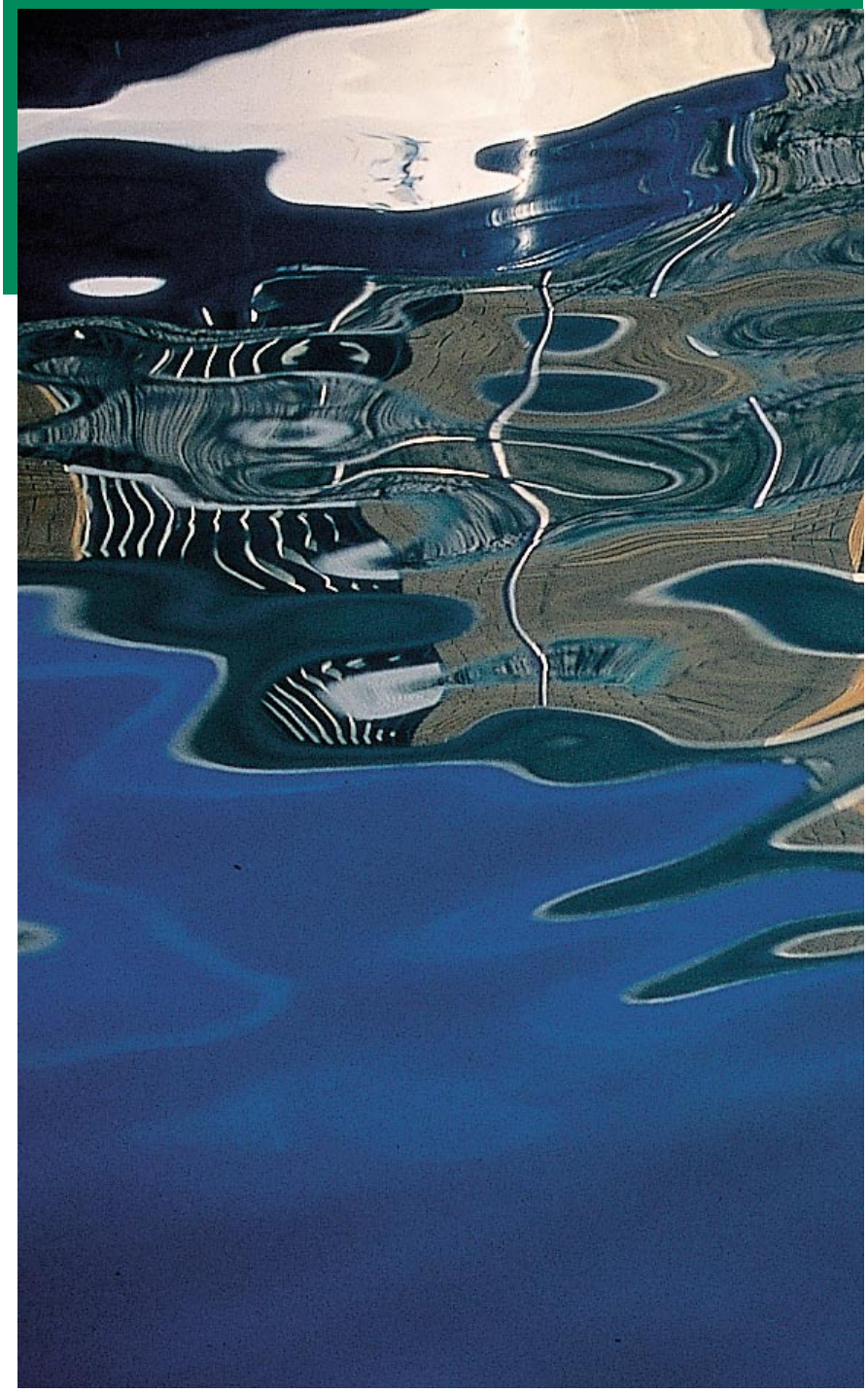
INTERVIEW
Living with Hydroinformatics

Interviews with Mike Abbott, Jean Cunge, Roger Falconer, Philip O'Kane and Arthur Mynett



VLADAN BABOVIC
WL | Delft Hydraulics, The Netherlands
Chairman of the Hydroinformatics Section

It was sometime in the early summer of 1989. I was a mere student at IHE-Delft. Suddenly, there was a lot of "buzz" at the institute. An important meeting was under preparation and some very famous people were invited to attend. All those professors whose books we studied: Abbott, Cunge, O'Kane… Something big was going on, but what? It was only weeks later that we learned that the new subject of "Hydroinformatics" was conceived. Hydroinformatics? "What is that?" we asked ourselves. This is, I guess, what we are still trying to find out. At least I am.

Over the years that followed I was fortunate to work and study under the guidance of doyens who contributed to the creation of the subject. Instead of providing my own interpretation of hydroinformatics I feel that it is much more appropriate on this present occasion to interview some of the founding fathers of the field and share with you their perspectives.

Q. Could you please give us a quick run-down of events that led to the creation of hydroinformatics?

Cunge: Hydroinformatics is not an institution or an organisation that could be 'created'. The name was definitely first proposed by M.B. Abbott and then has become accepted (during the years 1988-1991) but the content existed already in embryonic form. The content has no clear frontiers and is not defined even now: according to various stakeholders there are various definitions…

Abbott: As with almost any other initiative, the origins of hydroinformatics must be sought in the new needs of society on the one hand and the new possibilities presented by this society to satisfy those needs on the other hand. The social needs in this case were those of improvements in the design, construction and operation of large and complex hydraulic works, while the new possibilities were those of an ever-increasing and ever-cheaper computational power. It was on this basis that numerical models appeared that presented entirely unprecedented means to predict the behaviour of water, based upon the laws of physics supported by empirical relations.
The possibilities of such models were first demonstrated at the 1961 IAHR Congress held in Dubrovnik, where they were met with a mixture of widespread incredulity, considerable disbelief, some derision and not a little hostility. Many persons who felt themselves wedded to physical scale models were particularly critical of this approach. A great support was however provided by some other senior hydraulicians who did sense the possibilities inherent in this new approach. French hydraulicians were particularly evident at Dubrovnik and showed the way to combine excellent hydraulic understanding, deep mathematical insight and sound business acumen to good effect in this field. It was this combination that was subsequently identified as being of the essence of what was to become hydroinformatics. One consequence that followed soon after this was the formation of an IAHR Section that was devoted to 'the use of computers in hydraulics research'.

O'Kane: I attended the 1989 meeting. There was a meeting soon afterwards at the DHI User Conference [Jean Cunge was there as well] when Mike Abbott floated the idea of a Journal. I took a minority position that the copyright to the title (most important) and to the printed material should not be given to a commercial publishing house - those rights should remain with a scientific/technological society answerable to the research/user community.

"The social needs in this case were those of improvements in the design, construction and operation of large and complex hydraulic works, while the new possibilities were those of an ever-increasing and ever-cheaper computational power."
Mike Abbott

Falconer: In my view computational hydraulics took off in the 1970s, with some key players being Jan Leenderetse of Rand Corporation in the US, Mike Abbott at the IHE, Jean Cunge at Sogreah and Cees Vreugdenhil at Delft Hydraulics. The subject developed rapidly over the next 2 to 3 decades as more and more organisations got involved in the subject and with companies acquiring their own models for hydro-environmental impact assessment studies. In parallel with this revolutionary change, there was now no need for the large scale physical hydraulic model studies of specific sites. Hence, those non-numerical modeling academic researchers turned more to data acquisition in the laboratory and later in the field. New data facilities and instrumentation, e.g. ADVs and ADCPs, led to increased amounts of data, with a new science being born out of the need to analyze these large volumes of data. New approaches were used to analyze and interpret these data sets, such as Artificial Neural Networks, and solutions to hydraulic problems could now be obtained using new techniques or these new techniques could be used to develop process prescription or coefficients for improving the accuracy of traditional computational hydraulics models. This new field of study led to the creation of hydroinformatics, focused primarily around Mike Abbott and the IHE.

Q. What was the role of the technological institutions DHI, LNH, LHF, WL and HR in all this? What about educational institutions?

Cunge: Very limited after 1985. It was all the work of individuals and some of the technological institutions followed through support such as enabling their employees to participate in meetings and even, sometimes, providing financial support. DHI was definitely the leader as its commercial strategy was based on the development of the domain. Others followed, some willingly (even if the resources allocated to that purpose by their management were limited, e.g. EDF/LNH or LHF) or because simply they did not wish to be left out. The only educational institution that followed the general strategy was IHE, through the personal link of M.B. Abbott.

Abbott: The formal teaching of what then became 'Computational Hydraulics' as a full nine-month course was initiated in January 1966 at what was then called 'the International Courses in Hydraulic and Sanitary Engineering' in Delft. Being responsible for this course, I was intensely aware of the need to combine this with practical applications, and the then-director of the Courses shared this awareness. However, our attempts to interest the traditional laboratories and institutes were (politely) rebuffed and so I turned to an old friend of my Copenhagen days, Torben Sørensen,

who had in 1964 set up the quite grandiosely named 'Danish Hydraulic Institute' (DHI), initially with just five persons. Torben Sørensen had been impressed by the pioneering work of Walter Hansen on modeling storm surges in the North Sea, published in Die Kuste in 1956, and, together with Helge Lundgren, the doyen of Danish hydraulicians, he had used this model in an important Danish study, preparatory to commissioning an own one-dimensional model in 1958. In 1969 he and I proposed a new business model for numerical modeling to the Danish Academy of Technical Science… Our first application was rejected because it was directed to international applications and the Danish Academy saw no possibility of DHI succeeding internationally, so we resubmitted the proposal in 1970 for Danish applications and received sufficient financing to start work. Within some five years we were some sixteen persons in our 'Computational Hydraulics Centre' and DHI had grown to more than forty persons, but of course with nearly all the work coming from outside Denmark. This last achievement was for much the greater part again the work of Torben Sørensen, who, besides possessing a wide-ranging knowledge of hydraulics problems and their structural solutions, was an enthusiastic and successful entrepreneur and businessman. He was also a highly principled director and this led him into some difficult situations when ethical issues were involved, where he came into conflict with some interests whose ethics were, to put it mildly, more questionable. I want to emphasize this aspect here because I see it so neglected in many of our present-day practices. Ethics is of the essence of hydroinformatics.

■ **Q. And what about IAHR? The Section has been renamed. Was it difficult to combat traditionalist views?**

■ **Falconer:** The IAHR did have a role in the development of hydroinformatics, in that it provided the meeting forum for hydroinformaticians to meet and discuss new ideas and approaches to solving hydro-environmental problems. To embrace this change in emphasis of research in the field developing in the hydroinformatics area, as well as the traditional computational hydraulics field, the section title was re-named in about 1994. It is always difficult to combat traditionalistic views in any environment and hydroinformatics has been no exception. It was particularly difficult to combat such views in IAHR in the early days, but times have moved on, many members have retired and have been replaced with new and younger hydraulic researchers who have a more positive approach to hydroinformatics and, in my view, the subject is now going from strength to strength within the IAHR – its natural home.

■ **Mynett:** Well, if only we recall the 1995 IAHR Congress in London: Hydroinformatics sessions tugged away in a small room in the basement but were continuously attended by a crowd of over 100, including most Council members and (vice) presidents. NiNi made a plea for holistic views and Vladan Babovic, and Tony Minns stunned the audience with new approaches and working technologies

■ **Abbott:** It was IAHR that led to the most remarkably close and friendly cooperation between practitioners from otherwise competing organisations. Together we were aware that we were building an industry, which was a great adventure in itself and its own reward, and we correspondingly shared our discoveries and insights freely with one another.

■ **Cunge:** In 1989 there were no problems any more – the "combat" you mentioned took place some 15 – 20 years before. The problem was actually solved by naming the Section "Computational Hydraulics".

■ **Q. Hydroinformatics is technology. What happened to science?**

■ **O'Kane:** Applying HI tools to real cases leads to insight - a goal technology shares with science; the insight concerns the particular case and from many cases it leads cumulatively to other insights about specifications for better tools and their eventual emergence.

■ **Cunge:** Hydroinformatics makes use of scientific results and certainly stemmed from water sciences (hydraulics, computational hydraulics), applied mathematics, computer science and applications of ITC. It would not be possible to carry out hydroinformatics activities without new developments in these sciences.

"In my view the biggest opportunities for hydroinformatics are in the field of environmental health, where the challenges are global and immense." Roger Falconer

■ **Falconer:** Science is still very much a major part of hydraulic research. Although much of the traditional work in developing the governing equations describing physical and biochemical processes has been completed, the science of understanding these processes and describing them with higher levels of accuracy continues as much as ever. For example, the development of the LDA and PIV has enabled hydraulic researchers to acquire a better scientific understanding of a wide range of processes, thereby enabling us to improve our models - both now and in the future. There will, always be a need for science; nothing has changed in terms of our hunger to understand and apply science, which continues to affect most aspects of our daily lives.

■ **Q. Hydroinformatics has been around for only 5-6 years. From your perspective, what were the significant events that took place?**

■ **O'Kane:** The leading role of DHI's modelling systems; Mike's extraordinary output on its foundations.

■ **Falconer:** Firstly, in my view hydroinformatics has been around for much longer than 5 or 6 years. Since the change of name in the early 1990s and the first Hydroinformatics conference in IHE Delft in 1994, the key drivers of hydroinformatics have been the biennial conferences and the Journal of Hydroinformatics. The NATO workshop involved too few players in the field and the IAHR Special Issue was not read widely enough and was not distributed to the right people. For example, many of the key players at the hydroinformatics conferences are either not active members or not members of IAHR.

■ **Mynett:** Hydroinformatics has been around longer: my personal involvement with Hydroinformatics dates from the April 1994 NATO Advanced Research Workshop in Kasteel Vanenburg in the central part of The Netherlands. Already at that time the issues were on the role of (us as) 'science and technology tool' developers in relation to the (Logica) software industry or the (North West / Welsh) water boards in the UK. In my personal opinion Hydroinformatics really took off during the first International Hydroinformatics Conference held in June1994 at IHE; that was the first gathering of those involved in these developments, as well as (potential) customers like ministries, water boards, and engineering firms.

■ **Q. Where is hydroinformatics today? Where should it go? What do you see as the next steps in the evolution?**

■ **Abbott:** Hydroinformatics is something active, positive and creative, so that its development is essentially unpredictable. It is still developing of course, but personally I do regret that it is being so little applied to the problems of the two billion poorest people on our planet in such areas as agriculture, aquaculture and health provision. It is increasingly clear that with the expenditure of only a small portion of the present development budgets, the standard of life of the poorest on Earth could be improved out of all recognition, but so little is done to realize this. No doubt, even this will change…given enough time!

■ **O'Kane:** The major constraint is now instrumentation, especially in aquatic chemistry and below the surface of the ground. The Journal of Hydroinformatics needs to go fully electronic with modest page charges, on-line discussion and free downloads.

■ **Cunge:** I feel that there should be more initiative from the IAHR Hydroinformatics Section towards common work with other branches of sciences and activities, beginning of course with those water related, but on the basis of equality. EcoHydraulics has been the first step but it is very much hydraulic dominated. Agriculture, regulations and legal problems (first step could be the next Hydroinformatics Conference in Nice where special sessions are devoted to European Water Directives), soil science, biology…

■ **Falconer:** In my view the biggest opportunities for hydroinformatics are in the field of environmental health, where the challenges are global and immense. For example:

- 1.2bn people on our earth have no access to safe drinking water and over 3m citizens (mainly children) die annually of diarrhea;
- 2.4bn people on our earth do not have access to basic water sanitation and over 1m die annually of hepatitis A;
- Flooding often causes many deaths, particularly in the Indian sub-continent, where over 250,000 recently lost their lives following the Indonesia tsunami;
- More than half the hospital beds in the world today are occupied by people with water related diseases (BMJ 04).

It is not the medical professional who has been trained to alleviate or reduce these major environmental health issues cited above, but it is the hydroinformatician who probably has the best tools at his/her disposal, now and more so in the future, to address some of these massive challenges.

"… Global observation and information systems are becoming rapidly available – hence data-mining will become even more important. WASN - wide area sensor networks for optimal control of complex hydro/geo/environmental systems."
Arthur Mynett

■ **Mynett:** Environmental issues are not always well understood and hence cannot easily be "modeled" in conventional (computational) ways; however, alternative computer-based techniques are available and can be blended into new modelling paradigms … Global observation and information systems are becoming rapidly available – hence data-mining will become even more important. WASN - wide area sensor networks for optimal control of complex hydro/geo/environmental systems. Along the same line: Enviromatics – computer-based forecasts that enhance farm production and species diversity may change research and education, and hence influence Hydroinformatics more than we are able to do ourselves …