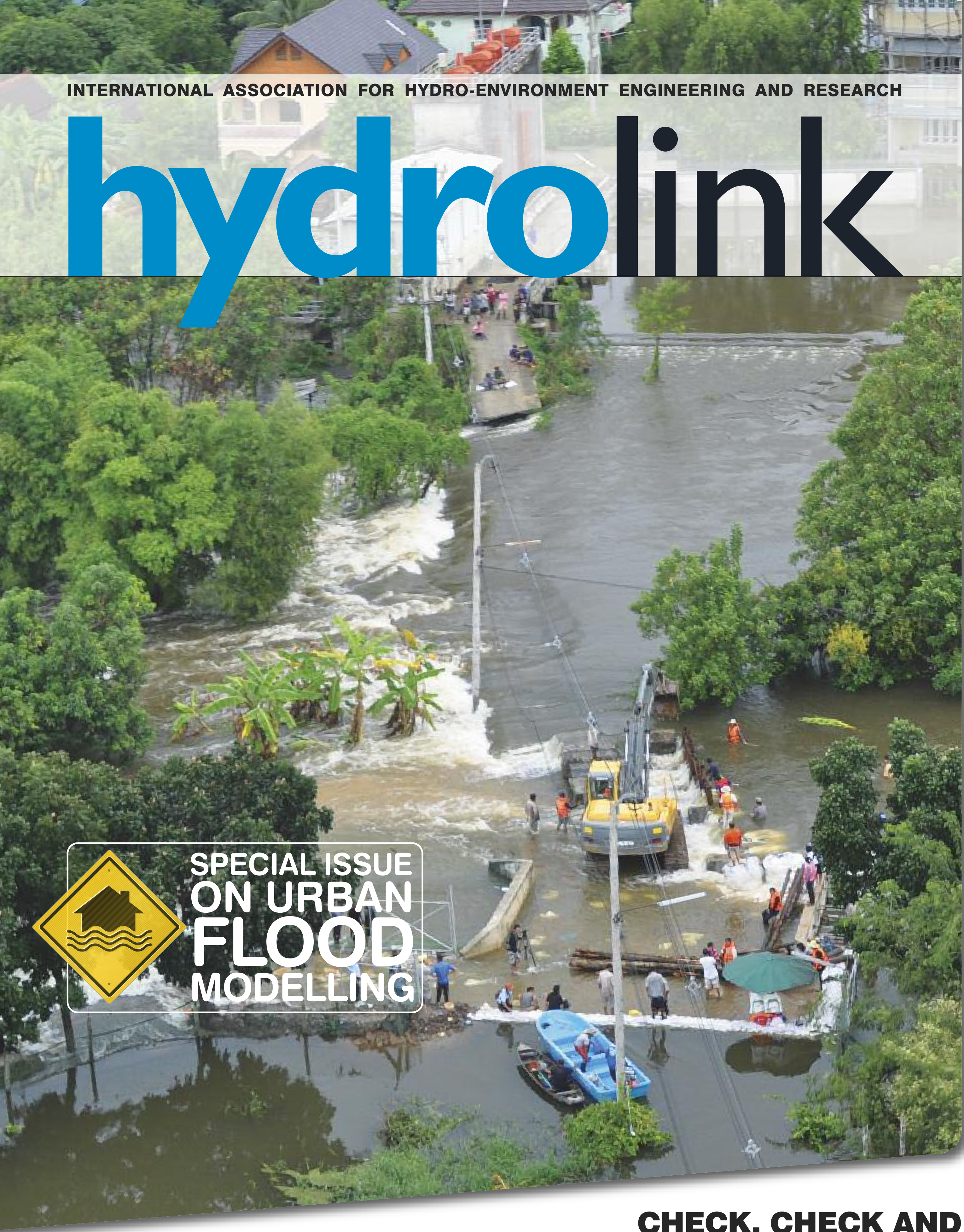

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THE ESTABLISHMENT OF AN ADVISORY BOARD

EDITORIAL BY CHRISTOPHER GEORGE

During the last four years and especially since Prof. Michele Mossa took on the role of first Editor of Hydrolink two years back you will have noticed a radical improvement in the technical content and presentation of what used to be the "IAHR Newsletter": this process of improvement has been further consolidated this year with a doubling in size and consequent increase in space available for the special issues. Given the heavily scientific content of our house journal - the Journal of Hydraulic Research - and the many requests we have received for using Hydrolink as a vehicle for bringing the practice and academic community closer, the Council of IAHR has recently approved the establishment of an Advisory Board to be chaired by Dr Angelos Findikakis of Bechtel, USA (and IAHR Council Member) composed of representatives of several of our leading Institute Members from around the world. This Board will work with the Editor and the IAHR Leadership to identify themes for future issues which are of wide interest and relevance to our community.

This special issue on Urban Flood Modelling is a perfect example of this new approach and is based on a seminar recently held in Deltares in Delft coinciding with the retirement of Dr. Adri Vervey - a very well known member of our community! We hope that readers will find the topic interesting and we would very much welcome suggestions also from you our readers!

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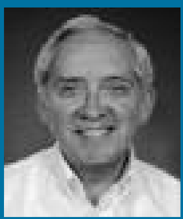

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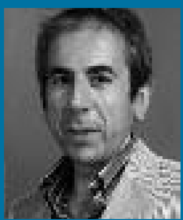

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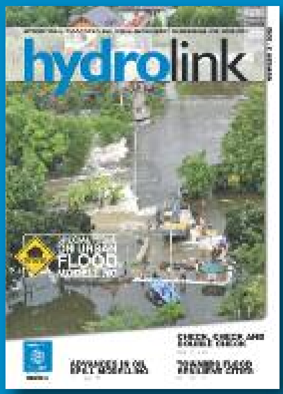

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Cover picture: Field inspection of a dike breach along Chao Phraya River, Thailand
Adri Verwey

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IN THIS ISSUE

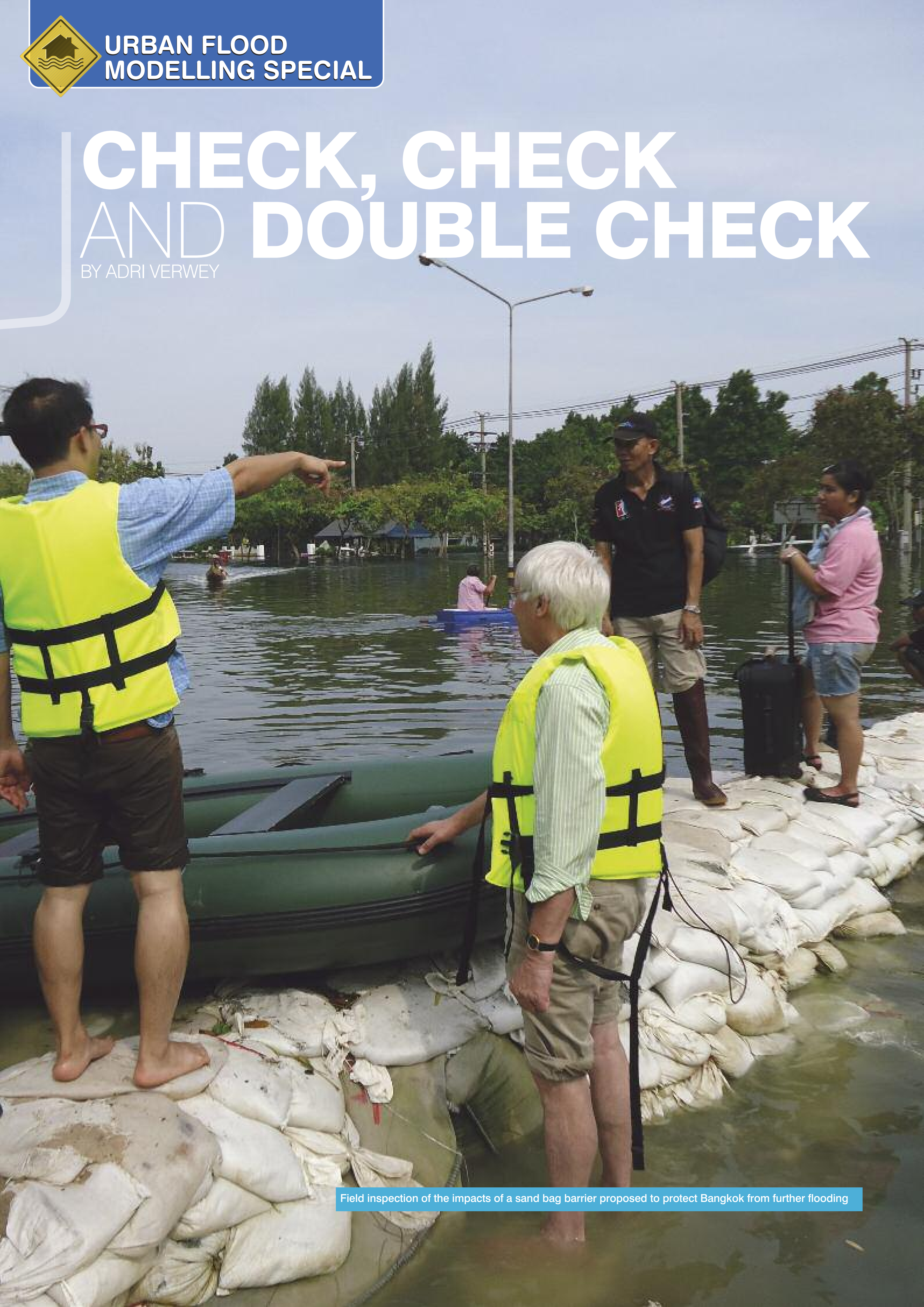
URBAN FLOOD MODELLING SPECIAL

The contents are based on the presentations of the Seminar Urban Flood Modelling, on the ocassion of the retirement of Adri Verwey.

To watch the presentations ***click here*** !

CHECK, CHECK AND DOUBLE CHECK

BY ADRI VERWEY



Field inspection of the impacts of a sand bag barrier proposed to protect Bangkok from further flooding

When my retirement from Deltares in Delft approached, I had to prepare for my own presentation at the Urban Flood Modelling Farewell Seminar held on April 24 this year. The question came up: "What will be your most important message to be passed on to a new generation of engineers?" This led to the issue expressed by the title of the presentation: "Check, check and double check". Looking back at a career of more that 40 years as a hydraulic software developer, modeller of rivers and urban drainage systems and advisor on flood management, checking has become a guiding principle and lessons were learnt by eye openers while working on projects.

Software development

Working as a young engineer on the development of the MIKE 11 modelling system predecessor (System 11) at the Danish Hydraulic Institute, testing the codes was painstaking because of the long turn around times for compilations and test runs. Each mistake was punished heavily in terms of lack of

> **"The lesson I learnt is that thorough designs and thorough checks before submitting runs save a lot of time in code development and lead to more robust software products"**

progress. Jobs were submitted via a terminal connection from Hørsholm, Denmark to the new IBM 370 main frame computer at Lyngby University. One can imagine my joy when I was invited to spend the Sunday at the computer centre, right between all these blue boxes that processed my instructions. Turn around of jobs was immediate and I expected great progress. When I made up the balance at the end of the day I had a great disappointment. No more progress than on ordinary week days. My conclusion was that on weekdays I double-checked or even triple-checked my codes before submitting the jobs and I took no time for that on that particular Sunday. These days the main frame computer is on our desk, but the trap of immediate turn around time remains. I sometimes hear programmers using the expression: "I am going to "tap in" a code". The lesson I learnt is that thorough designs and thorough checks before submitting runs save a lot of time in code development and lead to more robust software products.

Checking system performance after completion of works

Another lesson learnt about the need for double checking resulted from code development at EDF in France. The closure of one of the Phénix nuclear reactors at the end of the seventies led to the need to develop a numerical model to simulate the heat exchange process. Very exciting work and state-of-the-art at that time. However, the model did not lead to an immediate explanation of how temperature differences caused cracks in the mantle of the heat exchange vessel. As part of the checks, the pressure differences, set as boundary condition along the return chamber of the heat exchanger, were increased. This provided temperature differences high enough to explain the emergence of cracks. But what was the cause of such differences? The functioning of the return chamber had been tested thoroughly by simulations with a hydraulic scale model. The picture became clear when further checks were made. During the design process of the reactor the need had come up to reduce the height of its return chamber. Apparently no new model tests were made to check the new conditions, possibly based upon the jugdement that the changes were too insignificant to cause much impact. Maybe it also played that no information was available to calibrate the models used. Also this last aspect is very common in our engineering practice. In flood management, for example, it is more or less impossible to calibrate models for the purpose for which these are developed. One does not often monitor 1 in 100 year floods. Both model application areas show the need to check the performance of a system by monitoring and recalibration of models used, once the works have been completed. Check, check and double check. However, this is rarely planned. The job is considered to be finished, the consultant has gone and the authorities in charge find other focus areas.

Model development

At various stages the development of a mathematical model requires systematic checking. Most important is the check on the correct representation of the system behaviour. Such checks, partly done before the model is even constructed, vary from simple hand calculations to a complex model calibration and validation. The development of a pilot model can be extremely helpful as it provides a quick insight into data needs and system behaviour. This was clearly demonstrated during the 2011 floods in Thailand, where I advised the Thai Government on handling the floods. The first days after arrival at the flood centre the highest priority was the development of understanding of the flood behaviour. Slowly progressing from the north, the city of Bangkok was threatened by a progressive flood wave front. Simple calcula-

Dr. Verwey, **recently retired from IAHR Institute Member DELTARES, has broad experience in river and urban flood management both through fundamental research and software development in these fields and through consultancy projects. During the Bangkok floods of 2011 he advised the Thai authorities on emergency flood management operations. Activities included the development and application of a flood model to study the flooding of the Bangkok area. On this basis he gave advice to the Thai Ministry of Science and Technology, the Army and Prime Minister Yingluck Shinawatra. He is also playing a leading role in the development of drainage master plans for (parts of) large cities, such as Hong Kong, Ho Chi Minh City, Singapore and São Paulo. Recently he was advisor to the World Bank in the preparation of the drainage master plan for the City of Barranquilla. Currently he is a ministry appointed special advisor on flood protection in Singapore. At Deltares he has been for many years responsible for the further development of the SOBEK modelling system.**

tions on the basis of the Manning equation showed the unbalance between flood volumes coming down by gravity and the discharge capacity of Chao Phraya River and the large number of irrigation and drainage canals around Bangkok. As a result, the first conclusion drawn was that there was a high risk of further progressing overland flow. Within a few days, backed up by colleagues at Deltares, an integrated 1D2D pilot simulation model was developed based upon the SOBEK modelling system. Due to continuous time pressure, the model could only partly be refined. However, even so the model showed its tremendous value in understanding the flood mechanism. Systematic checking also showed its importance when combining model development with extensive field visits. On various occasions the model had to be corrected on the basis of own field observations. My former students know that I always stressed the importance of field visits in model development, but in this case its importance surprised even me. For example, as part of the hectic flow of information it was first told that at a crucial pumping station at Khlong Bang Sue 5 out of 8 pumps had failed, followed the next day by a message that all 10 pumps had failed, whereas a subsequent field visit to check conditions showed that all 15 pumps were functioning perfectly well. Once again, check, check and double check information while constructing a mathematical model.

The responsible role of education

The design and application of simulation models requires a good understanding of the underlying physical principles. The development of such understanding is a clear responsibility of university teaching staff. During many years of teaching at UNESCO-IHE in Delft, I had to spend quite some time to show my students, arriving from many different countries of the world, that much of the flow in rivers and canals is of unsteady nature. Their education had not gone beyond the point where steady flow principles were taught. On this basis, how can they understand the functioning of an urban drainage system? The design of a good urban drainage system is based on the art of reducing peak discharges and this requires orchestring the best system composed of storage and conveyance elements. Having only steady flow principles at hand, the urban drainage engineer is completely lost. Without a focussed university curriculum, the principle of check, check and double check is beyond reach.

Thinking out of the box

Thorough checking becomes even more important when leaving traditional paths. Concrete lining of urban drainage channels is the traditional way to enhance channel conveyance. With the current expansion of many large cities in the world, peak discharges in existing drainage channels tend to increase, resulting in new flood prone areas. The basic principle of reducing these peak flows again is delaying runoff from upstream and speeding up runoff at the downstream end of the system. Stretching the runoff hydrograph results in bringing its peak value down. Looking around in new urban developments, the use of glass lining of buildings is striking. So, why not apply this material as well in drainage canals? Glass instead of (weathered) concrete lining of channels brings Manning numbers down by nearly a factor two. The Manning equation shows that for the same cross-section the use of smooth material along the walls may increase the discharge capacity substantially. This is what I suggested to the Public Utility Board in Singapore in 2011 and it was taken up by covering walls of some of the existing drainage canal sections with epoxy-based material. However, such measure requires very thorough checking. Can downstream sections of the channel handle the increased flows? How is the energy of increased flow velocities handled? Nature has its ways of dissipating energy. In the first place wall friction takes care of it. However, if this is insufficient the flow will generate hydraulic jumps with localized production of turbulence and subsequent erosion capacity. Can the canals stand this? Checking of the adapted system design cannot just be based on standard simulation models and the use of common sense. Introducing new concepts in hydraulic design also provides a new challenge to research and education.

Urban runoff monitoring site inspection at the NUS Campus, Singapore

Concluding remarks

Many more examples could be given of cases where extensive checking appeared to be essential in my work as a practicing engineer. Checking becomes a second nature when applied systematically. This is a challenge for the new generation of engineers, disturbed by a continuous flow of short messages, e-mails and used to abbreviating texts to short hand forms. An era with managers expecting continuously that projects can be handled in shorter and shorter times. However, this last point may also be an extra impulse to the new generation of engineers to check, check and double check their work right from the beginning of a project, whether it is software development, model development, creative engineering, or other work. There is a good chance that this awareness avoids loss of own valuable time or that of other professionals at a later stage of a project or thereafter.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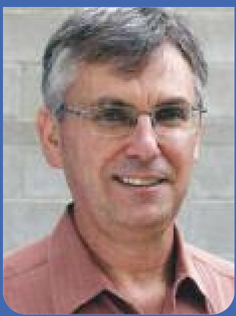
40 YEARS OF EVOLUTION IN SCIENCE-BASED TOOLS FOR FLOOD AND WATER MANAGEMENT

BY ROBERT CARR



Dr. Robert Carr is Deputy CEO of eWater Ltd Australia with specialist technical skills in Hydrologic and Hydraulic Modeling including flood-plain and water management, waste-water and bulk water supply investigations and design. Robert graduated from Civil Engineering from the University of Queensland in 1980 and MSc and PhD from Iowa State University USA in 1982 and 1985 respectively. Robert has worked in Australia, New Zealand, Singapore, Thailand and North America and been involved in projects and research for more than 25 years mainly across Asia and North America. His present role at eWater involves transitioning from a cooperative research centre (CRC) which has developed models to express Australia's unique capability in water sharing policy into a self-managed independent modelling centre focussed on the tools and associated communities of practice.

Finding the balance between managing floods, water security and environmental flows at physical scales from local urban to transboundary river basins has become a real concern for policy makers in recent years, particularly when climate change and megacity growth are brought into the conversation. Computer-based modelling systems are considered by many technical experts to be a reliable method of analysis to support decisions in water management, but with the science and engineering methods underpinning these models constantly shifting, decision and policy makers have tended to use other methods to reach consensus.

Further, the emergence of proprietary software modelling platforms has to some extent constrained functionality and created a timing lag between new knowledge and mainstream adoption that weakens the credibility of models to represent truly integrated planning based on latest science. This paper explores ideas around new combinations of community-based model development in combination with business models which may offer a new paradigm for integrated water resources planning.

Models as Decision Support Systems - What Happened to Artificial Intelligence?

What we commonly refer to as computational modelling can be traced back to developments in computational hydraulics in the 1960's and 70's. Abbott (1991) identified several generations of modelling from the first use of computers to solve analytical equations to the final (5th) generation which was foreseen to involve artificial intelligence (AI) to bring these by now highly sophisticated numerical tools into the realm of decision-makers. While it could be argued that by the early 1990's that Abbot's third generation of generalised modelling systems was well underway and the 4th of data integration was largely foreseeable as a natural progression, the 5th generation was still somewhat 'out there' and held great promise. However looking from where we are today some 20 years later after Abbot's paper, the merging of advanced hydrological and hydraulic models with AI technologies has largely failed to deliver on the promise for a number of reasons.

- The underpinning science is still not complete. New methods are constantly being developed and new science developed which causes any decision to be subject to question if not able to adapt. We are living in a world of a deluge of information (Attwood, 2009) which implies that models also need to adapt quickly to retain the trust of the public and policy-makers.
- Decision makers perceive the world differently from model developers and indeed those who apply the codes to solve real-world problems. Models need to adapt to decision makers perception and compare approaches rather than be locked into one or two methods. Rule-based approaches do not represent reality, where decisions are ultimately made on the basis of complex hierarchies of influences.

- Some AI Tools (artificial neural networks, genetic algorithms, chaos theory, model trees, fuzzy logic, intelligent agents etc) were found to require a significant amount of tailoring and judgement to ensure that optimisation outcomes were practical. Some techniques have been found to be useful in tradeoff analysis to help decision makers visually appreciate the implications of choice but the vision of generalised AI linkages between water models and AI has largely stalled in practice.
- In an attempt to define more and more detail through more detailed theoretical process descriptions, models have become very data intensive despite inconsistencies in the quality of the underlying data sets. Different models require different types and density of data due to the level of conceptualization of the model. Models have generally been 'out in front' of the underlying data sets and while some models delve into considerable detail in conceptualizing physical processes, the data and process knowledge required to support those models is prohibitively expensive to collect and maintain. The true cost of these models is not in the software itself, but in the investment in data and human knowledge required to operate and maintain them. There is a tendency to develop models to reflect the scale of the data rather than the scale of decision or supporting science. All these factors lead to models that are slow, over-parameterized and unsuited to AI applications and have unfortunately become largely Data Support Systems rather than Decision Support Systems.

The conclusion is that after 40 years of modelling platform development, best available science coupled with Human Intelligence remains the best combination and clearly an adaptable flexible platform is required to facilitate the process in a way that appeals to decision makers rather than replace them with AI.

So the challenge is to find a way of connecting the various communities that interact with models together in such a way that supports the concept that water is a public good necessary for life, is self-sustaining from a business perspective and innovative to the extent that new knowledge can be integrated and mainstreamed with minimal delays.

Innovation Management via Open Source Variants

There are many challenges to developing and maintaining water management models given the requirements for constant innovation: Innovation is made even more difficult because the basic IT platforms won't stop moving. For example new computer hardware and operating systems appear regularly, and programming languages are constantly under revision as new standards are developed. Data storage systems, Geographical Information Systems, SCADA and Web-based sources of information are also constantly changing as those fields progress and improve their own technologies and approaches.

Users have become accustomed to working with sophisticated packages with intuitive interfaces and there is an expectation that water management tools will follow a similar development path even though this may not represent fundamentally new science and knowledge. It is uneconomic to constantly implement new science before some level of mainstreaming already exists, but mainstreaming cannot occur unless new science is tested in real world applications.

This paradox is the fundamental reason why proprietary systems lag the public research innovation front and is further compounded by the need for the self-validating proprietary software organisations to be conservative in their approach to new methods.

Open Source is a development method for software that has the promise to deliver reliable, flexible, high quality products at relatively low cost compared to other approaches. There are several variations on the theme ranging from essentially public domain to commercial groups which may approach vendor lock-in models by offering limited access to proprietary systems. Open Source conceptually is ideally suited to the concept of a platform that encourages innovation and comparison of methods, leading to rapid mainstreaming of new knowledge without the time lags associated with proprietary systems. As an innovation platform it has the further benefit of distributed peer review and transparency of process (www.opensource.org).

Innovation Opportunities in Business Models

We find ourselves in a challenging funding environment where the sponsors of research demand that the link between research and practical outcomes is made clear and a pathway to mainstreaming is considered. It is also increasingly important to appeal to the widest possible range of stakeholders to rapidly deploy the outcomes of research. The challenge is to find a business model that self-supports the research mission but at the same time provides financial stability and a sense of moral purpose and direction in an increasingly global commercial business environment.

A Business Model can be defined generically as describing "*the rationale of how an organization creates, delivers, and captures value (economic, social, or other forms of value)* (Osterwalder, 2010). In the context of the above, any business model which has at its core the improved understanding of a public good element such as water needs to have at its an element of 'Free'. In this context (Oserwalder, 2010) a 'Free' business model does not necessarily mean that there are no revenue streams for the organization, it means that *"at least one substantial customer segment is able to continuously benefit from a free-of-charge offer"*. One configuration of business model which could support sustainable open innovation around a public good element such as advances in policy-driven water management tools is described below:

1 **Community.** The core values acknowledge that the community is working towards improving our ability to manage water for the benefit of the public good. The Community Business Model relies on user loyalty, social networking and user-generated content to deliver innovation and his heavily reliant on the :network effect", "crowdsourcing" and other approaches to generating content and knowledge. This model is also attractive to advertisers because it is a place where conversations are taking place between potential consumers. Wikipedia™ and Facebook™ are examples of communities.

2 **Membership.** The membership model can be used to reinforce the theme of community through a subscription fee which is applied on the basis of the ability to pay. Such a model removes many of the elements of commercial negotiation because unlimited access to a set of tools and forums is contained within the subscription (all you can eat model) Users may be charged a periodic fee to subscribe, while knowing that some other users are offered the same access but without a fee due to their special status. In the membership model, subscription fees are incurred irrespective of actual usage rates and subscription and advertising models are frequently combined. Some level of advertising is often permitted within the membership model because it supports the community (also integrated advertising/product listing). An example of this business model is online newspapers.

One business model pattern which offers an opportunity to combine Community and Membership offerings is known as "Freemium" (Osterwalder, 2010). The Freemium model can be adapted to combine some free content with "premium" (i.e., subscriber- or member-only) content. Advertising and product listing can be brought into the business model where it supports the community and is understood to be there to lower the cost of membership, particularly for those members who have little access to funds. Such approaches are common for example in social media, a good example being the forum hosting site ning.com™ where the basic services are provided with advertising, the user pays for additional functionality and removal of advertising.

The Freemium business model offers the opportunity to apply a commercial open source approach with open innovation as an engagement model and has a number of benefits towards achieving the goal of a financially sustainable independent enterprise. Freemium can be tailored to create and capture value by providing a collaboration environment for those partners who are of a similar mission and vision, and are prepared to join as members of the community. It is attractive to external parties who can benefit from shared ideas or assets. It also allows "Outside In" innovation by adopting external contributions through two-way conversations (a kind of Knowledge broker role) and ultimately fosters a true Community of Practice around the public good water management mission.

Conclusion

In response to the ever-increasing deluge of literature and innovation in Integrated Water Resource Management, the need for transparency of process and best practice scientific foundation for decisions is driving new paradigms in how to structure modelling frameworks, communicate with stakeholders and fund the necessary research and maintenance of a community of practice. If successful, these new combinations can deliver the necessary linking of sophisticated modelling with human intelligence and deliver the next generation of water modelling advances.

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FLOOD MODELLING – WHAT NEXT?

BY JON WICKS

Computational flood modelling has been in use for some fifty years to inform decision making in flood management. Over this time there have been significant improvements in the modelling systems as they evolved from standalone simulation codes representing specific rivers, into generic modelling systems combining model building, simulation management and results presentation within a GIS-like framework.

Dr. Jon Wicks **Dr. Jon Wicks is the CH2M HILL and Halcrow Global Technology Leader for hydrologic modelling. He has over 20 years experience of the application and development of modelling and decision support tools in water resources and flood risk management. In the UK he has worked extensively on the River Thames, leading high profile projects covering flood forecasting, flood mapping and appraisal of strategic options for future management of flood risk through London. Internationally, he has worked in South America, Europe and Asia on major river systems such as the Mekong in Laos, Thailand, Cambodia and Vietnam. He has published over 30 papers and regularly presents at major conferences.**

The marketing material associated with the current commercially-available flood modelling systems paints the picture of comprehensive, integrated, fast and easy-to-use systems that fully meet user needs. However, user experience suggests that this is not the case and further development, underpinned by academic research, is needed as the needs of users continue to evolve.

So, what more do we need from our flood modelling systems? We need them to be faster for building models and faster and more robust for running models. The systems need extended functionality to generate the outputs that the decision makers need now and in the future. The results need to be more accurate, more detailed and easier to use. The modelling process needs to be more efficient and the modelling systems more intelligent so that only 'fit for purpose' results are generated. The whole life cost needs to be controlled and the software must run well on standard IT hardware and use available input data.

These issues are discussed in more detail below from the perspective of a practitioner delivering flood modelling projects. Possible research opportunities to help address these issues are suggested. It is hoped that this article is a useful contribution to the ongoing challenge of aligning IAHR activities with industry needs.

Faster to build and run

The standard flood modelling process includes the following main steps:

(1) Select the optimum modelling approach given the specific project objectives, data availability and time/modeller resources
(2) Build the initial model (collecting new data where required and feasible)
(3) Test, calibrate and validate the model
(4) Undertake production runs and provide quality-controlled processed results

Each of these main steps could be made more efficient and some examples are provided below.

An 'expert system' could be provided to guide modellers through the modelling approach selection process (step 1) – this would require research on which modelling approaches are appropriate for each type of study given the availability of data and other project constraints. Benchmarking studies, such as [1], can provide some of the evidence.

Step (2), the model build process, could be improved through standardisation of data formats. Working with software developers, survey organisations and modellers, the Environment Agency (EA) has recognised this and has developed a 'universal transfer format' (called EACSD) to improve the efficiency of data transfer from surveyors into flood modelling packages. There is the opportunity to develop automated model building modules based on this new format.

Step (3), testing, calibration and validation, could be speeded up through the development of tools that identify common issues and help resolve them, and through automated calibration/validation processes. The danger here is that model parameters are automatically adjusted beyond physically realistic limits in order to produce a good fit to calibration data. In many instances a better solution may have been to change the modelling approach, model schematisation or question the accuracy of the calibration data. Research is needed on combining automated calibration with strategies for identifying deficiencies in the modelling approach, schematisation or calibration data.

Faster run times, step (4), can be achieved through a range of measures. Many of the established modelling systems use numerical solvers that were designed many years ago when computer memory restrictions were a key constraint – RAM is now plentiful and different solvers are likely to be more appropriate. Similarly, the ready availability of parallel processing hardware is a recent change and the traditional solvers may need replacing to make use of parallelisation on either the GPU or CPU. Commercial modelling system developers are already making good progress in this area, but other approaches exist for improving run times; it would be useful if all approaches were assessed systematically and independently to identify which approaches are most likely to make the largest positive impact on run times.

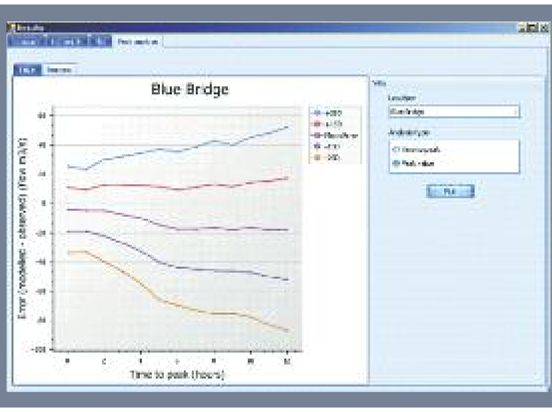

Figure 1.
FORPAST- a Halcrow tool to calculate and communicate how forecast model accuracy varies with lead time

Figure 2. 3D visualisation of flooding (ISIS 2D)

Extended functionality

Flood modelling is used to inform a large range of types of flood management decisions, including issue of flood warnings, setting design levels for new flood embankments, and understanding how plausible ranges in future climates will impact on flood risk. Each of the types of flood decisions may require different functionality in the flood modelling systems. The most common requirements of maximum water levels and flood inundation extent for single events are well catered for by the established modelling systems. However, user needs are evolving and may require new functionality informed by research activities. Examples are provided below.

Traditionally, flood mapping shows single sources of flooding (e.g. fluvial flooding, coastal flooding or surface water flooding). However, there is a growing understanding that 'all sources' mapping is required that enables stakeholders to understand the likelihood of flooding (from any one or multiple sources). There is thus the growing need for practical modelling approaches to generate this 'single value' of flood risk at a point. Interactions between different sources need to be included as does joint probabilities. A step towards an 'all sources' method was made by the Environment Agency [2] and the method (called MAST) is now implemented in the ISIS modelling system. However, further research is required, for example, to improve the method used for accounting for dependencies.
Flood depth and inundation extent will remain core outputs from flood modelling, however other outputs are required in order to better understand and manage the impacts of flooding on people, property, infrastructure and the environment. Risk to life is a key factor and while some modelling systems already generate a 'hazard rating', there is much more that should be done to improve the predictions of flood risk to life – particularly as in some countries flood-related deaths tend to be related to car travel. The debris carried by flood water is a key hazard in itself and also affects the flow paths (for example bridge openings blocked by trees or cars). Pollutant transport and morphological change during flood events are further potentially important factors which are usually ignored in flood modelling. While some methods already exist to enable simulation of these processes, standard practical approaches do not exist and therefore these are likely to be useful areas for research.

There is a growing need to better understand and communicate uncertainty in modelling outputs - improved methods are required to understand how the uncertainties in input data and modelling processes affect the outputs. This is an active research area (e.g. [3]) but no practical approaches have yet become standard in flood modelling practice. Methods to communicate uncertainty information targeted at different types of users are also required.

More accurate

The most important requirement is that the modelling results are of sufficient accuracy to support robust decision making. For some uses, relatively low accuracy is sufficient (e.g. broad scale analysis of future climates to help understand the potential magnitude of future flood risk). Whereas for other uses much higher accuracy is required (e.g. setting of crest levels for new structures designed to control flood flows). The challenge is to identify the situations (physical processes and flood management decisions) where the current flood modelling methods are not sufficiently accurate and then develop methods that provide the required accuracy. Figure 1 shows an example of how to communicate the variation in forecasting model accuracy with lead time.

In many cases it may not be appropriate to improve the representation within the base flood modelling system and a better approach would be to link through to different solvers. The OpenMI (www.openmi.org) standard has been developed to facilitate the simulation of interacting processes through enabling different models to exchange data as they run. OpenMI provides opportunities for researchers to dynamically link their research codes through to commercial modelling systems.

Easier to use and more intelligent systems

Commercial flood modelling systems are capable of producing vast amounts of different types of outputs. For end users, it can be challenging to extract from this mass of data the key information that is required to inform the decision. Another challenge can be to present the information in a way that is easy for the decision maker to understand (where the understanding needs to also cover the confidence they should have in the information). Visualisations using 3D photorealistic animations can be a very accessible way to present flood simulation data to non-modellers (e.g. Figure 2). A research area which would require collaboration between different academic departments would be to develop such 3D visualisation methods that also enable the uncertainty information to be communicated to stakeholders. A more general need is the development of guidance on how best to present flood modelling outputs for specific flood management decisions. An example of a product specifically developed for one use (real time flood incident decision making by non-modellers, thus focusing on ease of use and resilience) is FloodViewer (Figure 3).
The concept of an expert system to help decide on the overall modelling approach was introduced earlier. This could be extended to support the full modelling process and could cover aspects such as: suitable grid sizes and time steps, advice on suitable parameter selection including roughness (e.g. www.river-conveyance.net), and advice on how to decide if the outputs are sufficiently accurate for the intended use. Some of these aspects would require further research and development.

Best use of available IT technology and data

Making best use of modern IT and data acquisition technologies are two key ways to improve the flood modelling process and manage whole life costs. New IT technologies, such as cloud computing, GPUs, mobile devices and touch screen devices, provide opportunities for step changes in flood modelling. Perhaps even more significant change will be provided through new data acquisition technologies. The ready availability of terrain data from LIDAR has already transformed flood modelling in the UK where 2D modelling of floodplains is now the norm. Data from satellites and from widespread terrestrial sensors may have the same transformational impact in the future (perhaps a Google 'River View' for all water courses and including elevation data). While some of these new data sources will be high cost, others may be free to use (such as Google Earth, Google Street View and OpenStreetMap).

> **"IAHR can help develop ideas and new ways of thinking while ensuring that the hydraulic fundamentals are not forgotten"**

IAHR role

Further advancements in flood modelling systems are inevitable. The commercial software developers will be leading many of the advancements but there are clear roles for other members of the IAHR community to ensure developments are aligned with user needs and are scientifically robust. Some end users are seeking to drive the underlying research through publication of research strategies (e.g. [4]). Other developments will be on the back of external catalysts (such as satellite data or IT industry breakthroughs). Modellers themselves are also introducing innovation as they use available systems and data to meet the needs of their internal or external clients. Academics are looking for both challenge-led and discovery-led research opportunities in flood modelling.

IAHR has an important role in disseminating research outputs and, perhaps more importantly, encouraging collaboration between the various stakeholders to ensure advances in flood modelling meet the evolving needs of decision makers. IAHR can help develop ideas and new ways of thinking while ensuring that the hydraulic fundamentals are not forgotten. We live in a connected world which is becoming even more connected - IAHR has the opportunity to play a pivotal role in steering further advances in flood modelling which can lead to benefits for communities at risk of flooding throughout the world.

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Figure 3. FloodViewer – making flood mapping data easier to use in emergency situations (www.halcrow.com/floodviewer)

TOWARDS FLOOD RES

FROM FLOOD RISK TO WINDOW

BY ARTHUR MYNETT

Floods on the rise ... !

Flood disasters have had a major impact on human societies for many centuries already. However, in recent decades extreme flood events seem to be occurring more frequently and with greater intensity. Whether this is caused by climate change impacts or due to anthropogenic (man-made) effects need not be of considerable concern: all indications are that things are likely to get worse over the next few decades.

As of the year 2008 more than half the world population is living in large urban conglomerates. If the global population continues to grow towards 9 billion in the middle of the century, the world will consist of an increasing number of mega-cities of 20 million inhabitants or more. Mumbay in India, Shanghaj in China, Ho Chi Minh City in Vietnam are just a few top-ranking examples. Quite often these cities are situated in low-lying delta areas where the river meets the coast. With increasing river discharges, intensifying precipitation and rising sea levels, these cities may be in for major flood disasters in the not too distant future.

> "Many of the coastal megacities of today were not designed with high safety levels in mind"

Adequate protection levels

Many of the coastal megacities of today were not designed with high safety levels in mind. Often originating from small settlements near river mouths where ships would come in and trade goods, these cities have vastly expanded – and so have the value of their economic activities. Typical values for protection standards (if at all) range from 1/100 to 1/1000 in terms of design return periods; only in low lying delta's like the Netherlands, design values of 1/10000 are used as protection levels against coastal flooding.

But in cities like Bangkok, much lower values are used. As a result, extreme river discharges due to prolonged rainfall in combination with high tidal levels at the river mouth already led to severe flooding that made world news in the second half of 2011 – and more is yet to come. Meanwhile the economic value of urban developments and manufacturing industries has multiplied by various orders of magnitude.

ILIENT CITIES
S OF OPPORTUNITY

***Prof. Arthur Mynett* is a member of the IAHR Council. He holds a position as full Professor of Hydraulic Engineering and River Basin Development at UNESCO-IHE Institute for Water Education where he is Head of the Department of Water Science and Engineering. He has previously worked for Delft Hydraulics (now part of Deltares) for over thirty years and served on several international panels related to flood risk management.**

Clearly some fundamental changes are required providing adequate protection levels and safety standards against flooding.

From flood risk assessment to adaptive management

During the past decades considerable effort was spent on developing the concept of flood risk assessment, i.e. taking into account the consequences of flooding rather than merely protection levels. In doing so, it becomes possible to quantify the trade-offs between investments required to increase safety levels and the implications of economic damage and loss of lives. This trend is reflected in the EU research programmes on flood risk: rather than assessing and quantifying the risk of inundation without proposing solutions, the focus is shifting towards preparing actual measures that can avoid or reduce the consequences of flooding.

One such example in the Netherlands is the city of Dordrecht which is in open connection to the North Sea and exposed to storm surges as well as effects of sea level rise. The houses in the inner city have recently been flood-proofed and can withstand serious inundation levels without experiencing much damage, if at all. Such adaptive measures are presently being explored both in research and in pilot projects. In fact, the entire concept of adaptive management is receiving considerable attention, since it allows for implementing actual measures only when really needed, while at the same time allowing multiple (real) options for future decision making, depending on changes in external conditions and internal needs.

The multi-level safety concept

Rather than relying on one superstructure to protect the hinterland, the concept of multi-level safety is receiving considerable attention at present, certainly within the European Union. In the Netherlands, this concept involves: (i) an outer dike system intended to provide the first 'line of defence' against potential flooding; (ii) spatial planning and lay-out of roads and transportation infrastructure in such a way that access is assured to shelters and safe havens; (iii) emergency planning including early warning systems to provide advanced notice for emergency response units and for the public at large. This approach is very much in line with the recently developed EU Flood Directive which propagates three major levels: 'Protection-Prevention-Preparedness'.

Windows of opportunity

The number of large flood disasters is increasing each year and flood damages rise by about 5% annually. Yet urban development in the expanding (mega)cities of the world is largely unplanned (UN, 2007). Urban settlements predominantly grow 'organically' and even if spatial planners are involved, they by-and-large ignore flood risk and are not developing urban expansions with flood resilience in mind. This is where economic investments are at steak and the potential for severe disasters becomes a serious threat.

At the same time, dealing with possible effects of climate change can provide windows of opportunity for urban re-development. Following the concept of 'Living with Water' in cities like Boston and Rotterdam, former harbour areas have been transformed into attractive waterfront housing with valuable property that is in great demand. New concepts like Water Shore Habitats provide opportunities for urban redevelopment 'shaped by the water'.

There is even an increasing trend towards 'farming in the city' by developing Urban Agriculture as an integrative factor of climate-optimised urban development. The city of Casablanca in Maroc provides such example. Health food production and peri-urban tourism are other examples of reducing the water footprint and global carbon emissions. The 'Green Roof Concept' in cities like Singapore aims to reduce urban flooding by temporarily storing water on rooftops covered with vegetation, at the same time making tropical urban cities more pleasant for living by lowering the temperature and reducing urban hotspots – yet another example of turning flood risk into a window of opportunity.

10 QUESTIONS TO...

INTERVIEWED BY ELGARD VAN LEEUWEN PHD. 3DI CONSORTIUM AND SENIOR RESEARCHER AT DELTARES WYTZE SCHUURMANS PHD. 3DI CONSORTIUM AND CEO AT NELEN EN SCHUURMANS

Professor Guus Stelling about 3Di Water Management

Since January 2002 Prof. Stelling is professor of fluid mechanics in the Civil Engineering and Geosciences faculty of the Technical University in Delft. Until July 2010 he was the head of the environmental fluid mechanics section. Presently professor Stelling is also visiting professor at the National University of Singapore in the Faculty of Engineering.
In addition he is senior advisor at Deltares.

1. What is 3Di Water Management?

"3Di Water Management is an ambitious 4-year research programme that started in 2009. The challenge is to use detailed digital elevation maps (with a resolution of 0.5 x 0.5 m) for detailed flood computations on a large scale. While existing mathematical flood models can deal with schematisation of 1 million cells, the 3Di algorithm currently deals with schematisations consisting of more than 1000 million cells. Normally models of this scale would require calculation times of days, weeks or months. With the newly developed flexible mesh technique, however, computation times can be restricted to minutes or hours."

2. What's the secret?

"The crux is focussing on the important details: the locations in which the flow patterns are complex. In these areas the free water surface can be represented with far less grid points than the bottom bathymetry. This is the crucial component of the sub-grid approach. So although we process much more elevation information and generate high resolution calculation grids, the hydrodynamic 1d/2d calculations with our prototypes are still faster than the models currently available."

3. How do you do that?

"We simply keep an accurate record of how much water and how much momentum comes in and how much flows out. The accounting is very precise, despite the non-linear volumes. You see, if the amount incoming does not tally exactly with the amount outgoing, that's when accountants cry 'fraud'. In order to keep this water account, geographical areas are divided into blocks. This enables you to take into account fast streams through narrow streets and the influence of dikes and obstacles that slow down the current. It makes sense physically too, as phenomena like hydraulic jumps are also accounted for. So in order to calculate a flood, the landscape is divided up into small blocks where water flows in and out. The 'accounting' is the water balance: incoming minus outgoing = increase in storage. There is accounting at system level and accounting at block level. Both of them have to add up. Nothing new so far, as this calculation method has long been used in the Sobek calculation models. What's new is the block pattern. Until recently, blocks of equal size were used in calculations, and a fixed ground level per block. In the case of the latter, that was the only possibility, with the poor ground-level data available."

4. So the new elevation data is the trigger?

"Certainly for the innovations concerning the calculation grid. Thanks to the laser altimetry technology, much more detailed information is now available. And I use this data to determine a more complex block pattern. Rather than refining the whole block pattern, we work more intelligently. As I have said, we refine only those places where the current is complex, and those are the locations with greater height differences. The result is that a flat area like a field becomes one large cell while the blocks are divided up in larger so called 'quadtrees' around a dike or a discharge channel. With the old-style calculations, the field would have comprised too many blocks, while the defining elements like dikes would be contained entirely within a single block, rendering them 'invisible' for the purposes of calculation. Height differences used to be averaged within the block, giving rise to unrealistic flood zone forecasts. The new approach is more complex for each calculation stage but, as larger areas are calculated more quickly, the calculation as a whole is ready much more quickly. That's our big secret. For instance in practice, it provides a better grasp of the escape routes that will remain available during a flood, which is essential information for safe evacuation. And everyday water management benefits, too. Investments can now be made in exactly those places where flooding would cause the greatest damage. Tailored work for focussed investment."

5. Who is involved in the 3Di programme?

“The nice thing about the 3Di project is the close and inspiring collaboration between the scientists, consultants and water managers involved. The core of the project team is a small group of creative professionals covering different fields of expertise such as computational hydraulics, software development, virtual reality and water management. In this team my ideas are developed further and translated into software prototypes. The latter is done by Deltares engineers. Next, these prototypes are tested in case studies in two waterboards by the consultants of Nelen & Schuurmans. These waterboards ‘Hollands Noorderkwartier’ (the regional water board for North Holland province) and ‘Delfland’ (the regional water board for South Holland province) are our launching customers. They support the research programme, and, as members of the steering group, play a part in deciding the desired functionalities.”

6. You describe the 3Di team as ‘inspiring’, how do you build such a team?

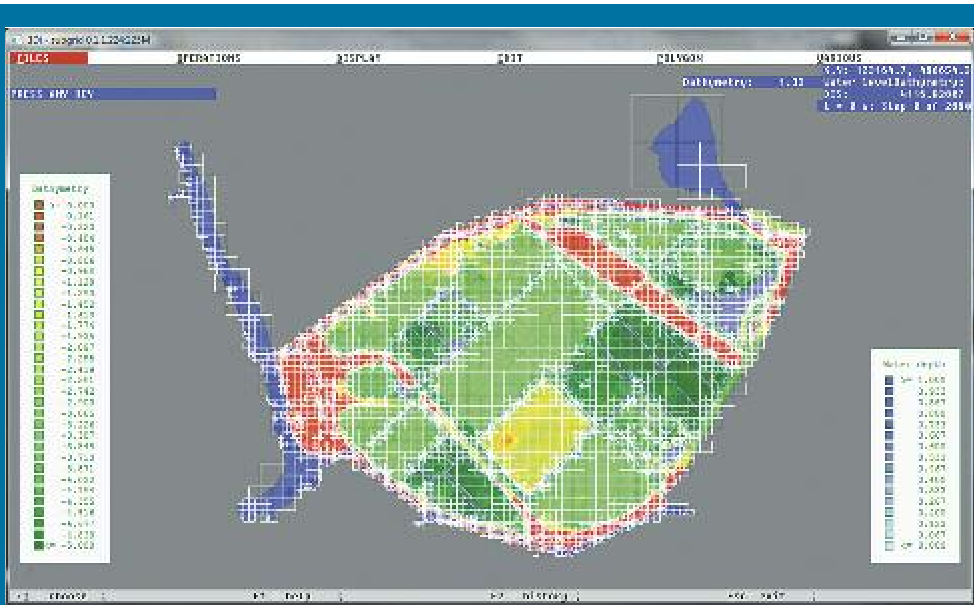
“By working with people, professionals as well as students and PhD’s, who do their work with passion, because they love their job and are really curious as to what we can achieve together. These people with their different backgrounds, ages and experience form a colourful small community with an amicable but professional way of doing things. There is plenty of room for laughter but in the end we all focus on creating software with an outstanding performance.”

7. What has been achieved so far?

“Well, apart from the 3Di algorithm I mentioned before, the Delft University developed a 3D environment based on the mapping of detailed elevation data, in which the results of our high resolution flood simulations can be projected. The result is a 3D stereo visualisation of floods. Believe me, it’s quite impressive to see how the water visibly swirls through the streets in 3D, accumulating on the left and accelerating to the right, flowing around buildings and under sheds. You can even determine waves from a vantage point directly above the action. And all with respect to the underlying physics. Another interesting innovation is the possibility of interactive modelling. Because the presentation of simulation results and model adaptations can be made during the actual simulation, the tool is especially suitable for decision support in calamity situations and design table situations. With three mouse clicks, the dikes can be raised while the effect on the course of the flood is visualised immediately. In projects on land-use, planning the possible interaction and advanced visualisation can be used to show policymakers, governments and water boards the effects and consequences of improvement works. Especially for the identification of climate adaptation measures such as green roofs and other forms of retention measures, interactive modelling has proved to be very effective. And it is also a way of enthusing the public. The tool will contribute to the public being progressively more aware of water management problems and possible solutions.”

8. Who benefits from 3Di?

“The real beneficiaries are the water authorities, who can save billions. How is that possible? If we don’t know what happens, civil engineers tend to overdimension dikes, water retention basins, drainage channels, etc. With more accurate models, we are able to design tailor made solutions. The Eiffel tower is more than 100 years old. If we were to design the same tower today, I am sure we could save more than 30% on the amount of



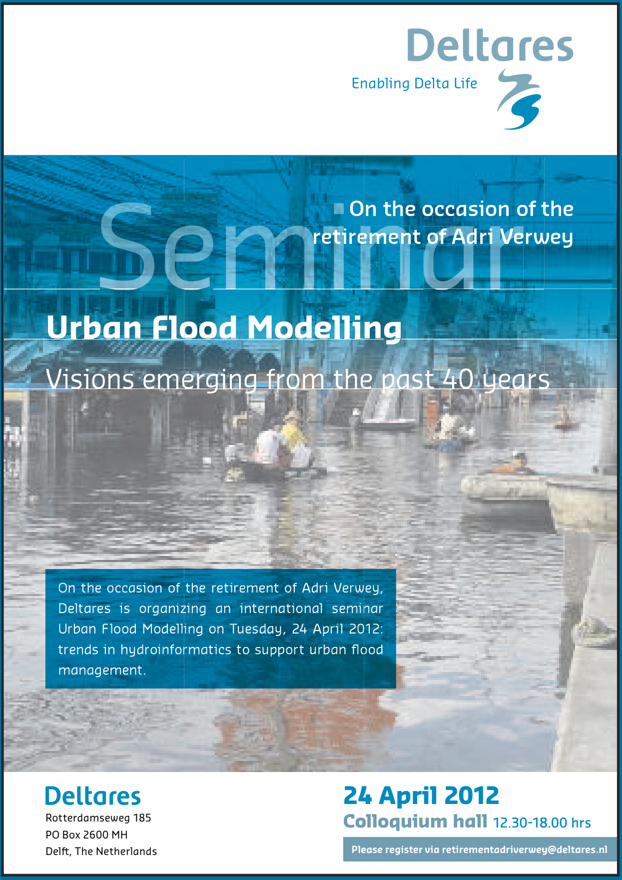
Example of a quadtree grid for calculating a flood in polder Watergraafsmeer. Around flood defence structures and discharge channels a much higher resolution is used than for the flat areas in between them.
In these areas the free water surface can be represented with far less grid points than the bottom bathymetry.

Visualisation of an historic inundation of the polder Wieringermeer during the second world war (1945). The 3Di model was calibrated on the basis of written eyewitness information. With a space mouse the user can ‘fly’ over the inundated area and zoom in on specific locations.

steel used. Simply because we now know more precisely where extra strength is needed en where not.”

9. What is the philosophy behind 3Di?
“In the early days, computer programmers made simulation models and used the models. Later on, the computer programmers made more sophisticated programs and specialists used these programs to make complex models. In 3Di we go one step further, we want other people to use these complex models to discover for themselves the impact of extreme storms, or man made measures.”

10. And the danger for improper use of models?
“We must not be too afraid for that. Focussed investments in infrastructure is very important nowadays. This means more flexible and integrated measures: not simply rigid dikes, but measures integrated in the public space. Not merely raising the dikes, but also changing street profiles, building retention basins, beach replenishments, emergency overflow zones and the like. Safety is combined with requirements concerning the environment and creating pleasant living spaces. All these things are interdependent. Processing detailed information is a prerequisite. 3Di is part of that.”



video of the presentations:
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DUJIANGYAN IRRIGATION SYSTEM: HISTORY AND CHALLENGE

A UNESCO WORLD HERITAGE SITE IN CHENGDU, THE SITE OF IAHR CONGRESS 35TH IN 2013

BY CAO SHUYOU, LIU XINGNIAN, HUANG ER

Chengdu is the capital of Sichuan Province, which is the venue of the 35th IAHR World Congress in 2013. The ancient Dujiangyan Irrigation System (DIS) in Chengdu was listed as a World Cultural Heritage Site by the World Heritage Center, UNESCO in 2000. DIS still plays a crucial role in flood control, irrigation and water supply for Chengdu Plain in Sichuan Province. The immense advances in science and technology achieved in ancient China are graphically illustrated by the DIS. The system is appropriately arranged in accordance with the terrain and topography of the river and Chengdu plain, thus successfully solving the problem of sand discharge, flood control, and water distribution. Consequently the task of gravity diversion could be fulfilled over a long period and across the whole irrigation district. Since the 1940s, series of prototype observations, hydraulic physical model experiments, and numerical modeling, have been conducted to explore the design philosophy, new planning schemes and key techniques for modern reconstruction. At the same time, science mechanisms and river dynamics of this Wonder are being discovered. It is interesting to learn the recorded history of the original construction and sustainable development, engineering and science values, and regular restoration experiences, and a new understanding to the original headwork structure of the DIS.

1 Hydraulic Miracle

The ancient Dujiangyan irrigation system controls the waters of the Minjiang River and distributes it to the fertile farmland of the Chengdu plain. The system is a major landmark in the development of water management and technology. As shown in Fig.1, DIS covers two main components. One is the headwork structure, the key control for water division and intake at Dujiangyan City (Fig. 2), and the other is the water distribution system itself in 7 cities and 37 counties (Fig. 3). For over two thousand years the whole system has functioned perfectly, serving flood control, irrigation, navigation and wood drifting. It has contributed greatly to the wealth of the Chengdu Plain and helped to earn its reputation as "The Land of Abundance".

The system is appropriately arranged in accordance with the terrain and topography of the river and Chengdu plain, thus successfully solving the problem of sand discharge, flood control, and water distribution. Consequently the task of gravity diversion could be fulfilled over a long period and whole irrigation district. The irrigation district covers 3 watersheds with a total area of 23.2 by 10^3 km^2 today, namely Mingjiang River, Tuojiang River, and Fujiang River. DIS is planned to extend to a total irrigation area of 1.01 million ha, based on actual irrigation area of 0.68 million ha at present.

The ancient headwork structure of Dujiangyan was a non-dam intake project. It is located on the top of an alluvial fan where the Minjiang River exits from the Longmen Mountains. The hydraulic headwork structure of ancient Dujiangyan was essentially composed of three main components: (1) Fish Mouth, a diversion embankment diverting flow to the intake stem channel; (2) Flying Sand Sluice, a flood and sediment sluice; and (3) Baopingkou (Top of Precious Vase), a water intake with a flood control function. A series of data analyses,

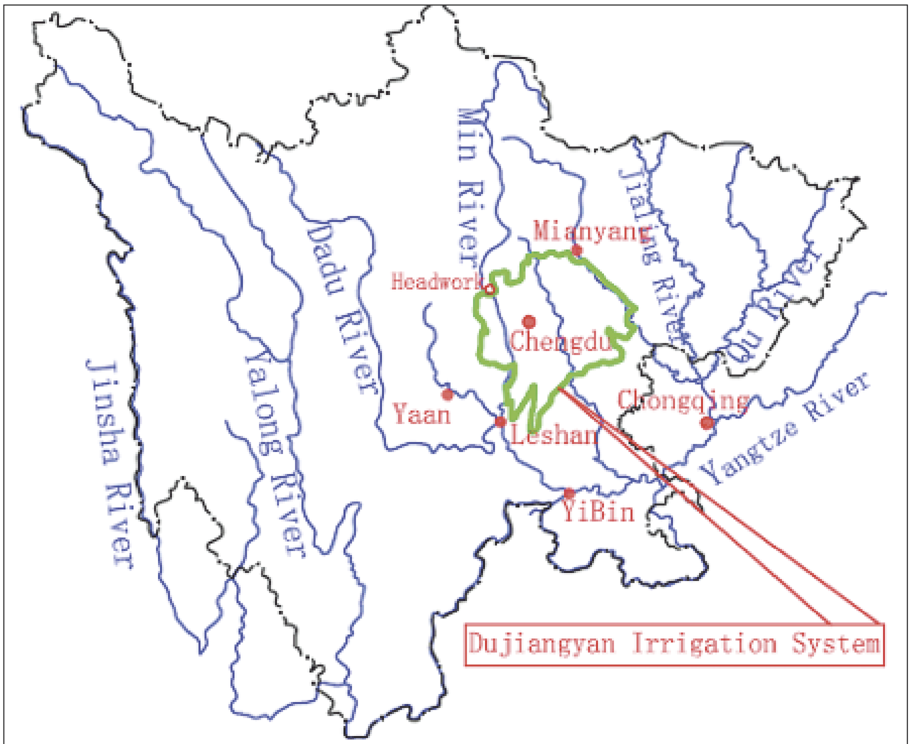

Fig. 1. Location of Dujiangyan Irrigation System (DIS) in Sichuan Province

mathematical modeling studies, prototype observations and hydraulic physical model experiments have been conducted since the 1940s. The purpose of this research is: (1) to investigate the scientific principles corresponding to modern fluid mechanics, including effects of headwork hydraulic structures on flood control, sediment exclusion, and management schemes; and (2) to study the scientific bases for modern sustainable development of the system, including the construction of a reinforced concrete checkgate on Outer River and the water regulation project, Zipingpu reservoir. In spite of the headwork of the DIS being modified over time since the original construction, modern research reveals that the effective sediment exclusion is attributed to the general layout of the three main head hydraulic structures, the utilization of secondary currents in channel bends, and the annual maintenance.

2 History of the original construction and sustainable development

The construction and sustainable development of DIS is an outstanding example of keeping abreast with the times and promoting harmony between mankind and nature. The processes of the original establishment and long period development of DIS can be divided into three main periods: the original construction period, the development period, and the modern period. The original construction of DIS was firstly recorded in a famous book titled as “the Historical Records” by Sima Qian (91 B.C.) in the Han Dynasty more than 2100 years ago. After Sima, numerous historical records of Dujiangyan can be found in history. To understand the Chinese hydraulic civilization one should start from Dujiangyan. As a result the Dujiangyan Study in order to save this civilized heritage based on Dujiangyan’s great historical value and modern function is establishment in China.

2.1 Original construction (256B.C. – 206 B.C.)

During the Warring States period of ancient China, the Qin Kingdom conquered the Shu Kingdom in 316 B.C. On the basis of the previous water conservancy project, Li Bing, the governor of the Shu Shire under the Qin State, built a diversion embankment called Yuzui (front-end look like a fish mouth) in the middle part of the Minjiang River at the upper end of the Chengdu Plain where the river just runs out from the mountainous region in 256 B.C.. The division embankment was constructed to stabilize the course of the main flow (the Outer River). Meanwhile, a new channel, the Inner River, was dug out by the side of the hill to divert water. Moreover, Baopingkou (throat of the intake like the tap of a precious vase) was excavated through the hard conglomerate rock mass in order to divert water and also to control flooding. Then, at the upstream of Baopingkou on the side next to the Outer River, Feishayan (a sediment and flow spillway) was built using woven bamboo baskets filled with local pebbles and boulders to discharge the surplus flood water and sediment into the Outer River, assuring the irrigation demand and domestic supply, and eventually, to prevent droughts and floods in the Chengdu Plain. Since then, the project has been honored as the 'Treasure of Sichuan', which played a crucial role in flood control, irrigation and water supply for Chengdu plain. On the other hand, as a part of the Dujiangyan water distribution system, the channel system of Chengdu plain was improved, especially towards river of Chengdu City. As a key river training project, Mingjiang River, Fu Jiang River and Tuojiang River were connected.

2.2 Development period (206 B.C. – 1930s)

The DIS experienced a period of ceaseless development from the Han Dynasty to the early 20th century, over 2100 years. The head control work was improved gradually, and the irrigation area increased step by step. Irrigation channels extended to Chengdu plain quickly to establish a mult-benefit channel network, which ensured irrigation; flood control and navigation in the Chengdu Plain. As a result, Chengdu became the economic center of South-western China. Unfortunately, the DIS was destroyed seriously at least four times owing to historical wars or natural hazards: (1) The headwork was destroyed and washed downstream for 1 km by an extreme flash flood on June 26, 910; (2) During the war of Mongolia China was conquered (1235-1267); (3) During the Sichuan war the Ming Dynasty fell to the Qing Dynasty (1644-1681); and (4) by a flash flood on October 9, 1933, which was induced by the bursting of block-lakes formed by the Diexi earthquake 150km upstream of Dujiangyan on August 25, 1933. In spite of being destroyed a few times, the DIS was recovered quickly. The name “Dujiangyan” first appeared in a historical record in Yuan Dynasty, and the title of the permanent water intake, “Baopingkou” first appeared in the Ming Dynasty.

Fig. 2. Overview of the headwork of Dujiangyan (Li & You, 2007)

Fig. 3. Irrigated district of DIS

Fig. 4. Undistorted model of DIS

2.3 Modern times (since 1940s)

The DIS started its modern period in the 1940s. The symbol of the beginning of the modern period was the first planning of permanent solutions and the first modern physical scale model experiments for the DIS in 1941. The Chengdu Hydraulic Laboratory was established in 1941. Three modern experiments on DIS were conducted at the laboratory in 1940s, which are:(1) Scour experiment on Yuzhui (Fish Mouth) and Inner Channel of DIS; (2) Study on backwater of Inner Channel of DIS; and (3) Study on hydropowers of upstream Mingjiang River. A British historian of Chinese science, Joseph Needham, visited Dujiangyan in 1943. He visited the hydraulic model of Dujiangyan. He met the head of the experiments, Dr. Chang Y. L., who got his Ph.D. degree at the University of Manchester. Dr. Chang was a professor of Sichuan University at that time. Joseph Needham was excited by those modern experiments during the Second World War, and presented the DIS to the west as a typical example of the rice-based irrigation systems of South China in both its history and its size. From the point of view of management, he noted that a government-managed irrigation system was constructed around 2200 years ago.

Large scale reconstruction of the DIS includes mainly the checkgate at Outer River finished in 1974 to replace temperate water adjust work, wood-tripods (macha) with bamboo-cages (Zhulong), into a permanent reinforced concrete checkgate, which makes a new development of the DIS.

At the onset of the new millennium, Dujiangyan irrigated 0.668 million hectares of farmland in 7 cities and 37 counties of the Sichuan province (in 2004). Zipingpu reservoir, the second generation project of Dujiangyan was finished in 2006.

3 Scientific and engineering values of DIS

A series of data analyses, prototype observations, mathematical modeling studies and hydraulic physical model experiments have been conducted since the 1940s, to explore the design philosophy, new planning schemes and key techniques for modern reconstruction. A series of physical models was conducted at Sichuan University to study the influences of ZPP dam on DIS (Fig.4). Concepts of modern science in Dujiangyan are summarized as hydrology conditions for the guarantee of water supply, unique topography conditions, scientific layout of headwork, and earthquake resistance ability.

Based on analysis of well-established literature, the headwork system of Dujiangyan has always been a checkgate dam water diversion system. The difference between ancient and modern Dujiangyan is just construction materials and structures. The checkgate dam was constructed by bamboo-cages with wood-tripods in the ancient project as a cofferdam, and by reinforced concrete with steel gate today!

The prototype-model correlation study on Dujiangyan Project shows that the rational general layout of the three main hydraulic head structures function well for flood control and sediment exclusion. The strong secondary currents caused by meandering channels can exclude intensive sediment to maintain the water intake project effectively. Based on modern hydraulics studies, the building of the Outer River checkgate dam improves the environment of water conduction and sediment exclusion since 1974.

As the second generation of Dujiangyan, the Zipingpu reservoir functions mainly for irrigation and water supply, with comprehensive benefits in power generation, flood control, environment protection and tourism. The water supply guarantee rate will be improved by 10 percentage points in the Dujiangyan areas. The Zipingpu reservoir will raise the flood control standard of the downstream Dujiangyan and the whole Chengdu plain, from once every 10 years to once every 100 years. A 100-year frequency flood (6030 m^3/s) from upstream of the reservoir can be reduced by the reservoir to 2390 m^3/s, less than a 10-year frequency flood (3760 m^3/s). As a result, the great Dujiangyan is protected by the Zipingpu dam!

Cao Shuyou, Professor of State Key Laborotory of Hydraulics and Mountain River Engineering, Sichuan University, China; Vice Chair of Scientific Committee, 35th IAHR World Congress.

Liu Xingnian, Professor and Vice Director of State Key Laborotory of Hydraulics and Mountain River Engineering, Sichuan University, China

Huang Er, Professor and Head of River Engineering Group, State Key Laborotory of Hydraulics and Mountain River Engineering, Sichuan University, China

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ADVANCES IN OIL SPILL MODELLING

BY POOJITHA D. YAPA

Conference Report on IAHR Kuwait International Summit on Advances in Oil Spill Modelling (November 8-9th, 2011)

A workshop was held in November 2011 under the sponsorship of Kuwait Oil Company and the Kuwait Institute for Scientific Research (KISR), Kuwait and was held at the latter location. It was a two-day workshop (open to the public), bringing together an international panel of leading experts on oil spill modelling to give presentations sharing their many years of experience on the topic and aimed at achieving a common viewpoint on where oil spill modelling stands. Expertise of the panel members covered a broad range of topics related to oil spill modeling that included areas of fluid mechanics and hydraulics, chemical engineering and chemistry, environmental engineering, and biology.

The purpose of the workshop was to present and discuss the state-of–the-art in modelling of oil spills and identify key needs for future research from a multi-disciplinary standpoint to satisfy the requirements of the oil industry and governmental organizations in preparing adequate emergency oil spill contingency plans. The Workshop was to serve as the "kickoff meeting" for the interdisciplinary Working Group (WG) with clear outputs which will constitute a roadmap for the Oil Spill Modelling WG.

The workshop was opened with the remarks from Dr. Naji Al-Mutairi, Director General of KISR, Dr. Christopher George, IAHR Executive Director, Prof. Poojitha Yapa, Chair IAHR Working Group on Oil Spill Modeling, and Dr. Khaled Al-Banaa, Vice-Chair IAHR Working Group on Oil Spill Modeling.
The following presentations were given:

- Overview of Current state of the art in oil spill modeling
  Prof. Poojitha Yapa (Chair, IAHR Working Group on Oil Spill Modelling, Professor of Civil and Envir. Engrg.,Clarkson University, USA)
- Modeling ocean/coastal hydrodynamics for oil spill simulations.
  Prof. Peter Sheng (Professor, Department of Civil and Coastal Engineering, University of Florida)
- The effects of oil weathering on the properties and behavior of oil
  Dr. Bruce Hollebone (Oil Research Laboratory, Emergencies Science and Technology Section of Environment Canada.)
- Using marine environmental risk concepts to evaluate alternative spill response strategies
  Dr. Mark Reed (Senior Scientist, SINTEF, Trondheim, Norway)
- Oil spill modeling and risk management systems in the Atlantic
  Mr. Rodrigo Fernandes (Researcher, MARETEC - Institute Superior Técnico Lisboa – Portugal)
- Computational-based decision support systems for risk assessment and management of sea oil spills
  Dr. Augusto Maidana (Scientist, International Center for Numerical Methods in Engineering (CIMNE), UPC, Spain)
- Model uses during oil spill emergency response
  Dr. Bill Lehr (Senior Scientist, Office of Response and Restoration, National Oceanic and Atmospheric Administration (NOAA), USA)
- An application of oil spill modeling on smart

phones
Dr. Khaled Al-Banaa (Vice Chair, IAHR Working Group on Oil Spill Modelling, Research Scientist, KISR, Kuwait)
- Oil spill modeling activities in Japan
  Mr. Hiroshi Yamada (Chief Consultant, Environment and Energy Division 1, Mizuho Information and Research Institute, Inc., Tokyo, Japan
- Oil shoreline interactions
  Dr. Eric Gundlach (ETech International, USA)
  Recorder: Bassam Shuhaibar Researcher, KISR, Kuwait

Collectively the presentations made by the distinguished speakers discussed the importance of water hydrodynamics, processes that oil undergo when spilled on or near the water surface, and oil spill modeling for emergency management as well as risk management in contingency planning.
All important physico-chemical processes that oil undergo (called oil spill processes hereinafter) after an oil spill that are needed to be included in an oil spill model and their relative importance in different time scales were identified. These processes are Advection, Mechanical spreading, Turbulent diffusion, Evaporation, Dissolution, Vertical mixing, Oil shoreline interaction, Emulsification, Bio-degradation, Photo-chemical reactions, Oil Sediment Interaction. In addition to identifying the processes, these talks covered how these different processes would play roles in affecting each other. For example evaporation may affect dissolution as well emulsification. Emulsification may affect the oil transport as well as further evaporation. Oil sediment interaction may affect the transport of oil as well as sediments. This may also lead to oil sedimentation as well. Regarding the hydrodynamics the presenters were of the view that in the past it has not received the attention it deserves and only the water velocity has been taken into account. For example, how a massive amount of oil in the water affects the water transport has not been modeled. The need for models to forecast under extreme weather conditions like hurricane conditions was also stressed. Langmuir circulation may also affect the oil transport and

Poojitha D. Yapa, a Professor of Civil and Environmental Engineering at Clarkson University, Potsdam, NY, USA has B.Sc (Honors) in Civil Engineering and M.Sc in Hydraulic engineering. He received his Ph.D. in Civil and Environmental Engineering from Clarkson University in 1983. His research has focused on "environmental hydraulics problems". For over 25 years his research has been focused on oil spill modeling. This includes not only trajectory modeling, but modeling physico-chemical processes oil undergo when spilled in the ocean or rivers. In the last 15 years his modeling has been on deepwater oil, gas, and hydrates, studying the complex processes they undergo during the travel from deepwater to the surface. Prof. Yapa and his students developed computer models such as CDOG, MEGADEEP, and ADMS for modeling the behavior of oil and gas when released in deepwater. The work has been published in leading journals.

needs to be included in the models in a more comprehensive way. Presentations also discussed how water velocity and turbulence affect not only the horizontal and vertical transport of oil but also the emulsification process. The water turbulence (including that induced by the winds) need to be included in models to simulate oil break up and coalescence, and vertical mixing,

On the model application side the presentations included past cases of simulating actual major spills, how models were used during emergencies as well as for risk management. Model capabilities are addressed later in this article in tabular form.

On the second day there were two extensive panel discussions on “modeling needs and data availability” and “what needs to be done to improve our current practices?” The two panel discussions were moderated by Prof. Poojitha Yapa and Dr. Bruce Hollebone respectively. During the panel discussions needs for models, model use, and data requirements and availability were identified. The tables below present a summary of the panel discussions.

For more information on the IAHR Working Group on Oil Spill modeling visit www.iahr.org

The author would like to thank the sponsors for their support

www.kockw.com

www.kisr.edu.kw/

Table 1: Physical properties of crude oils determined by composition

Property	Relevance	Predictability*
Density	Physical transport	Good
Viscosity	• Increases surface slick lifetime • Potential for injury to birds, marine mammals and shorelines • Affects "windows of opportunity" for different response actions	Poor without empirical data
Pour Point	• Spreading • As for viscosity	Poor without empirical data
Evaporation potential	Mass balance, density, emulsion stability	Good
Interfacial tension	Spreading dispersion & droplet sizes	Poor

* Predictability based on oil properties alone

Table 2: Weathering processes affecting oil spills

Natural weathering processes	Predictive ability
Evaporation	Very good
Water-in-oil (w/o) emulsification and viscosity	Fair-to-poor without empirical data
Oil-in-water (o/w) dispersion	Fair for fresh oils, poor for emulsions
Oil droplet formation and size distribution	Poor
Dissolution of oil components into water	Fair-to-good
Photo-oxidation	Poor
Biodegradation	Good for dissolved, poor for droplets/tar-balls

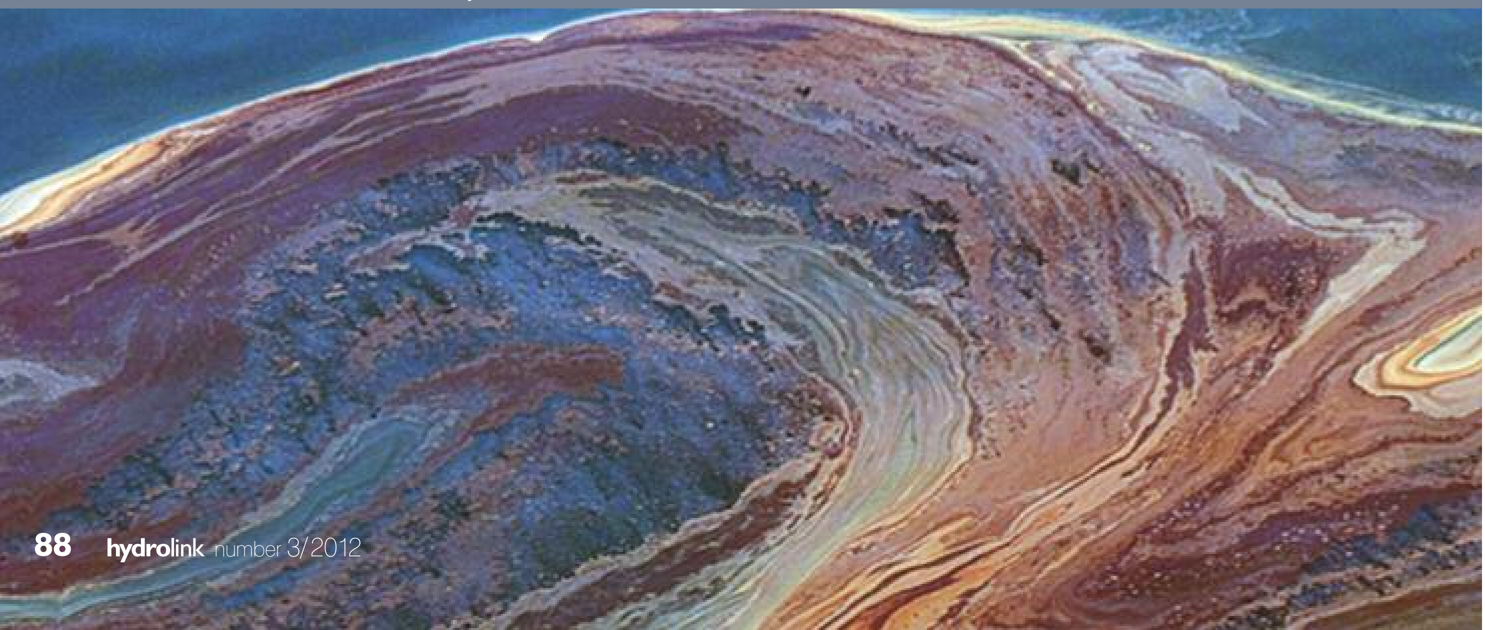
Table 3: Physical processes affecting oil spills

Physical processes	Predictive ability
Advection	Very good
Oil stranding	Fair
Remobilization from shoreline	Poor
Re-suspension	Poor-to-fair
Surface spreading	Fair
Langmuir circulation	Poor
Turbulent mixing (vertical & horizontal)	Poor (with LC)-to-good (without LC)
Oil-SPM	Poor
Interaction with Bottom Sediments	Poor
Current-wave interaction	Fair-to-good
Oil effects on hydrodynamics	Poor

Table 4: Response Actions

Response Actions	Modelling Capability
Surface application of dispersants	Fair
Injection of dispersants at source	Poor
Mechanical response	Fair-to-good
Controlled burn	Fair-to-good
Booming & containment	Good
New techniques (solidifiers; herders; etc.)	N/A

Oil swirls in the Gulf of Mexico currents May 6 AP. Photo: Dave Martin



IAHR AWARDS
CALL FOR NOMINATIONS 2013

IAHR members are invited to submit nominations for the Arthur Thomas Ippen Award, Harold Jan Schoemaker Award, and M. Selim Yalin Award. These awards will be presented at the 35th IAHR World Congress, Chengdu, China, September 8-13, 2013.

18th Arthur Thomas Ippen Award

For outstanding accomplishment in hydraulic engineering and research

The Founding Statement and the Rules for Administration of the Award are as follows:

Founding Statement

The Ippen Award was established by the IAHR Council in 1977 to memorialise Professor Ippen, IAHR President (1959-1963), IAHR Honorary Member (1963-1974), and for many decades an inspirational leader in fluids research, hydraulic engineering, and international co-operation and understanding. The Award is made biennially by IAHR to one of its members who has demonstrated conspicuously outstanding ability, originality, and accomplishment in basic hydraulic research and/or applied hydraulic engineering, and who holds great promise for continuation of a high level of productivity in this profession. The awards are made at the biennial congresses of IAHR, where the most recent recipient delivers the Arthur Thomas Ippen Lecture. The Award fund, which was established by Professor Ippen's family, is authorised to receive contributions from association members and friends of Professor Ippen. The 2011 Award was made to Prof. Xavier Sánchez-Vila, Spain.

Rules for the administration of the award

1. The Arthur Thomas Ippen Award (hereinafter referred to as the Award) will be made biennially, in odd-numbered years, to a member of IAHR who has developed a conspicuously outstanding record of accomplishment as demonstrated by his research, publications and/or conception and design of significant engineering hydraulic works; and who holds great promise for a continuing level of productivity in the field of basic hydraulic research and/or applied hydraulic engineering.
2. In selection of awardees candidates must be IAHR members of not more than 45 years of age at the time of presentation.
3. Each awardee will be selected by the IAHR Council from a list of not more than three nominees submitted to the Council by a Committee (hereinafter referred to as the Awards Committee) composed of the Technical Division Secretaries and chaired by IAHR Vice President, Prof. Jean-Paul Chabard. The Awards Committee will actively seek nominations of awardees from the IAHR membership, and will publish at least annually in the IAHR Newsletter an advertisement, calling for nominations. The advertisement will include a brief description of the support material which is to accompany nominations.
4. The awardee for each year will be selected by the Council by mail ballot in January of the year of the Congress.
5. The award need not be made during any biennium in which the Council considers none of the nominees to be of sufficient high quality.
6. The awardee will present a lecture, to be known as the Ippen Lecture (hereinafter referred to as the Lecture), at the IAHR World Congress following his election. The subject of the Lecture will be agreed upon by the awardee and the IAHR President. The Lecture will be published in the Congress Proceedings. Public presentation of the Award will be made by the President during the opening ceremonies of the Congress.
7. The awardee will be given a suitable certificate which will state the purpose of the Award and indicate the specific contribution(s) of area(s) of endeavour for which the awardee is recognised. The awardee also will receive a monetary honorarium upon presentation of the Lecture. The terms of the honorarium will be published in the announcement of each biennial Award. The monetary honorarium for the Award is US$1,500.
8. Wide distribution of awardees among different countries and different areas of specialisation is to be sought by the Award Committee and by the Council.
9. No individual shall receive the Award more than once.

Previous Winners

X. Sanchez-Vila, Spain (2011) for his outstanding contributions in the field of groundwater flow and contaminant transport with application to flow modeling in heterogeneous porous media.
Y. Niño, Chile (2009) for his outstanding basic contributions in fluid mechanics with applications to sediment transport and environmental flow processes.
M. S. Ghidaoui, HK China (2007) for his outstanding contribution to research in environmental fluid mechanics.
A. M. Da Silva, Canada (2005) for her outstanding contributions in the area of fluvial processes and in particular, sediment transport.

IAHR AWARDS
CALL FOR NOMINATIONS 2013

18th Harold Jan Schoemaker Award

for the most outstanding paper in the Journal of Hydraulic Research

IAHR members are invited to submit candidates for nomination for the Harold Jan Schoemaker Award. This Award will be made for the 18th time at the the 35th IAHR World Congress, Chengdu, China, September 8-13, 2013. to the author(s) of the paper judged the most outstanding paper published in the IAHR Journal of Hydraulic Research in the issues, starting with Volume 48 (2010) no. 5 up to and including Vol. 50 (2012) no. 4. A proposal for nomination shall be completed with a clear argumentation (maximum one page) regarding its outstanding quality and why the paper is of such a specific quality that it outweighs the other papers of the considered series.

Founding Statement

The Schoemaker Award was established by the IAHR Council in 1980 to recognise the efforts made by Professor Schoemaker, Secretary (1960-1979), in guiding the Journal of Hydraulic Research in its formative years. The Award is made biennially by the IAHR to the author(s) of the paper judged the most outstanding paper published in the IAHR Journal.

Rules for the administration of the Award

1. The Harold Jan Schoemaker Award (hereinafter referred to as the Award) will be made at each biennial IAHR Congress, to the author(s) of the paper judged the most outstanding and published in the IAHR Journal during the preceding two-year period.
2. The awardee will be selected by the IAHR Council from a list of not more than three ranked nominees submitted to the Council by a Committee (hereinafter referred to as the Award Committee) composed of the Technical Division Secretaries and chaired by Prof. Jean-Paul Chabard. The Award Committee will actively seek nominations of awardees from the IAHR membership (also non-members whose employers are corporate members will be considered)
3. The awardee will be selected by the Council by ballot. The awardee(s) shall be notified immediately by the Executive Director.
4. An award need not be made during any biennium in which the Council considers none of the nominees to be of sufficient high quality.
5. The award will consist of a bronze medal and a certificate.

Previous Winners

U. Chandra Kothyari, H. Hashimoto and K. Hayashi (2011) for the paper "Effect of tall vegetation on sediment transport by channel flows" (Volume 47, 2009, Nº 6)
H. Morvan, D.W.Knight, N.Wright, X.Tang (2009) for the paper "The Concept of Roughness in fluvial hydraulics and its formulation in 1D, 2D, and 3D numerical simulation models" (Vol. 46, 2008, Nº.2)
K.Blankaert and U.Lemmin (2007) for the paper "Means of noise reduction in acoustic turbulence measurements" (Vol. 44, 2006, Nº 1)
E.J. Wannamaker and E.E. Adams (2007) for the paper "Modelling descending carbon dioxide injections in the ocean" (Vol. 44, 2006, Nº 3)
A. Carrasco and C. A. Vionnet (2005) for the paper "Separation of Scales on a Broad Shallow Turbulent Flow" (Vol. 42, 2004, Nº 6)

3rd M. Selim Yalin Award

for significant and enduring contributions to the understanding of the physics of phenomena and/or processes in hydraulic science or engineering, and demonstrated outstanding skills in graduate teaching and supervision

IAHR members are invited to submit candidates for nomination for the M.Selim Yalin Award. This Award will be made for the 4th time at the 35th IAHR World Congress, Chengdu, China, September 8-13, 2013. The Founding Statement and the Rules for Administration of the Award are as follows:

Founding Statement

The M. Selim Yalin Award was established by the IAHR Council in 2006 to honour the memory of Professor M. Selim Yalin, Honorary Member (1925-2007), and Fluvial Hydraulics Section Chairman (1986-1991). Professor Yalin is remembered for his prolific and pioneering research contributions in fluvial hydraulics and sediment transport, and for his inspirational mentoring of students and young researchers.

The Award is made biennially by IAHR to one of its members whose experimental, theoretical or numerical research has resulted in significant and enduring contributions to the understanding of the physics of phenomena and/or processes in hydraulic science or engineering and who demonstrated outstanding skills in graduate teaching and supervision. The awards consisting of a certificate and cash prize are presented during the IAHR World Congresses. The Award fund, which was established by the family and friends of Professor Yalin, is authorised to receive contributions from association members and friends of Professor Yalin.

Rules for the administration of the award

1. The IAHR M. Selim Yalin Award (hereinafter referred to as the Award) will be made biennially, in odd-numbered years, to a member of IAHR whose experimental, theoretical or numerical research has resulted in significant and enduring contributions to the understanding of the physics of phenomena and/or processes in hydraulic science or engineering and who has demonstrated outstanding skills in graduate teaching and supervision.
2. Each awardee will be selected by the IAHR Council from a list of not more than three nominees submitted to the Council by a Committee (hereinafter referred to as the Award Committee) composed of the Technical Division Secretaries and Chaired by a Council Member. The Award Committee will actively seek nomination of awardees from the IAHR membership, and will publish at least annually in the IAHR Newsletter an advertisement, calling for nominations. The advertisement will include a brief description of the support material which is to accompany nominations.
3. The awardee for each biennium will be selected by the Council either at its meeting during the preceding even-numbered year or by mail ballot in January of the year of the Congress.
4. The award need not be made during any biennium in which the Council considers none of the nominees to be of sufficient high quality.
5. Public presentation of the Award will be made by the President during a public ceremony taking place within the Congress.
6. The awardee will be given a suitable certificate which will state the purpose of the Award and indicate the specific contribution(s) of area(s) of endeavour for which the awardee is recognised. The awardee also will receive a monetary honorarium, the terms of which will be published in the announcement of each biennial Award.
7. Wide distribution of awardees among different areas of specialisation is to be sought by the Award Committee and by the Council. Efforts will also be made to ensure a wide geographical distribution.
8. No individual shall receive the Award more than once.

Previous Winner

Prof. Ian Wood (2011) for outstanding contributions in the field of hydraulic engineering and especially in the experimental research of hydraulic structures, as well as in the teaching and supervision of graduate students from around the world.

How to nominate

Prof. Jean Paul Chabard (IAHR Vice President) is co-ordinating nominations received for the 2013 Award. The nominations should consist of a concise statement of the qualifications of the nominee, a listing of his/her outstanding accomplishments, pertinent biographical data, and a proposed statement of the endeavours for which the nominated awardee would be recognised. Each nomination should not be more than two typewritten pages in length.

Nominations for the three awards must be sent by January 15, 2013 to:

Prof. Jean-Paul Chabard
Chair IAHR Awards Committee
Project Manager
Professor at Ecole des Ponts ParisTech
Vice-President of the International Association for Hydro-Environment Engineering and Research (IAHR)
EDF R&D - 1, avenue du Général de Gaulle
92 141 – Clamart CEDEX , France
Tél. : +33 (0) 1 47 65 30 69
jean-paul.chabard@edf.fr

Alternatively you can also nominate through the IAHR Website www.iahr.org under About IAHR/Awards

COUNCIL ELECTION 2013 – 2015

NOMINATING COMMITTEE 2013

At its meeting in San Jose, Costa Rica in September 2012, the IAHR Council has identified a Nominating Committee (NC 2013) for the next Council election ahead of the next World Congress in Chengdu, China, September 2013. The Nominating Committee will be chaired by Nobuyuki Tamai (Japan), former President of IAHR, and comprises Rafael Murillo (Costa Rica), Phil Burgi (USA), Jiri Marsalek (Canada), Sundar Vallam (India), Jose Rodriguez (Australia), Cristiana di Cristo (Italy), Paul Samuels(UK), and Pierre Louis Viollet, (France) . IAHR President Roger Falconer (UK) will serve as the Council contact person.

The NC collects proposals from individual and institute members, searches itself for candidates, and evaluates the performance of present Council members in view of their possible re-election. It must consider the alignment of candidates with Council composition requirements, including the question of progression of Council Members to Vice Presidential positions or to the Presidency.

It is the task of the NC to propose a list of candidates for the 2013 Council election, which includes 5 Executive Committee positions (President, 3 Vice-Presidents and Secretary General) and 8 regular elected Council members. This list must reflect a balance between the possibly conflicting requirements of:

- world-wide representation of the IAHR membership and yet at the same time a small active group which is capable to lead the Association, and to fulfil Council assignments;
- continuous renewal through new members while assuring necessary continuity;
- adequate representation of hydro-environment engineering practice.

Invitation to the membership for nomination of candidates

The Nominating Committee hereby invites all IAHR members to submit suggestions regarding nomination of possible candidates for Council. Please make your suggestions of potential Council candidates to any member of the NC 2013 before ***the end of December 2012***, including a rationale for the suitability of the candidate proposed and an indication of the nominee's willingness to accept if elected. The Nominating Committee will give due consideration to all suggestions.

NC 2013 slate of candidates

The Nominating Committee will evaluate all proposed nominations with respect to their qualification for fulfilling the major tasks of the IAHR Council.

The IAHR Council has the task to promote the interests of the Association and co-ordinate the activities of its members serving the interests and needs of Hydro-environment Engineering and Research, both at global and at regional scale.

This includes long-range planning for the biennial World Congresses as well as co-ordination and interlinkage of activities of Regional and Technical Divisions and Committees, e.g. conferences, IAHR publications and Awards and promotion of continuing education, student chapters and short courses. Membership promotion, finances, IAHR secretariat liaison and links with institute members, industry and the profession are also important tasks, as well as relations with government agencies and other professional/technical societies and international organisations.

The Nominating Committee will develop a slate of candidates, which must be published according to the By-Laws by May 11th. This slate may contain up to two candidates for each position.

Any member wishing to receive a printed list of the slate of candidates should contact the Secretariat after this date.

Nomination by petition

If the Nominating Committee has not included your suggestion in its slate or if you have another suitable candidate not hitherto considered, all members have the option to file a nomination by petition within two months after publication of the NC 2013 slate. The new election procedure gives any group of members in the Association, which feels that its interests are not properly taken into account by the NC 2013 slate, the chance to submit nominations by petition for any of the eight regular Council member positions. A valid petition requires signatures of 15 members from at least five countries or from a group of countries representing 10% of the IAHR membership. This assures that there is support for a candidate which goes beyond a personal or national interest. All valid nominations by petition will be included in the ballot.

Nominations by Petition must be submitted to the Secretariat within two months after publication of the NC slate of candidates with a statement from the candidate, that she or he is willing to accept the nomination, a resumé including professional career, involvement in IAHR, and a statement on the planned contribution as Council member.

Ballot

The NC will submit its list of candidates to the Secretariat for publication together with any candidates "by Petition", reaching members at least two months prior to the congress. Members will be invited to elect the new Council through written or electronic ballot before and at the Chengdu Congress, September 2013.

Contact:

NC 2013 Chair:
Prof. Nobuyuki Tamai, Past IAHR President
n_tamai@mba.ocn.ne.jp
Council contact person:
Prof. Roger Falconer, IAHR President
FalconerRA@cardiff.ac.uk

PEOPLE & PLACES

Mustafa Altinakar, from The University of Mississippi, USA has been recently appointed as Chair of the Fluvial Hydraulics Committee and he replaces Ana María Da Silva.

Andreas Dittrich from the Technical University of Braunschweig, Germany has been appointed Vice Chair.
For details of the other members of the new Leadership Team please visit www.iahr.org

Deltares Scientific Director

Deltares has appointed Dr. Jaap Kwadijk as Scientific Director in succession to Huib De Vriend who retired in May this year. Dr Kwadijk who is a specialist in hydrology and climate change is also Chair of the Deltares Scientific Council which is a group of nine meading scientists affiliated to Deltares and the Technical University of Delft.

Recent retirements

IAHR members, Ross Warren, Senior Project Manager from the Division Water and Environment of COWI A/S , Denmark and Prof. J.K. (Han) Vrijling of Delft University of Technology, The Netherlands have recently being retired.

IAHR Member HYDROPROJEKT CZ has changed its name to *Sweco Hydroprojekt*

Sweco's engineers, architects and environmental experts are working together to develop total solutions that contribute to the creation of a sustainable society. Sweco delivers qualified consulting services with a high knowledge content throughout the client's project chain, from feasibility studies, analyses and strategic planning to engineering, design and project management. Sweco is among the largest players in Europe and a leader in several market segments in the Nordic region and Central and Eastern Europe. Sweco carries out about 30,000 projects for around 10,000 clients annually. Sweco has a local presence in 12 countries and conducts project exports to some 80 countries worldwide.

New Student Chapter in Spain!

IAHR UPCT Cartagena Student Chapter
Dpto. Ingeniería Civil
Universidad Politécnica de Cartagena
EICM, Paseo Alfonso XIII, 52
30.203 Cartagena (España)
Teléfono: +34 696866407
web: www.upct.es/hidrom
www.upct.es/~ingcivil/

President
José María Carrillo Sánchez
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Treasurer
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chaparroluis@gmail.com

Main research topics they are involved in: •Water Intake Systems in Semiarid Regions •Physical and CFD •Numerical Modelling of free overflow spillways and dissipation basins •Physical and CFD Numerical Modelling of flow over racks •Dam Safety Evaluation •Characterisation of Hydraulic Jumps •Physical Modelling of Breakwaters •Calibration of flowmeters

PEOPLE & PLACES

Stockholm International Water Institute welcomes new Executive Director

The Stockholm International Water Institute (SIWI) has appointed Mr. Torgny Holmgren as its new Executive Director. Mr. Holmgren will lead the institute from September 15, 2012.

Mr. Holmgren is currently Ambassador and Head of the Department for Development Policy at the Swedish Ministry for Foreign Affairs, where he is responsible for Swedish policy on global development and has recently served at the United Nations Secretary General's High-level Panel on Global Sustainability. An economist by training, Mr. Holmgren has also previously served at the Swedish Ministry of Finance, the World Bank, and the Swedish Embassy in Nairobi, Kenya.

Statement of distinguished IAHR-APD Membership Award

Prof. Vallam Sundar and Prof. Lianxiang Wang received the IAHR-APD Distinguished Membership Award during the recent APD IAHR held in Jeju, Korea (20-23 Aug 2012). Prof. Vallam is from ITTM Chennai, India and former Chair of IAHR APD. Prof. Wang is from IWHR, China and is Secretary of IAHR APD.

A sad moment

Prof. Stephen Coleman, New Zealand (1966-2012)

Associate Professor Stephen Coleman of the University of Auckland New Zealand, an active IAHR member and outstanding hydraulic researcher, died on July 23, 2012 at the age of 46, after a short battle with stomach cancer. Stephen has been a key player in hydraulic research over the last decade, and had an exceptionally high potential for significant new achievements in the forthcoming decades.

For a full obituary go to the iahr website under "obituaries"

Enzo O. Macagno, Argentina-USA (1914-2012)

Noted hydraulician Enzo Oscar Macagno died in Iowa City, Iowa, on September 9, 2012, at the grand age of ninety-eight years. He was professor emeritus at the University of Iowa's well-known institute, IIHR-Hydroscience & Engineering (formerly known as the Iowa Institute of Hydraulic Research).

For a full obituary go to the iahr website under "obituaries"

Edward Silberman, USA (1914-2012)

Prof. Silberman has recently died after a record 60 years of IAHR Membership. He was Director of the St. Anthony Falls Laboratory between 1963-1974.

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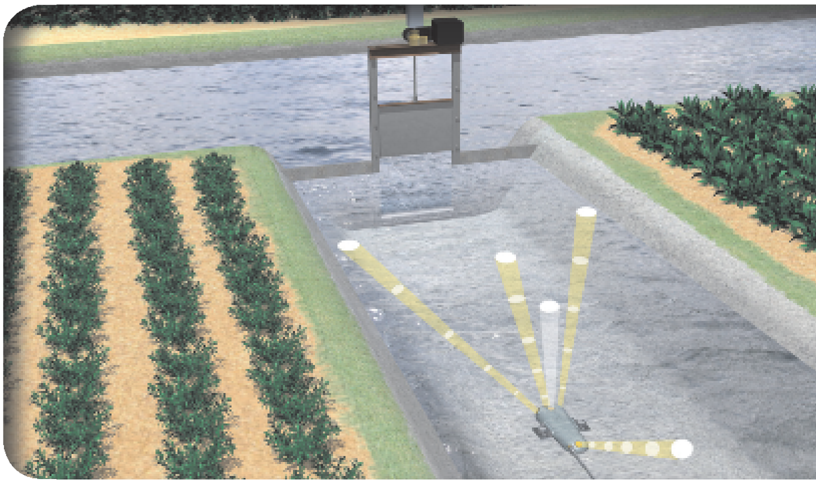
IQ™

Pronunciation: /ˌī-ˈky{uuml}/
Function: n
Definition: [i - intelligent q - flow]

a: term used to express the superior intelligence in an acoustic Doppler measurement device;
b: a score on a standardized intelligence test determined by extraordinary data collection capabilities relative to the average performance of other flow meters.



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