



# IAHS Newsletter

NL89 September 2007

**Includes reports of many of the symposia and workshops held in July at the IAHS Scientific Assembly at IUGG Perugia**

## **Des Walling's commitment to the study of erosion and sedimentation rewarded with the 2007 International Hydrology Prize**



The 2007 International Hydrology Prize, awarded annually by IAHS with UNESCO-IHP and WMO, was presented to Professor D. E. Walling by A. Askew (IAHS President) and S. Demuth representing UNESCO Water Sciences Division. The ceremony took place during the second IAHS plenary at Perugia. See p. 4 for the citation.

*Des (left) about to receive the silver medal from Arthur Askew.*

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## **Young/early career scientists events at ICSU and IUGG**

**Global Scientific Challenges: Perspectives from Young Scientists**, a conference celebrating 75 years of ICSU (April 2007), emphasized the great potential of scientists in Less Economically Developed Countries; the importance of science communication; and the need to remove some of the institutional barriers to transdisciplinarity. See report p.19.

**Young Scientists Event, IUGG Perugia** (July 2007) proposed actions to engage more “early career” scientists in IUGG (and IAHS). See report p.20.

### **2007 Tison Award for Christophe Cudennec and Houda Boudhraa**

See p.7 for the citation.

## **Distributed versus Lumped Modellers' frisbee match tied 1–1**

The IAHS conference in Perugia was rich in intense and lively scientific discussions, both during and after the sessions. On the streets leading to the underground poster hall, a vivid discussion started among a group of young hydrologists, concerning the relative merits of lumped and distributed hydrological models.

Our first reaction was to find Vit Klemeš, the well-known former IAHS president, and ask him to settle the dispute in his own way but he declared that he didn't “want to engage into 21st century hydrology”. We had thus to settle the question by ourselves, and we agreed to confront our forces in a frisbee game. The *lumped modellers* would confront the *distributed modellers*, and the winning side



*Players with the frisbee adapted to Lumped Modellers! would earn the much desired title of ‘best hydrological modellers’ for the coming two years. Continued p. 15*

## A Note to Members, from Perugia

I have often spoken and written of my belief in the importance of the commitment and work of the individual hydrologist, but that is not to say that this individual should work in isolation – most certainly not. In fact the very first of the statutes of IAHS establish its purpose as, *inter alia*, to provide for the discussion and comparison of research results, and to initiate, facilitate, and coordinate research. This is the main purpose of the Assemblies of IUGG and IAHS. In the note I wrote for the last issue of the *Newsletter* I mentioned that “the Assemblies every two years are what give IAHS its full identity as an international association that brings together all the hydrological sciences and, every four years, links them directly with the other geophysical sciences that come under the wing of IUGG”.

So from 2 to 13 July 2007 we met in the beautiful medieval city of Perugia for the XXIV IUGG General Assembly. Lucio Ubertini was our brave and ever-smiling host. I say brave because few would take on the task of inviting over 4000 geoscientists to spend one or two weeks in a small city, especially in parallel with an international jazz festival. We all have our own special memories of the Assembly, most of which will include the beauty of the countryside and of the ancient towns, the superb Italian food and wine, not forgetting the hard work of Salvatore Grimaldi and Arnaldo Pierleoni in support of Lucio

and the contribution made by the many friendly university students who, in their blue T-shirts, ensured that we found our meeting rooms and were able to load and project our PowerPoint presentations.

The statistics show that, of the 4375 that attended the Assembly, 505 were linked to IAHS. Cate and her colleagues at Wallingford did a great job in editing, printing and distributing five new Red Books, which they brought in person to Italy. IAHS organized 17 symposia and workshops, and co-convened 25 other meetings. As always, there were some “no shows”, but no more than usual, and in general it was agreed that the scientific sessions had gone very well and that in relation to IAHS’ most essential purpose, namely “to provide for the discussion and comparison of research results”, the Perugia Assembly had been very successful.

At its Council meeting, IUGG formally approved the final step in the long but amicable process by which our cryospheric colleagues have separated from IAHS to form their own association within the IUGG family: the International Association of Cryospheric Sciences (IACS) with our good friend Georg Kaser as its President. The close links between IACS and our own Commission on Snow and Ice Hydrology (ICSIH) were very evident in Perugia where they co-sponsored a number of activities. This bodes well for the future.

IUGG also formally accepted the offer of Melbourne, Australia, to host

the XXV IUGG General Assembly in July 2011. So put that date in your diaries, because it is not too early to start thinking about topics for sessions and other activities that IAHS might organize “down under” in four years time.

In the last newsletter I also invited you to come to Perugia to ensure that your views and those of your colleagues are taken into account in the governance and future planning of our Association. The two Plenary meetings that we held in the second week of the Assembly were well attended. Reports on past activities were presented and I had the great pleasure of awarding Des Walling (UK) the International Hydrology Prize for 2007 and Christophe Cudennec (France) and Houda Boudhraa (Tunisia) the 2007 Tison Award – see p. 4 and p.7.

Elections were also held for officers of the Association and its Commissions. I am indebted to John Rodda and his colleagues on the Nomination Panel and to the other Nomination Groups for the care with which they oversaw this process. The detailed result is to be found on the Association web site: [www.iahs.info](http://www.iahs.info).

I congratulate all who have been elected and wish them well in their new roles, each of which is essential to the future of IAHS. I also express my thanks to those who stood for posts but were not elected. Their willingness to serve the Association is warmly acknowledged and I invite them to continue to work in support of the Association and its Commissions in the years ahead. I am pleased to report that Pierre Hubert and Chuck Onstad were re-elected as Secretary General and Treasurer – deservedly by acclamation. I will risk singling out four of the newly-elected members of the Bureau for special mention:

*Gordon Young (Canada) – President-Elect* a past Secretary-General of the Association who returns to work with us after many years with the UN system. “Welcome home Gordon!” Over the next two years, Gordon will be developing medium to long-term plans for IAHS and it will be my pleasure to pass the chair over

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Articles and letters from IAHS members on all aspects of hydrology and related topics are welcomed for publication in the Newsletter. They should be sent to the IAHS Secretary General, Pierre Hubert, preferably by e-mail to: [iahs@ensmp.fr](mailto:iahs@ensmp.fr), alternatively to:

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#### Next deadline for copy

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to him at the opening of the Hyderabad Assembly in September 2009.

**Dan Rosbjerg (Denmark) – Vice-President Responsible for Planning of Assemblies** I am most grateful to Dan for agreeing to take on this important task and I call on all members, and in particular those proposing and finally convening sessions at the next two Assemblies, to work closely with him to ensure their success.

**Rajendra Prasad (India) – Vice-President Responsible for Projects and Contacts with Individual Members** Rajendra has agreed to work with the Commissions and Working Groups of the Association to develop a series of activities for inclusion in the medium-term strategy. In this, he is open to receive proposals from all members of IAHS as regards future activities and I invite all members to contact him with their ideas.

**Juan Carlos Bertoni (Argentina) – Vice-President Responsible for Relations with Developing Countries** IAHS can be proud of the efforts it makes to encourage the involvement

of its members from developing countries and Juan Carlos has agreed to work on this important aspect of our work for the next four years, following on the excellent work that Xia Jun has done for us in the past.

There were also two meetings of the IAHS Bureau: one of the old Bureau and one of the new. We considered reports by all the Officers, Commissions and Working Groups and Chuck Onstad updated us on the finances of the Association, which we were pleased to learn is currently in good health. We also considered at some length a number of issues relating to IAHS' publications programme.

Among the many other items of business, the Bureau formally terminated the Working Groups on Hydrology 2020 and GEWEX, with thanks to their members and in particular their chairs. It then considered at some length proposals for new working groups and, after careful debate, agreed to establish Working Groups on Education and Hydro-meteorological Projects. It requested ICWRS to take responsibility for a

Working Group on Statistics in Hydrology, with a view to its either remaining under that Commission or becoming an independent working group of the Association. It also established a Working Group on Precipitation, with a request that its plan of action be developed in more detail over the coming months. The minutes of meetings of the Bureau will be available soon on the IAHS web site under Archives.

As we launch into a new two-year period in the life of IAHS, I would like to record the Association's appreciation to all those whose term of office finished in Perugia, whether as officers of the Association or as a member or officer of one of its subsidiary bodies. In particular we would thank Kuniyoshi Takeuchi, Chris Leibundgut, Xia Jun and Louise Heathwaite for all that they have done for IAHS over the years and, most recently, as President and Vice-Presidents, respectively. They may have left the Bureau, but we can be sure that they will remain active individual members of the Association for many years to come.

*Arthur Askew, IAHS President*



Some of the IAHS officers – participants at the second IAHS Bureau meeting in Perugia – clockwise from back left: D. Rosbjerg (IAHS VP), I. Cluckie (ICRS), W. Stuckmeier (IAH SG), A. Szöllösi-Nagy (UNESCO), J.C Bertoni (IAHS VP), U. Shamir (IUGG President), A. Askew (IAHS President), G. Young (IAHS President-elect), S. Franks (ICCLAS), A. Pietroniro (ICRS), J. Pomeroy (ICSIH), J. Gibson (ICT), C. Gardner (IAHS Press), P. Hubert (IAHS SG), S. Demuth (ICSW), D. Koutsoyiannis (IAHS Deputy Editor), Z. Kundzewicz (IAHS Editor), M. Hill (ICGW), O. Ünver (WWAP).

Contact details for all officers are available at the IAHS website, and a summary is provided on the back cover.

## **International Hydrology Prize** Citation by A. Askew

Desmond Eric Walling was born in Essex on the outskirts of London (UK), but spent much of his childhood in Surrey. He later followed the call to – “Go west young man” – and headed first to Somerset and then on to Devon where, in the early 1960s, he entered the University of Exeter to study Geography.

He obtained his BA in 1966 and his Doctorate five years later. Those of us who know Exeter can well understand why he chose to go no further west. Who would want to leave such a beautiful campus in such a delightful county?

Many will remember the First Scientific Assembly of IAHS, which was held at Exeter University in 1982. The success of that Assembly owed much to the untiring efforts of Des and his colleagues. The success was scientific, but it was also financial – the two do not always go hand-in-hand – and the profits made led to the establishment of the other Prize that is awarded annually by IAHS: the Tison Award for young hydrologists. It was also used to set up the Exeter Travel Fund, which still helps to support young scientists to attend IAHS and IUGG conferences. This gave Des much justified recognition within the international hydrology community.

He had been appointed Lecturer in 1971 and by the time of the Exeter Assembly he was a Reader in the Geography Department. He later rose to the position of full Professor and since 1998 he has held the post of Reardon Smith Professor at the University. One cannot help but remark on the fact that, while Des has spent his entire academic life of over 40 years in one institution, he has become known and respected throughout the World for his work. In fact, I think it is true to say that never has a candidacy for the International Hydrology Prize been supported by so many countries.

What is it that has made Professor Walling so well known that the World beats a path to his door?

First and foremost is Des' commitment to the study of erosion and sedimentation: a topic which is now more important than ever, given the continual increase in demand for land for urban development and food production while vast areas are being degraded by erosion and water courses and reservoirs are being filled with sediment. His is a commitment not only to much-needed research, based on meticulous field experiments – real data – but also to the application of the research results in operational practice, and to teaching. This last focus is well illustrated by the fact that he has supervised more than 60 PhD students over the past 35 years.

Key topics within the field of erosion and sedimentation where his contribution is readily recognised include:

– *Global sediment yields and the sensitivity of river loads to environmental change.* The global map of sediment yields that he produced with Bruce Webb back in the 1980s is still widely cited.

– *Suspended sediment dynamics.* His classic work on sediment rating curves remains some of the most important in the field and is widely cited.

– *Sediment measurement problems.* He was amongst the first hydrologists to emphasize the major errors

associated with many measurements of the suspended sediment loads of rivers.

– *Suspended sediment properties.* Des's work has addressed the gap that existed in the past between establishing the magnitude of suspended sediment fluxes and considering the properties of the sediment.

– *Use of environmental radionuclides in the study of erosion and sedimentation.* He pioneered important advances in the use of caesium-137, lead-210 and beryllium-7 in studying the mobilisation, transfer and storage of sediment in river basins, collaborating in this with the International Atomic Energy Agency and is without doubt a world leader in this field.

– *Sediment source fingerprinting.* Des Walling and his team have pioneered advances in the use of “fingerprinting” techniques.

– *Flood plain sedimentation.* His work in establishing the importance of flood plains as major sediment sinks is widely cited and has underpinned much subsequent work in the field.

– *Catchment sediment budgets.* Looking back over Des's research career, it is clear that one of his main objectives was to quantify the sediment budget of a catchment. It is good to see that as his career moves into its later stages he has now succeeded in constructing full sediment budgets for several of the catchments that he has studied and the papers that he has produced documenting this work and its findings must be seen as making a major contribution in the field.

– *Sediment problems in river basins.* Recent increase in concern for the role of fine sediment loadings in degrading aquatic habitats and ecosystems has meant that it has an increasing relevance for river basin and catchment management, and Des has responded to these new challenges through his work on the role of fine sediment in diffuse source pollution, the transfer and fate of nutrients and contaminants, particularly phosphorus, and the siltation of salmon spawning gravels.

The results of this work are recorded in some 30 books, monographs and edited volumes and more than 430 scientific papers. In all this he has brought a reputation for care, consistency and clear thinking which have led others to rely on him as a source of sound advice and leadership.

The second reason for Professor Walling's international reputation is the fact that, while his home base has always been Exeter, he has not sat immobile among the leafy lanes of the Devonshire countryside. He has travelled extensively and collaborated in projects in many other countries, including Algeria, Belize, Chile, China, France, Greenland, Italy, Kenya, Laos, Lesotho, Morocco, Norway, Poland, Russia, Spain, Thailand, Zambia and Zimbabwe. The list of countries he has visited is far longer, of course, and the experience he has gained from his travels has led to his having a global view of erosion and sedimentation problems that is evident from the universal nature of much of his work, making it relevant, not just to the County of Devon or even to the UK, but to the wide range of situations faced in other countries.

The third reason follows naturally, but not automatically, from the second. From his very earliest days as a research worker, Professor Walling chose to put his considerable ability at the service of the international hydrological community, in particular but not exclusively, IAHS.

Des has been a strong supporter of the Association's publications, editing/co-editing 15 volumes of "Red Books" and publishing more than 70 papers in the series. He almost certainly holds the record in this regard. His interest in IAHS Press has never been purely as an outlet for his own work, however, and he has given much in return. Some years ago he was very much involved in establishing IAHS Ltd as a not-for-profit company and has for some time been the Chairman of IAHS Ltd, a role he takes very seriously, being at all times aware that the Board that he chairs is effectively the employer of four staff.

Quite naturally, Des has been closely involved in the International Commission on Continental Erosion of IAHS, being its Secretary from 1975 until 1983 and then its President until 1991. His fellow members of that Commission hold that its current healthy state owes much to Des' leadership in past years. During those years he convened or co-convened a number of successful symposia, including one at the Assembly in Foz do Iguaçu in 2005 which generated two volumes of proceedings.

His commitment to IAHS has not been at the expense of other organizations and, from 1996 to 1999, Des served as President of the International Association of Sediment Water Sciences and in October 2004 he was elected founding President of the World Association for Sediment and Erosion Research (WASER). He has served as a member of the Advisory Council of the International Research and Training Center in Erosion and Sedimentation (IRTCES) in Beijing for several terms. The link here is of course with UNESCO, through which he has been actively involved in its International Hydrological Programme, serving at one time as co-ordinator of various IHP projects on erosion and sedimentation and being currently a member of the Steering Committee of the UNESCO International Sedimentation Initiative. He has worked with the International Atomic Energy Agency on the use of environmental radionuclides and, within the non-governmental community, one can also mention his close involvement with various components of the International Geosphere-Biosphere Programme.

With a *curriculum vitae* such as this, it is not surprising that Professor Walling has been awarded a number of national and international honours over the years. He received the Vollenweider Award of Environment Canada in 1990 for "Contributions to Excellence in International Freshwater Research and Scientific Leadership" and in 1995 he was the first recipient of the President's Prize of the British Hydrological Society. In 2000 he was awarded the Victoria Medal of the Royal Geographical Society of London for "Outstanding Contributions to Hydrology and Fluvial Geomorphology".

In view of his outstanding contributions to the science of hydrology and to international co-operation, not only within his own field of erosion and sedimentation, but in hydrology in general, there can be no doubt that Des Walling is a worthy recipient of the International

Hydrology Prize. It is therefore with great pleasure that, together with UNESCO and WMO, the Association awards him the Prize for 2007.

### **Response by D. E. Walling**

Mr President, representatives of UNESCO and WMO, friends and fellow hydrologists:

It was a very great pleasure and indeed a surprise for me to receive an email from our President back in March informing me that I had been awarded the International Hydrology Prize for 2007. This is a great honour, particularly when I have recently seen the Prize referred to as the Nobel Prize of Hydrology. I am very grateful to those amongst the international community that nominated me for this prize and to the panel that made the award. I feel both proud and humbled to join the ranks of previous recipients of the prize. As someone who started to participate in IAHS activities back in the mid 1970s, thirty years ago, my sense of pride is further strengthened by the fact that, with the exception of the first recipient, Professor Tison, I have met all the previous recipients and I feel greatly honoured to join their ranks. There are three other UK hydrologists on that list, and the addition of my name brings this to four. However, if it is permissible to introduce an element of friendly rivalry, I should indicate that the UK is still some way from matching the record of the US, which currently has six recipients.

Arthur has, in his inimitable way, provided a beautifully crafted and very generous summary of my achievements over the past 35 years or so, and it is somewhat sobering to have those years and my different achievements paraded in front of me. I feel somewhat like the drowning man, whom, we are told, sees the whole of his life flash past before he succumbs to his fate. Fortunately my fate is rather kinder!

Arthur focused on my achievements, but of course many, if not most of these, would have been impossible without the support, help and collaboration of the many people with whom I have had the privilege to work and interact over the years. It is difficult to single out individuals from a long list, but I would like to mention just a few:

Firstly, Professor Ken Gregory, my undergraduate tutor and PhD supervisor at the University of Exeter, who encouraged me to work on rivers, catchments and muddy water.

Secondly, a number of UK engineering hydrologists, including Peter Wolf, Michael Hamlin and Jim McCulloch, who encouraged a young geographer to both follow his interests in erosion and sediment transport and to join the national and international hydrological communities.

Thirdly, the large group of former PhD students, research fellows and colleagues in both the UK and overseas with whom I have been fortunate to work over the past 35 years. I will not list these, but I would like to direct particular recognition to Bruce Webb, who should be here this evening and with whom I have worked as a colleague and friend for some 30 years. With W as the 23rd letter of the alphabet, I had to search very hard to find someone who would come after me when listing authorship in alphabetical order! I was very fortunate to find Bruce.



I would also like to acknowledge the many gentleman scientists from overseas, including Harold Guy, Dick Hadley and Bob Meade from the USGS and Fred Fournier, a former President of ICCE, who generously passed on their knowledge and enthusiasm to a young researcher from the UK, where the accepted position was that soil erosion was not a problem and the rivers were not muddy enough to cause problems and where some therefore thought that I was wasting my time in devoting attention to erosion and sediment yields. I can well remember very early in my career being taken to task by one very eminent UK hydrologist, who, after I had given a short paper on suspended sediment yields, argued that there was no such thing as suspended sediment, because the word sediment was derived from the Latin word *sedere* meaning to sit and could therefore not be suspended! I was firmly put down, but I recovered!

IAHS, UNESCO and WMO are the sponsors of this award and I would like to thank them once again for bestowing this honour upon me. More broadly, however, I would like to recognise their important contribution to the development of my career. It is my links with IAHS that enabled me to branch out from my roots in physical geography and become a true hydrologist. I think that I probably have John Rodda to thank for this, when, back in 1975, he arranged for me to be nominated as Secretary of ICCE. At that time the acronyms IAHS and ICCE meant little to me, but they have subsequently become a very important part of my life. I attended my first IAHS symposium in Paris, 30 years ago, in 1977 and my first IAHS General Assembly in Canberra, Australia, in 1979 and I have attended all subsequent General Assemblies and Scientific Assemblies. I have greatly valued the opportunities provided by ICCE to collaborate with other hydrologists working on erosion and sedimentation in many different parts of the world. Equally, I have greatly appreciated the way that our Association has promoted hydrology as a discipline in the international arena and its camaraderie. I have many fond memories of past Assemblies and, for example, of encouraging Jean Rodier to sing Clementine and pushing Jim Dooge to treat us to a rendition of Molly Malone. UNESCO was also very important in stimulating my interest in catchment hydrology and hydrological processes back in the 1960s through the IHD, and it raised the profile of sediment studies by providing support for several projects on erosion and sedimentation within the IHP, in which I was fortunate to be invited to participate. The UNESCO International Sedimentation Initiative, ISI, with which I am now closely involved, continues that support. Equally, although perhaps more indirectly, WMO has provided important support for sediment studies as part of hydrology, by including sediment measurement as a key component of their initiative to develop standardised measurement programmes.

In his generous review of my achievements, Arthur has clearly shown where my interests lie. It is in the field of erosion and sedimentation, a fascinating area, where I have been able to range from studies of global patterns of sediment yield, through the development of new measuring techniques and the application of fallout radio-

nuclides as sediment tracers, to investigations of the characteristics of sediment particles and the sediment budgets of small catchments. It has proved a very fulfilling field of study. IAHS has always recognised this as a part of hydrology and ICCE, its International Commission on Continental Erosion, was established way back in 1948 at the General Assembly in Oslo. Initially it was the International Commission on Land Erosion, but, because of the emphasis of the work of members such as Professor Tixeront and Fred Fournier in looking at global patterns of erosion sediment transport, it was renamed ICCE. This gave it a distinctive focus, which I also have enjoyed pursuing by looking at the global pattern of sediment yield and recent changes in the sediment loads of the world's major rivers.

Looking back through the list of recipients of the International Hydrology Prize, I am conscious that I am the first from the area of erosion and sedimentation to have received the award and I would like to feel that this in some ways brings further recognition to this field and to ICCE. It is a field, which, I would suggest, is assuming increasing importance, as hydrology concerns itself with the problems of environmental protection and sustainable development. Soil erosion has long been recognised as threatening the soil resource and reservoir sedimentation is a major problem in many areas of the world. These problems remain and sediment is likely to represent a major constraint on future water resource development in many areas of the world. If reservoirs fill up with sediment, they are difficult to replace. However, it is the more widespread and insidious impacts of sediment on water quality and environmental quality that have in recent years raised its profile worldwide. Sediment has been referred to as the world's number 1 pollutant and its important role in the transport of nutrients and contaminants through terrestrial and aquatic systems is being increasingly recognised. Thus, for example, if you want to understand the mobilisation, transfer and fate of phosphorus and organic contaminants in terrestrial and aquatic systems, a knowledge of sediment mobilisation, sediment sources and sediment budgets is essential. Equally, sediment is increasingly seen as a key influence on aquatic ecology and within EC countries it is at last being recognised as being of central importance to the Water Framework and Habitats Directives. As I mentioned previously, when I started research in his area in the UK back in the late 1960s, I was told that neither soil erosion nor sediment represented significant problems and that I was wasting my time! I persevered and my presence here today shows how, in retrospect, that advice proved wrong. Sediment is a key pathway for material transport at all scales ranging from the global earth system to the individual farmer's field. Our understanding and knowledge has expanded greatly over the past few decades, but there is still more to be done and I would urge IAHS to continue to encourage and support work in this field and to promote its closer interaction with other areas of hydrology. I hope that I will not be the only "mudlark" to join the ranks of recipients of the International Hydrology Prize and that others will join me in the coming years.

## 2007 Tison Award Citation by Z. Kundzewicz

The Jury of the 2007 Tison Award: Z. W. Kundzewicz (Chair, IAHS Editor), B. Webb (ICWQ), M. Thoms (ICCE) and A. Bellin (ICGW), recommended bestowing the 2007 Tison Award upon Dr Christophe Cudennec and Ms Houda Boudhraa, of France and Tunisia, respectively. The winning paper: *A multi-level and multi-scale structure of river network geomorphometry with potential implications towards basin hydrology* was published in the PUB Red Book *Predictions in Ungauged Basins: Promise and Progress* (IAHS Publ. 303). It was jointly authored by Christophe Cudennec, Jean-Christophe Pouget, Houda Boudhraa, Mohamed Slimani & Slah Nasri. Three of the co-authors are not eligible for the Tison Award, in view of their ages, as it is only made to younger (<41) authors.

The paper, on identification of the underlying structure of diverse, strongly self-similar river networks, results from a search for a general law governing hydrological processes. The work has utilized concepts exposed in the seminal papers in the water field, by Horton (1945), Schumm (1956), a book by Eagleson (1970), and several publications by Rodriguez-Iturbe and collaborators, since the 1970s. But, apart from those already listed, one should mention one more name, Professor Benoit Mandelbrot, who was born in Poland, educated in France, and had a brilliant scientific career while working in the USA. He was the discoverer of the fractal geometry of nature and the father of scaling, with several generic works published in the field of hydrological sciences. These beautiful theoretical concepts hold promise for the practice, which has not materialized so far. Perhaps the awarded paper, a contribution to the PUB initiative, is a small step in this direction.

The awarded paper is a result of French–Tunisian cooperation. Dr Cudennec has spent a considerable time in Tunisia and Ms Boudhraa has stayed in Rennes (France). Both authors co-authored another paper published in the same volume, and Christophe – yet another one.

Dr Cudennec has been known in IAHS for quite some time, and has attended several assemblies and symposia. He is not an ivory-tower scientist. He has visited a number of countries, including developing countries in Africa, Asia and South America, where he carried out field work. Although he is a Frenchman, Dr Cudennec often publishes in English; hence, his papers are accessible to a broader audience. It is worth mentioning that he has had an episode of work in the diplomatic field, as a science and technology attaché in the French Embassy in Iceland.

Ms Houda Boudhraa is likely to receive her PhD this month (July 2007). She has collaborated with Dr Cudennec both in Tunisia, during his three-year work period there, and in France, during her longer stay at Agrocampus Rennes.

I am very pleased that the Award goes to Dr Cudennec and Ms Boudhraa. Dr Cudennec delivers an important service for IAHS and *Hydrological Sciences Journal*. He is one of 30 *HSJ* associate editors. Yet, his role is more important than those of other AEs. The two official languages of *HSJ*, and IAHS, are English and French. For several years now, Christophe has been checking French titres, résumés and mots clefs of all the papers accepted in *HSJ*, before they are published. In practice, not all authors provide

Christophe and Houda with their Tison Award certificates



French abstracts that are reasonably correct, linguistically. If the language of the resume is poor, or else (and this is quite common), if the authors supply no resume at all, Christophe translates the abstract, etc. into French. He also verifies the quality of the language of papers submitted in French. He thus helps support the continuing presence of the French language in the Journal and in the Association.

Finally, let me share a personal reflection. Twenty years ago, the Tison Award was given for the first time. I am proud to say that I was the first laureate. This Prize, whose monetary value is only symbolic, has had a considerable impact on my scientific career. Ladies and Gentlemen, I feel honoured and pleased to bestow the 2007 Tison Award to Dr Christophe Cudennec and Ms Houda Boudhraa. Let me wish that this Prize marks an important milestone in their scientific careers. Congratulations and good luck.

*Reply by Christophe Cudennec* Thank you very much Drs Kundzewicz and Askew. The tradition is to say few words. In order to respect the bilingual status, I'll speak in English and Houda in French.

I'm much honoured by this award and to have my name added to such a list of distinguished colleagues.

Let me find this is recognition of hydro-geomorphological and scaling approaches in our discipline. Let me understand this is a recognition of PUB issues in developing countries, where data scarcity is a crucial problem to address all the water-related aspects Dr Young has just listed. Let me believe this is recognition of North–South cooperation. I'm truly happy and proud to share this award with a promising Tunisian scientist, the first African to receive the Tison award, all the more, a woman.

Thanks a lot to the jury for this honour, and to the Association for being what it is.

*Reply by Houda Boudhraa* J'aimerais remercier toutes les personnes qui m'ont donné l'occasion de me présenter ici aujourd'hui. Je remercie vivement les membres du jury du prix Tison 2007, je remercie également le secrétaire général de l'AISH, monsieur Pierre Hubert, puis toutes les équipes de l'IRD et de l'INAT. J'ai eu l'honneur et le grand plaisir de connaître Christophe et de travailler avec lui dans le cadre de ma thèse et durant ces années j'ai beaucoup appris avec lui et je compte bien continuer cette collaboration. Je suis très heureuse et fière, en tant que tunisienne et africaine, d'être là ce soir pour recevoir le prix Tison 2007, merci encore.

## Reports from IAHS Symposia and Workshops at Perugia

### **A New Focus on Groundwater–Seawater Interactions** Symposium HS1001

To unify the broad interest in the subject of submarine groundwater discharge (SGD) and groundwater–seawater interactions, this two-day symposium was organized by two IUGG associations: IAHS through its International Commission on Groundwater (ICGW), and the International Association for the Physical Sciences of the Oceans (IAPSO).

SGD and associated chemical fluxes are of interest to those studying the water and chemical budgets of oceans as well as those interested in terrestrial groundwater processes such as saltwater intrusion. The purpose of the symposium was to draw members from both the marine and terrestrial perspectives to exchange ideas and develop a common dialogue about groundwater and seawater interactions. Scientists from both groups participated.

The presentations included a variety of investigative methods including those based on physical, chemical, and modelling approaches. For example:

- Peter Swarzenski (US Geological Survey) used improved electrical resistivity techniques to characterize the shape and movement of freshwater plumes beneath coastal waters. Results obtained with the new equipment contain a much higher level of detail than had been previously possible.
- Julie Gattacceca (U. Paul Cezanne, France) used stable isotopes and electrical conductivity measurements to characterize saline intrusion into the coastal aquifer near the Venice Lagoon in Italy.
- Eunhee Lee (Seoul National University, Korea) used a numerical model to quantify the effects of extreme rainfall events on rates and patterns of SGD.

Quantifying the global rate of fresh SGD relative to coastal river discharges was also discussed at the meeting. Interestingly, consistent estimates (between about 6% and 10%) were reported by both Igor Zektser (Russian Academy of Sciences) and Makoto Taniguchi (Research Institute for Humanity and Nature, Kyoto, Japan). The reliability of these estimates is expected to improve as additional data is collected and analysed.

While this symposium fostered a productive exchange between marine and terrestrial scientists, more dialogue is necessary. Modelling approaches could be improved by explicitly including the findings from studies based on chemical approaches. Likewise, results from studies based on chemical methods could be further constrained using numerical models. Discussions at the symposium seem to have illuminated a path for future collaboration.

There were 31 scheduled oral presentations and seven poster presentations. The pre-published IAHS Red Book (Publ. 312) contains the accompanying peer-reviewed papers for all 38 presentations.

*Ward Sanford & Christian Langevin, US Geological Survey  
Maurizio Polemio, National Research Council, Italy  
Pavel Povinec, University at Bratislava, Slovakia*

### **A New Focus on Integrated Analysis of Groundwater–Surface Water Systems: Process understanding, conceptualization and modelling** Symposium HS1002

Our symposium was held over three days and included participants from six continents and 18 countries. A total of 41 talks were presented during the oral sessions, which were well attended with 50+ attendees per session. The talks presented a well-balanced mix of topics, including: (1) field and process studies, (2) process conceptualization, (3) modelling approaches, and (4) applications, and also covered a wide range of geographical locations (many different countries and continents) and environments (lowlands and uplands).

The first part of symposium concentrated on the understanding of processes and their conceptualization and the audience was introduced to a wide range of physical, geochemical and ecological methods for investigating the interactions between surface water and groundwater. Keynote speaker Marie-Jose Dole-Olivier emphasized the importance of integrating methods from different science disciplines and made a plea for a better cooperation between scientists from different backgrounds. The second part concentrated on the modelling of surface water–groundwater interactions in different geographical and climatic environments as well as at different scales – from fully distributed to lumped models. Many speakers identified the need for developing integrated modelling approaches and also underlined their importance as concept development tools. The audience was invited by keynote speaker Ana Barros, to take on the challenge of downscaling models to a scale that adequately captures the relevant processes within the studied systems. In the third part of the symposium practical applications and specific case studies were presented. The participants agreed that there is a need for more specific process studies to improve the understanding of surface water–groundwater interactions in different landscapes and climates and also to provide a better basis for the development of integrated modelling systems.

The popularity and great interest in our session has demonstrated the increasing interest in the topic of surface water–groundwater interactions and the presented case studies and modelling applications have confirmed that a better understanding of the interactions between surface water and groundwater is key to the protection and effective management of our water resources, qualitatively as well as quantitatively.

*Corinna Abesser, British Geological Survey  
Thorsten Wagener, Pennsylvania State University, USA*

Selected papers from HS1002 are being peer-reviewed ready for publication in an IAHS Red Book early in 2008.

### **Hydrology in Mountain Regions** Symposium HS1003

Papers from HS1003 (no report available), are being peer reviewed for publication in an IAHS Red Book early in 2008.



## **Quantification and Reduction of Predictive Uncertainty for Sustainable Water Resources Management** Symposium HS2004

This symposium provided a joint forum for meteorologists and hydrologists addressing climate variability and its representation in water management tools. It was organized by the IAHS ICCLAS (Coupled Land–Atmosphere System commission) and the joint IAHS/WMO Working Group on GEWEX and supported by IAMAS (International Association of Meteorological and Atmospheric Sciences) International Commission on Climate (ICCL), the IAHS ICWRS (Water Resources Systems) and ICRS (Remote Sensing) commissions and the PUB (Predictions in Ungauged Basins) working group. In total, 86 abstracts were presented during the symposium which was conducted over 3½ days (the longest IAHS event). The meeting attendance was good, with 60 to 160 people in the room (capacity 190), except towards the very end of the symposium when fewer were present. The presentations reflected well the multidisciplinary aim of the meeting which was to address uncertainties in the end-to-end prediction of hydrological variables, beginning with the atmospheric driver and ending with the hydrological calculations used for decision taking in water management. Generally, the presentations were of excellent quality and they provided the basis for many questions and discussions.

The first session on *Climate prediction and variability* was opened by Andy Pitman who evaluated model performance of a range of climate models. This led to the important conclusion that climate models predicting the best mean precipitation would not necessarily be the best suited for hydrological prediction of extreme events, and he suggested a new approach for climate model selection to reduce uncertainty in hydrological impact assessment. In the same session, the value of climate predictions for ensemble flood forecasting was further assessed, and new methods for deriving regional climate forecast information was presented. Spatial variation in rainfall intensity was also an issue, and the potential value of satellite image time series to improve understanding of weather event formations was discussed.

The second section, which focused on *Spatial meteorological data and uncertainty*, was opened by Andras Bardossy who discussed the sensitivity of rainfall–runoff modelling to spatially interpolated and simulated rainfall data at different spatial resolutions. He showed that the rainfall prediction bias of extreme events was more critical than spatial resolution and demonstrated how rainfall data could be corrected to improve the modelled discharge. Other studies examined the use of different interpolation techniques and additional data (i.e. ground-based radar and satellite remote sensing) for uncertainty reduction in areal precipitation and evapotranspiration estimation. Overall, the presentations confirmed that data availability and modelling of both spatial precipitation and extreme events remains an important challenge.

The focus of the third session was *Hydrological predictions using integrated climate–hydrological modelling*. It was opened by John Schaake (on behalf of Alan Hall, who unfortunately was prevented from participating)

who gave a useful overview of the GEWEX/IAHS organization and affiliated hydrometeorological research activities, discussing the results and experiences gained since 1988 to provide a good basis for meeting future challenges related to regional hydrological applications (contribution to HAP) and the use of new regional/global satellite data products in hydrological modelling (contribution to GEOSS). The promising perspectives of using global and regional climate models for downscaling and hydrological prediction and forecasting were presented by other speakers working in different climate zones.

The *Uncertainty in hydrological forecasting* session was also opened by John Schaake, who summarized the main climate–hydrological ensemble prediction challenges identified in the Hydrologic Ensemble Prediction Experiment (HEPEX) to handle uncertainty and provide reliable ensemble hydrological forecasts, i.e. integration of uncertainty, the use of multi-range model predictions, maintenance of spatial/temporal relationships, and the consideration of forecaster skill and model guidance. A number of new approaches to study and quantify uncertainty in hydrological modelling were also presented, which clearly highlighted the continued importance and innovative character of this research area.

Aaron Boone opened the fifth session, *Water resource predictions using spatial data and integrated land surface–atmosphere hydrological modelling*, presenting results from the African Monsoon Multidisciplinary Analysis (AMMA) where multi-sensor satellite data, field campaigns and multi-resolution modelling are being combined to represent the land surface and climate forcing in different hydrological models. Methods and impacts from using land surface representation in coupled or uncoupled atmospheric–hydrological modelling were also addressed by other speakers, and issues related to the representativeness, upscaling and model parameterization of soil properties were presented and discussed. Furthermore, a number of studies evaluated and elaborated on the capability of land surface models to predict streamflow in relation to results from hydrological models.

The final session, *Model systems for operational flood management and sustainable water management*, was opened by Mike Butts who presented the implementation of ensemble weather predictions and real-time data assimilation techniques in a flood management decision support system. The system facilitated improved short-term flood forecast accuracy and longer-lasting effects were achieved based on updating in both river and catchment models. Other studies illustrated the value of ensemble predictions, different models and calibration strategies for operational probabilistic flood forecasting. The symposium ended with the presentation of systems and methodologies for improving sustainable water resource management. In this context, Charles Vörösmarty discussed the perspectives of global Earth observation systems, and other studies were presented that discussed problems and methods to handle uncertainty and improve the management of water reservoirs.

Main Convenors: *Eva Boegh, Roskilde University, Denmark*  
*Harald Kunstmann, IMK-IFU, Germany*

The symposium papers are published in IAHS Publ. 313.

## **Water Quality and Sediment Behaviour of the Future: Predictions for the 21st Century** Symposium HS2005

*From measurements and calibration to understanding and predictions*

The occurrence of intense hail and rain just before the start of HS2005 and out of what, hitherto, had been a clear blue sky during "IAHS week" at Perugia was not an encouraging portent. However, the unexpected storm passed quickly and the sun shone for the rest of this Symposium, which provided a stimulating range of presentations.

The sessions attracted an audience which varied between 15 and 35 participants, and saw 26 of the 36 scheduled papers being presented, and these covered three main topics. Examination of sediment and nutrient behaviour in surface waters was the first of these and included papers which addressed river systems at very different scales. Jean Guyot introduced new information about sediment yields in the Peruvian part of the Amazon Basin, while Yves Trambly discussed the relationship between extreme suspended sediment concentrations and watershed characteristics in rivers of North America, and Adrian Collins presented a national assessment for England and Wales of the impact on annual mean fluvial suspended sediment concentrations of projected changes in agriculture by 2015. On a somewhat less extensive geographical canvas, Kaz Chikita showed how discharge, water chemistry and sediment load in the sub-arctic Tanana River of Alaska could be accounted for by a tank model which incorporated the effects of forest fires, while Art Horowitz explained the problems of measuring the fluxes of suspended sediment, trace elements, and nutrients for the City of Atlanta, USA. The effects of urbanization at the very specific scale of sediment removal in stormwater ponds were discussed by Kate Heal.

Sim Reaney demonstrated that as climate change takes place in the future, hydrological connectivity in catchments is likely to increase and to exacerbate the risk of pollution by fine sediment and nutrients. However, the complexities of determining exactly how water quality will respond to climate change were addressed by Doerthe Tetzlaff, who used long-term data to investigate the relative influence of climatic variability and land-use change on upland water quality in the Loch Ard catchments of Central Scotland, and by Berit Arheimer, who suggested from modelling Swedish rivers, that the impact of climate change on future phosphorus loads is likely to vary between catchments. Also concerning river nutrients, Stefan Krause, using a variety of different approaches, highlighted the importance of surface-groundwater interactions on nitrate conditions in the riparian flood plain of the Havel River, Germany; Shin-ichi Onodera reported the effect of frequent storms on nitrogen, phosphorus and silica discharge in a mountainous coastal catchment of western Japan, and Rajesh Shrestha explained how catchment-scale nitrate transport may be modelled using a combined process based and data-driven approach.

Water quality problems associated with metals and other contaminants were the focus of a second group of papers. Huaxia Yao stressed the long-term nature of

uranium contamination in Beaverlodge Lake, Canada, following mine decommissioning, while Martin Thoms revealed the complexities of the distribution of sediment-associated heavy metal concentrations in the River Murray, Australia, which is not only highly regulated but also influenced by a number of urban areas. The importance of understanding water-sediment processes for predicting environmental impacts by metal pollution of rivers in developing countries was emphasized in a case study of the historic mining district of Taxco, Mexico, by Aurora Armienta, while Alan Jones demonstrated the potential of ground-penetrating in quantifying the accumulation of metal-rich sediments in ponds treating urban diffuse pollution.

In terms of other facets of water pollution, new modelling approaches to predict biological oxygen demand (BOD<sub>5</sub>) in the primary clarifier of an activated sludge wastewater treatment plant and the occurrence of pesticides in the surface and groundwaters of the Fucino Plain, Italy, were presented by Adebayo Adeloje and Marco Petitta, respectively, while more general assessments of water quality problems were discussed for the Corumbataí River in Brazil by Daniel Bonotto, and for the Athi and Nairobi rivers in Kenya by Shadrack Kithia. A low-cost solution to the particular problem of monitoring water quality in the flood flows of flashy small rivers was advocated by Janaína Lima through the design of a siphon sampler capable of collecting samples during the falling limb of the hydrograph.

The final group of papers dealt with broader management of sediment and other water quality issues, including problems of groundwater contamination. Charles Vörösmarty highlighted the important impacts that river regulation is having on sediment supply to major coastal deltas of the world, which in many cases poses a greater threat than potential sea-level rises induced by climate change. With reference to the highly important Great Barrier Reef World Heritage Area, Brad Sherman explored the appropriate use of catchment models for water-quality target setting and land-use management, while Conceicao Alves explained the development and application of a watershed information system for water quality analyses using the example of the Townbrook watershed in New York State, USA. The vulnerability of groundwater systems to pollution and the need for careful management was highlighted by Pierre Serrat for the Roussillon flood plain in southern France, where groundwater pumping has become very excessive, and by Mitsuyo Saito for the Yellow River Delta, China, where nitrate contamination of groundwater poses a threat to the marine environment.

In addition to the oral papers, four excellent posters were presented by younger hydrologists, including studies of denitrification in a volcanic confided aquifer in the Miyakonojo Basin, Japan, by Mikami Kumiko; the sensitivity of nutrient export in the River Rhine to climate, land-use and population changes using a modelling approach by Sibren Loos; the influence of volcanic activity on the chemistry of the River Napo in Ecuador by C. Bernal, and the transport of suspended sediment in the River Congo since 1987 by A. Pandi.

*Bruce Webb, Exeter University, UK*

The symposium papers are published as IAHS Publ. 314

## **Changes in Water Resources Systems – Methodologies to Maintain Water Security and Ensure Integrated Management**

Symposium HS3006

As was confirmed during this symposium (organized by ICWRS), water management is a very broad field, both in terms of methods and thematically. We saw methodological innovations from relatively mathematics-intensive reservoir operation algorithms to improved procedures for stakeholder involvement. The themes ranged from flood management in Europe to drought mitigation on the Arabian peninsula. Most presentations stressed that increased pressure on water systems can be observed around the globe, while the local setting determines the specific solution space. The heuristic value of the different cases and possible solutions was large, but it is difficult to come to general scientific conclusions.

The overall interest in the symposium was large. A total of 116 abstracts were submitted, the largest number of all symposia and workshops. Of these abstracts, 65 were selected for the Red Book (IAHS Publ. 315), and after review, 41 articles were published. Geographically, there was a wide spread, with contributors from 14 countries in the Americas, Europe, Africa and Asia.

A relatively large number of studies addressed recent problems with water resources in China. The rapid economic development clearly puts pressure on rivers and groundwater resources, with agriculture as the largest water using sector. The water-poor North China Plains are especially affected in this respect and measures are sought to reduce system evaporation instead of the more traditional efforts to increase irrigation efficiencies. The presentations and the Red Book give a good overview of the different problems and include many new data from China.

Many of the presentations showed that the stakeholder perspective is indeed finding its way into the science of water resources management. Specifically, examples from Kenya, USA, Brazil, The Netherlands and Germany, showed how stakeholders are not mere consumers of scientific products and models but can, or should, also help set the research agenda.

*Nick van de Giesen  
Delft University of Technology, The Netherlands*

## **Remote Sensing for Environmental Monitoring and Change Detection**

Symposium HS3007

A total of 38 abstracts were accepted to this Symposium, divided into six oral sessions and a poster session covering ½ day of Tuesday 10th of July and the entire 11th of July. The Symposium was convened by Christopher Neale and Al Pietroniro, representing Manfred Owe who was unable to come to Perugia due to unexpected reasons. The session themes were Hydrology and GIS Applications, Evapotranspiration, Thermal Infrared Applications, Snow and Ice, Microwave and Radar, and Vegetation Monitoring.

The sessions progressed normally with only three no-show oral presentations. Attendance varied between 25 and 40 people. The session moderators were Christopher

Neale, Jerry Ritchie, Andrew French, Thomas Schmutge and Al Pietroniro. The oral sessions were held in a classroom of the Department of Mathematics, University of Perugia. The audio visual equipment was adequate and worked without any hitches. An operator was always present to help with loading the presentations in the appropriate order onto the laptop. The room was hot and the seats provided medium comfort.

The technical level of the sessions was good, with many state-of-the-art and relevant applications. The follow-up question and answer periods at the end of most presentations were lively, aided by the fact that most presenters kept their presentations within the allotted time; this is definitely an advantage of offering 20 minute time slots.

The International Commission on Remote Sensing met on Tuesday evening at 6:00 pm, with the meeting lasting over an hour. Unfortunately, because the poster session started at the same time and was held at a venue almost 30 minutes away on foot, by the time the committee members arrived at the poster session it was pretty much over.

*Christopher Neale, Utah State University, USA*

The HS3007 symposium papers are published in IAHS Publ. 316.

## **Isotope Tracing of Water Balance, Hydrodynamics, and Hydrological Processes**

Workshop HW1001

The session included 28 presentations (19 talks, 9 posters) and lively discussions on the role of isotope tracers in a range of investigations, including precipitation-runoff generation processes, tropical storms, lake dynamics and water balance, hydrograph separation, unsaturated zone, groundwater recharge, karst systems, geothermal systems, and regional hydrology. A range of tracer applications were presented, including use of artificial tracers, CFCs, SF<sub>6</sub>, stable isotopes of water, carbon, sulphur and nitrogen, and numerous radioisotopes including carbon-14, radon-222, chlorine-36, and tritium. One significant trend in the discipline is toward holistic integration of isotopes and other tracers within multi-faceted, multi-disciplinary water resources research programmes. Participants included representatives from countries in all inhabited continents. The success of the session and the extent to which tracers have been incorporated within presentations in other sessions, suggests that ICT serves a growing audience in the hydrological sciences.

*John Gibson, National Water Research Institute, Canada*

## **Towards Improved Evaluation of Hydrological Models: The Need to Understand and Characterize Uncertainties in the Modelling Process'**

Workshop HW2004

Our session over 2½ days (from Monday morning) was very successful, both in terms of audience size (the room was full/busting for most of the period until Wednesday morning when we had overlap with HW1002), audience



participation with good questions, as well as the quality of the scientific content (initially we had 92 abstracts). Our poster session was also busy, but inevitably we had a considerable number of gaps in the poster contributions.

We themed our session into a number of sub-themes, Monday morning and part of the afternoon focused on “Input uncertainties and ensembles”, then through until Tuesday afternoon we had “General approaches to assessing overall uncertainties”, followed by ‘Land use, internal information, scale issues and regionalization’ and finishing on Wednesday with “Water quality modelling and the use of multi-criteria methods”. Clearly there was overlap between some of the themes, but this seemed to give good continuity to the talks for each oral section.

One of our largest sub-theme sessions was the first one, perhaps reflecting the difficulties we still have in characterising reasonable input errors into our models! We had a range of talks, from those that took quite formal Bayesian approaches to error characterization by assuming some general error model (i.e. Ashish Sharma) to those who tried to quantify the possibility for errors in inputs from their own catchment data (i.e. Jerome Latron), and many variants in between. The most striking aspect of these talks for me was that the *general assumptions* of error often enshrined in the formal and/or other approaches, seemed to be out of sync with what the potential for errors (and their non-stationary characteristics) were when assessed with actual field data (e.g. Dmitri Kavetski gave *quite small* error estimates in his very interesting talk). Jerome gave the clearest example of this where he showed the variability of rainfall inputs to their 4 km<sup>2</sup> catchment (with multiple raingauges) could be up to 55% in summer periods whereas in winter this dropped to no more than 9% due to the characteristics of the storm types (convective vs frontal systems). Clearly such issues are catchment dependent, and this might be an extreme example, but it seems as scientists wishing to be realistic about our possible input errors, then the difficulties of doing this on a storm-by-storm basis are to a greater extent problematic unless some data exists at the site we are modelling. This issue of data error could also be commented on from another talk by Amengual Arnau on extreme flood events. In this case it was noticeable how the peak of the extreme flood was shown as a point as if the measurement of the discharge at this time was *true*. This level of accuracy in such data was also tackled by the audience and certainly we all need more realism in our treatment of such data and so our ability to monitor extremes of hydrology.

We also had some interesting studies that used radar rainfall data (Zhu Dehua and Guiseppa Mascaro) and techniques for downscaling coarse data (Boni Giorgio), to show the extent that this altered model predictions and parameter distributions. I think there was an important point to make from the downscaling studies where one author suggested there was a scale at which our measurements could be seen as being *reliable*; I tackled this point and I am still not clear on how we can determine scales at which we can be more or less sure of input forcing data. Also, when making assessments of input errors on models, there was an interesting thread in the talks that these are

often assessed with only one model structure. It would be interesting in the future to consider multiple structures and how the same ensemble of input realizations affects the prediction uncertainties in a grand modelling experiment (how to get this type of activity funded springs to mind!?).

Holly Hartman (our first invited speaker) kicked off the second sub-theme by reminding us all of the many possible metrics that could be used to define a *good* model, especially for certain operational purposes. This clearly gave focus to the issues of the discriminatory power of some performance measures to certain targeted applications; some of her examples were from flood risk studies and used such metrics as “false alarm rates”, etc. Bettina Schaeffli presented her recent research on assessing models in the wavelet (frequency) domain. Her research in this area suggests an evolving new way of looking at model performance which has some advantages over the typically-used Nash-Sutcliffe measures as per the example results shown. It is worth keeping an eye on this area and others where I believe the community is moving away from just applying standard performance measures to problems and thinking in more detail about the information content in data, especially when using multiple sources of data. Hoshin Gupta discussed these sort of issues in more detail, as too did Martyn Clarke in his analysis of multiple model structures using a detailed set of diagnostics regarding their predictions in time.

Finally, I feel a couple of speakers who got to grips with some of the main PUB-related science questions in their talks were Thorsten Wagener and Wouter Buytaert. Thorsten was addressing the important issue of regionalising predictions using some new regression techniques for a number of catchments in the UK, and Wouter was looking at “parameter drift” in model predictions in terms of using the knowledge of the drift for predicting land-use change.

I should point out that though I have highlighted only some presentations, which does not mean to suggest the quality throughout our oral programme was not sustained and I wish to thank all our authors for making our session a great success. Some thoughts to the future, from our session, on improving environmental model diagnostics:

1. The main point seems to me to improve our knowledge about the extent of errors in our observed data (we could also call this the information content of our data) and how non-stationary these characteristics are for different data. This should involve a combination of better practice in the field to assess the natural variability (and limitations of our monitoring approaches) of measurements (spatially and temporally) and our development of better practice in including these characterizations in our model evaluation techniques. This should mean that our use of appropriate performance measures should be improved to relate to the potential error characteristics in the observations, a practice which is generally done very poorly at present. I think Neil McIntyre gave some great examples in his talk about his recent experiments that are trying to characterise the uncertainties in observational data.

2. We need community experiments to be able to better assess our predictive capabilities and to benchmark “where we are” for different climatic and hydrological regimes. The linkages between the available models, the available data, and the uncertainty techniques used, must be better understood and this requires research that applies common models/data/techniques. I should note this was a point also raised at the PUB plenary and needs a community approach to science problems.

I would also like to highlight that this conference and special session nicely linked and had high relevance to our international IAHS-PUB (Predictions in Ungauged Basins) discussion based workshop that we (myself, Thorsten Wagener, Alberto Montanari (local organiser) and Bettina Schaeffli) held the following week at Bertinoro in Italy, over 2½ days. A collection of 28 invited delegates gathered to address a number of issues regarding uncertainty analysis and model diagnostics. The workshop was very successful and in fact we have five draft papers in preparation for a special issue of *Advances in Water Resources* as we focused the workshop on developing outputs for the science community. Our next workshop will be in 2009! A summary report of this meeting is planned for *EOS* in the near future.

Conveners: Jim Freer, Thorsten Wagener & Erwin Zehe

### **From measurements and calibration to understanding and predictions**

Workshop HW2005

Calibrated hydrological models often suffer from poor predictability due to equifinality. One important reason for this problem is that models are often merely calibrated on the output signal at the downstream end of a catchment. The availability of additional “orthogonal” information on internal state variables could constrain the solution space considerably, leading to reduced predictive uncertainty of the model. Hence there is a clear need for more information. In part this information can be provided by a denser network of discharge and groundwater observations within a catchment, but in poorly gauged catchments such information is seldom available. New observation techniques can provide crucial additional information on ungauged catchments to further constrain the modelling space. Such techniques may include: gravity observations from space to derive time series for water storage in a catchment; estimates of rainfall patterns from space at different temporal and spatial resolutions; radar altimetry to derive water levels in rivers and lakes; techniques to derive estimates of actual evaporation from remote sensing and ground observations; techniques to derive soil moisture estimates from remote sensing; isotope diagnostics; combination of atmospheric and hydrological modelling, etc. This session invited contributions on new measurement approaches and on calibration techniques to reduce predictive uncertainty of hydrological models, with a focus on poorly gauged catchments (PUB). It was organized by PUB and ICWRS.

In view of the workshop character of the session, special time was allocated to discussion, but 24 oral presentations and 15 posters were included. The session was very well attended, and the discussion was lively. Presentations concentrated on new technologies and new data sources for PUB, such as: laser altimetry; coupling with atmospheric models; use of geodetic information due to water loading; constraining groundwater models with lake level observations; observations of soil moisture from space; determination of evaporation from space; the use of spectral properties to constrain models; the importance of data, and the utility of snapshot observations; transfer of calibration results to other basins. Attention was given to finding orthogonal, often “soft” information to constrain models. The workshop also discussed modelling techniques: the advantages and disadvantages of distributed modelling and when distributed modelling is needed; and the need to shift the attention from optimality to consistency.

The poster session was well attended. The workshop participants went together to the poster session and formed a poster train to jointly hear poster presentations and pose questions to the presenters. This led to a very dynamic and active poster session, which was well appreciated by both the presenters and attendees. A special issue as a result of this session will be produced.

Convenor, Hubert Savenije

Co-convenors: Witold Krajewski, John Gibson & Mary Hill

### **New Avenues for Contemporary Water Resources Management**

Workshop HW2006

Contributions to this workshop, which was sponsored by ICWRS, addressed the complexity of water resources management problems, as well as the potential of system analytic tools to provide or support solutions. It provided a broad and encouraging overview about the challenging field of integrated water resources management.

Berit Arheimer demonstrated the role of integrated watershed modelling within a participatory management process. Desmond Manful presented the Numerical Modelling Policy Interface Network, which is a contribution to overcome the gap between the requirements of complex planning and the need for participatory decision making. Asish Sharma and André Musy gave presentations related to different aspects of climate change impact assessment under uncertainty. Alon Rimmer developed a system dynamics simulation tool to evaluate and predict lake salinization processes. Christos Makropoulos demonstrated the embedding of a neural network based integrated urban wastewater system into a catchment model. Juan Valdés introduced a Drought Frequency Index for hierarchical optimization of a multi-reservoir system. Hyun Suk Shin presented results of the application of a catchment model for Korean Total Maximum Daily Load management. Advances in water related data availability through web applications were shown by Neno Kukuric and Charles Vorosmarty. Radu Drobot presented an integrated water quality management system that is based on a comprehensive object-oriented GIS model.

Various applications of system analysis tools were presented. System analysis tools can build a bridge between information technology and water resources management. The results demonstrate the continuing evolution of information technology and the related development of new water management tools. Recently, efforts of cross-linking between data and web-services have been achieved at both local and global scales to increase the availability of policy-relevant data to various stakeholders. The complexity of the water resources domain and the changing role of users within the transition towards integrated water resources management will be a challenge for further interdisciplinary work.

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### **The Impact of Environmental Change on Sediment Sources and Sediment Delivery** Workshop HW3007

This two-day workshop convened by Des Walling (UK), Jim Bogen (Norway) and Paolo Porto (Italy) proved a very successful component of the IAHS Assembly at Perugia. It provided a focus for participants from ICCE, as well as proving of interest to other members of IAHS. It was attended by about 50 people and the programme included the presentation of 23 oral papers and 10 posters. The contributions were truly international, and included papers and posters based on work in Canada, USA, Brazil, Ecuador, China, Japan, Korea, Russia, Australia and New Zealand, as well as many countries in Europe.

The aim of the workshop was to provide a forum for presentation and discussion of recent work on the impact of environmental change on catchment sediment dynamics, and it succeeded in highlighting both new findings from different areas of the world, and the development of new approaches and techniques for investigating this important issue. The latter included both modelling strategies and novel sediment tracing and dating techniques. Contributions addressed a range of scales, varying from an assessment of recent changes in the sediment loads of the world's rivers to the results of detailed catchment investigations, and focused on different aspects of the sediment budget, including sediment sources, sediment delivery, depositional sinks and sediment yields. Most papers were concerned with the recent past, but some considered changes over much longer periods, highlighting the need to recognise the inherent variability of natural systems when assessing change in those systems. Although the emphasis was expectedly on changes in the magnitude of the sediment fluxes involved, the important themes of changing sediment quality and the impact of changing sediment fluxes on river ecology and habitats were also addressed.

Although several of the contributions highlighted the impact and potential impact of climate change on catchment sediment dynamics, most emphasised the overriding importance of human impact as a driver of change. For example, a paper from New Zealand graphically demonstrated the major increases in erosional

activity that occurred after the arrival of European settlers and the potential role of reforestation in reversing those changes. One interesting paper from China showed that the very high rates of soil loss associated with the loess region are not a recent phenomenon, but were equally high 450 years ago, and that human impact therefore has a long history. Much recent work on global change has understandably focused on climate change, but it is important that other facets of environmental change related to human occupation and exploitation of the Earth's surface should also be considered, particularly in the context of changing sediment dynamics.

Des Walling, University of Exeter, UK

### **Loss of Knowledge** Workshop HW 3009

This Workshop was organized as a co-operative venture between IAHS and WMO and was planned very much as a workshop in the sense that comparatively few papers were accepted, each author being given 30 minutes for presentation, and the last third of the session was devoted to a general discussion with the aim of summarizing the problems reported and seeking for solutions.

The last day, and particularly the last afternoon of an Assembly, is not the most auspicious time for a meeting. We were therefore pleased that 20 to 30 participants attended and that two or three leading members of the hydrological community joined us for the discussions, even though they did not present papers themselves. One, perhaps erroneous, conclusion is that it is good to convene sessions on the 13th of the month if they fall on a Friday.

The seven papers presented reported on a wide range of causes for the loss of hydrological knowledge. The authors came from six countries and four continents. Their presentations helped to stimulate the lively debate that brought to light the following facts:

- Stations are closed because of a lack of funding or simply a lack of fuel for transport.
- Even when the problems faced because of a lack of data are clearly recognized, those who hold the purse strings still cut funding for data collection, storage and interpretation.
- A lack of accurate data has often led to legally binding agreements being made, e.g. for sharing a water resource, which are impossible to implement.
- Politicians have little interest in the matter because benefits from the collection of data only accrue after many years, i.e. well beyond the next parliamentary elections.
- Data collected at regional and national level are not interpreted for use at local/village level.
- Past records are lost because they are on paper and rot or are eaten by rats – or even used as wrapping paper in the local market – one reason being that those in charge of their storage are not trained and do not appreciate the value of what they are storing.
- On the other hand, computers and CDs may be stolen or destroyed in time of war, whereas paper records may go untouched because they have no street value.
- New methods of collecting information on freshwater resources, in particular those based on remote sensing,



can appear so attractive to those who do not have a sound understanding of the subject that old traditional methods are abandoned in favour of the new, without consideration of the errors and uncertainty thereby being introduced.

- In developed countries, technical education is being scaled down in favour of degree courses and so few, if any, young people are being trained as hydrological technicians.
- In some developing countries, more children now go to school but they then leave the village to work in the neighbouring town and fathers and mothers no longer have the opportunity to pass on to their sons and daughters the old wisdom of the ages.
- Many Hydrological Services have neither the resources to train staff nor the salaries that would retain them once trained.

The major conclusion was that the basic cause of the loss of knowledge is a lack of appreciation by those in higher authority, above all within the relevant Ministries, of the importance of maintaining long-term programmes for the collection of hydrological data and information and for their safe storage. Consideration of the present situation led to the following comments:

- Efforts must continue to change government policy, possibly by convincing politicians that their projects will fail if the design data are inadequate.
- For this purpose, it is important to identify what design and operational data are needed for each facet of the project, including hydrological, technical, social and economic data.
- From this, an assessment can be made of the uncertainty and likely operational risks resulting from the data shortage.
- This can lead to evaluation of additional project costs that need to be incurred to overcome the data shortage.

Proposals for action, some old and some new, were put forward including:

- A set percentage of the cost of any water project could be given to the Hydrological Service which supplies the information used to design the project. This would not immediately provide the data required by the project in question but, over the years, it would ensure that the Service concerned was well enough funded to provide the data and information required for all future projects.
- Volunteer gauge readers should be given the public recognition that they deserve for their vital role in assessing and monitoring freshwater bodies.
- There should be greater interaction between Hydrological Services and the users of hydrological data and information because it is the users who benefit from this information
- Water supply authorities, hydropower companies and other organizations which sell water-related services could be obliged to pay for the collection of data and information that are needed to support their activities.
- An effort might be made to synthesize the material that is available on estimating the value of hydrological data and information. This synthesis could then be made available to Hydrological Services as an aid to their efforts to increase national funding for such work.

The results of IAHS's PUB initiative would complement this and could be distributed as associated material. Professional economists and statisticians should be invited to participate in this work.

One proposal of interest was for formal legislation to be introduced that would oblige all those who develop plans for water resource or flood control projects to include therein a quantitative estimate of the uncertainty in any of the design figures presented. This would be required in preliminary plans, detailed designs and in operational plans. Consultants who do not comply with this requirement would be excluded from bidding for future projects. The result would be that those who accept to fund and implement such plans would do so in the face of a clear statement as to uncertainty, and would feel obliged to adopt more conservative options with higher costs or lower productivity so as to reduce that uncertainty to levels which the public will accept. This would be a great step forward for project design in general but, in particular, it would demonstrate publicly the price that is being paid for giving so little support to acquiring and retaining hydrological knowledge. The hope is this would lead to more resources being channelled to data collection and storage and the training of technicians and professionals.

*Arthur Askew, IAHS President*

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### ***Interactions between snow, vegetation and the atmosphere*** Workshop JHW001

UCCS Symposium hosted by IAHS in collaboration with ICSIH, IAMAS-ICPM, iLEAPS and IGS

Vegetation influences snow distribution by trapping falling and wind-blown snow, and exposed vegetation canopies alter the radiative and turbulent energy fluxes to underlying snow and the atmosphere. Snow insulates the ground and releases water and nutrients on melt, in turn influencing distributions of vegetation. Snow and vegetation distributions both respond to, and feedback on, changing climates. For this symposium, submissions were invited on observational and modelling studies of ecological, hydrological, meteorological and interdisciplinary aspects of interactions between snow, vegetation and the atmosphere. There was a good response to this call, with 43 abstracts being submitted. There was time for 18 full oral presentations, and four of the poster presenters took the opportunity to give short poster introductions during the oral session. Attendance varied during the day, according to the draw of parallel snow sessions, but the room was generally close to capacity (~80), with some people standing.

Most of the presentations dealt with snow in forests, reflecting considerable interest in this topic for both hydrological and meteorological applications, the increasing ability of models to represent forest snow processes and the increasing availability of observations for model development and evaluation. There were also two presentations on discriminating between rain and snow in records of total precipitation, which remains a considerable uncertainty for model input. Considering

recent interest in interactions between physical climate processes and changing arctic vegetation, the only disappointment was that there were no abstracts submitted on shrub–snow interactions or ecological studies.

With a good number of researchers with observational and modelling interests coming together, we took this opportunity to give the first public announcement of results from phase 2 of the Snow Model Intercomparison Project (SnowMIP2), which is run as a UCCS working

group and deals with simulations of forest snow processes. A lively discussion on SnowMIP2 was held as part of the workshop.

We thank IAHS and Pierre Hubert for support in organizing the symposium.

*Convenor: Richard Essery, University of Wales (Aberystwyth), UK  
Co-convenors: Robert Baxter, John Pomeroy  
Takeshi Yamazaki, Matthew Sturm*

## ***Distributed versus Lumped Modellers' frisbee match tied*** continued from p. 1

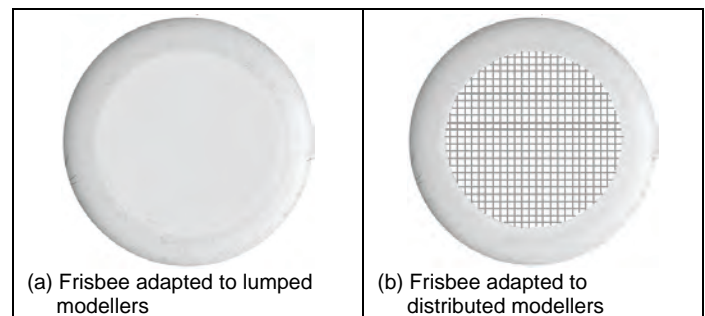
Unfortunately, finding a flat sports field adequate for playing frisbee was definitely difficult in Perugia, and the game had to be postponed until the IAHS banquet. There, on grassy lawns, the dispute was to be settled. There was only one real problem: darkness. Indeed, we arrived at sunset. The two teams agreed, however, to hold the game:

- On one side, the *Distributed* believed that the physically-based origin of their mental model would give them a better capacity of extrapolation (thus allowing them to win the game even in the dark);
- On the other side, the *Lumped* were sure that the greater robustness of their model, its capacity to function in real time and to update would easily be a definitive advantage in the dark.

We must acknowledge that none of the teams could confirm its starting hypothesis, and when darkness eventually prevented team mates from recognizing each other (not to mention catching the frisbee) the score was tied (1–1) and the game had to be stopped.

It was decided that both teams would practice separately for the next two years, and that a game would be arranged in Hyderabad in 2009 (in daylight). Thus, we invite all hydrologists to prepare themselves, using exclusively one of the two models described in Figure 1.

*V. Andréassian, B. Augeard, L. Berthet, M. Bourqui,  
W. Buytaert, T. Gräff, D. Kavetski, S. Krause, N. Le Moine,  
J. Lerat, T. Mathevet, L. Oudin, C. Perrin, A. Valéry & J. Wienhöfer*



**Fig. 1** Official IAHS frisbees to be used in Hyderabad-2009.

## ***IAHS Press at IUGG in Perugia***

For the first time since the IAHS Assembly at Maastricht in 2001, all the IAHS Press staff attended an IAHS event. We much enjoyed meeting the faces behind the new emails and were delighted by the friendliness of all – indeed Penny and Jill were very taken by their “fame”. And, it was very useful to catch up with other colleagues.

The IAHS Press stand was always busy. This was partially due to the T-shirts promoting the 2009 IAHS assembly in Hyderabad (provided by the LOC in India), that we had to give away, but we hope that if you did not also order some books there, you have since studied the flyers you took and contacted Jill to place an order.

The IAHS banquet was sumptuous, and held in the garden of the hilltop villa that is the new base of the World Water Assessment Programme (WWAP). As is traditional, various singing talents were demonstrated, and a recent innovation, dancing, much to everyone’s amusement.

We can report that many hydrologists took advantage of the “other” event taking place in Perugia, the Umbria Jazz Festival, which, even if it did cause accommodation problems for some (many hotels were booked up), was

excellent. We did not have much opportunity to explore Perugia itself, but would like to go back to do so, and recommend it to others.

*Cate, Frances, Jill & Penny*



*Jill and Penny with Dr Ikhile, Odunuga Shakirudeen (back) and Dr Adeaga, participants from Nigeria.*

## The five Red Books pre-published for Perugia

Please send book orders and enquiries to:

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IAHS Press, Centre for Ecology and Hydrology  
Wallingford, Oxfordshire OX10 8BB, UK

[jilly@iahs.demon.co.uk](mailto:jilly@iahs.demon.co.uk)  
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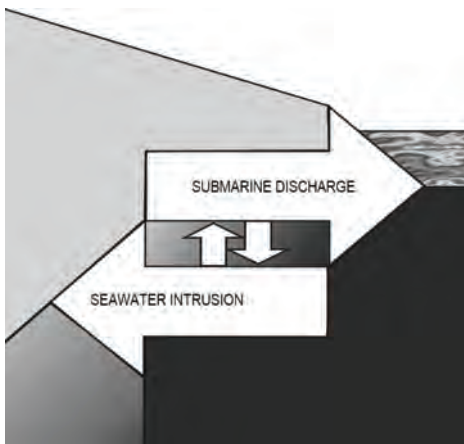
IAHS Members may obtain a discount on books bought for their personal use and should ask for it when placing an order.

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### A New Focus on Groundwater–Seawater Interactions

edited by Ward Sanford, Christian Langevin, Maurizio Polemio & Pavel Povinec

Publ. 312 (2007) ISBN 978-1-901502-04-6; 344 + x pp. Full price £64.00, IAHS Members' price £48.00



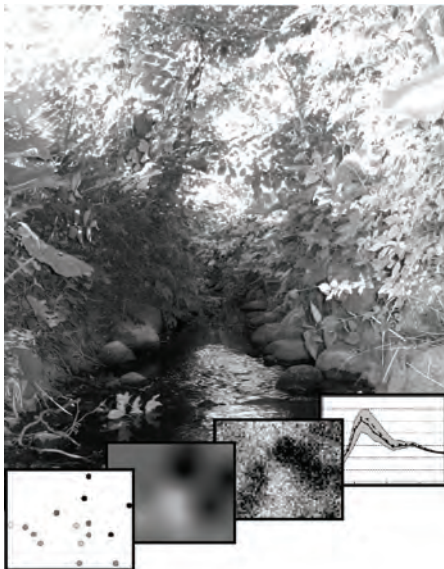
Water and chemical fluxes across the sea floor provide an important linkage between terrestrial and marine environments. Oceanographers recognize that these fluxes may act as a source of nutrients or harmful contaminants to marine systems. They may also act as a beneficial source of freshwater for coastal estuaries that require relatively low salinities. Hydrologists and hydrogeologists recognize that fluxes across the sea floor comprise an important part of the water balance for coastal aquifers. Most fresh groundwater discharge to the ocean is derived from terrestrial aquifer recharge. However, excessive groundwater withdrawals from coastal aquifers can cause saltwater intrusion by intercepting the seaward flux. Quantitative estimates of fresh groundwater discharge toward the coast can provide a basis for determining safe withdrawal rates.

The papers in this volume, an outcome of the symposium organised jointly by the IAHS International Commission on Groundwater and the International Association for the Physical Sciences of the Oceans, IAPSO, in 2007, present research by those working from the marine and terrestrial sides of the issues. Together, they form an important contribution to the literature.

### Quantification and Reduction of Predictive Uncertainty for Sustainable Water Resources Management

edited by Eva Boegh, Harald Kunstmann, Thorsten Wagener, Alan Hall, Luis Bastidas, Stewart Franks, Hoshin Gupta, Dan Rosbjerg & John Schaake

Publ. 313 (2007) ISBN 978-1-90150278-09-1; 508 + iv pp. Full price £87.00, IAHS Members' price £65.25



The atmosphere is the primary driving force for all hydrological processes, yet the availability of spatially and temporally reliable hydrometeorological information remains a critical issue in many hydrological studies. The problem is made more urgent by the suggestion that a warmer climate will lead to an intensification of the hydrological cycle, and to an increase in the frequency of extreme events. In order to accurately represent and understand the impact of climate dynamics on the development of freshwater resources, water management tools that account for the coupled land-atmosphere system are needed. The derivation of spatially and temporally representative hydrometeorological data and their accurate representation in water management tools is important to predict current and future developments in freshwater resources, and the influence of changing climate and land surface patterns due to intensified human activities.

The contributions consider the uncertainties in the end-to-end prediction of hydrological variables, beginning with the atmospheric driving, and ending with the hydrological calculations for scientifically-sound decisions in sustainable water management. The book is organized in two parts; the first addresses the *Quantification and reduction of predictive uncertainty in hydrometeorological forcing*, and the second includes studies aiming at *Minimizing risks in water management decisions by improving the understanding and spatial representation of the coupled land-atmosphere system*



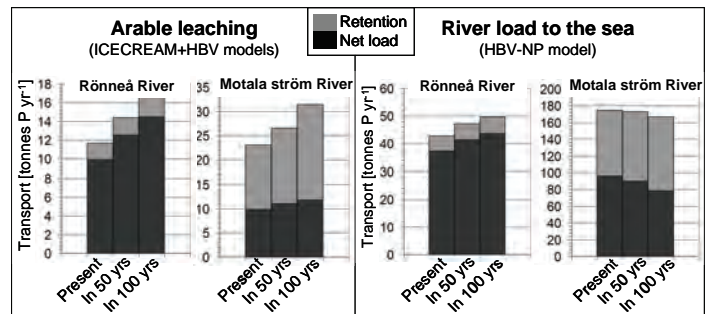
## Water Quality and Sediment Behaviour of the Future: Predictions for the 21st Century

edited by Bruce W. Webb & Dirk De Boer

**Publ. 314** (2007) ISBN 978-1-901502-14-5; 322 + x pp. Full price £62.00, IAHS Members' price £46.50

This volume is an outcome of the symposium organized by the IAHS International Commissions on Water Quality (ICWQ), Continental Erosion (ICCE), and Groundwater (ICGW), and the Predictions in Ungauged Basins (PUB)

Working Group, with the objective of bringing together experts to provide a state-of-the-art review of our current understanding of how water quality and sediment behaviour might alter as a result of future climate and land-use change. The aim was to examine, for both surface water and groundwater systems, not only the nature and controls of future changes in water quality and sediment behaviour, but also what the implications of these will be for human use of water and for freshwater ecosystems, and how well our science is equipped to predict the future in this regard. Thirty-six reviewed papers were accepted for publication. They are grouped in three sections in this volume: Sediment and Nutrient Behaviour in Surface Waters; Metals and Other Water Quality Problems; and Management Issues.



## Changes in Water Resources Systems:

### *Methodologies to Maintain Water Security and Ensure Integrated Management*

edited by Nick van de Giesen, Xia Jun, Dan Rosbjerg & Yoshihiro Fukushima

**Publ. 315** (2007) ISBN 978-1-901502-19-0; 330 + viii pp. Full price £62.00, IAHS Members' price £46.50



As a guiding principle, integrated water resources management (IWRM) is now well established. In the policy arena, IWRM is more or less taken as a given, and is continuously enriched with new concepts, such as adaptation and transition management. The scientific basis for IWRM, however, has not yet fully crystallized. As this book shows, IWRM is, for an important part, a set of practices and, consequently, case studies play an important part in the scientific literature. This volume specifically addresses change in water resources systems. The continuously changing pressures on our water resources are diverse: the pressure to produce food and provide household water is of extreme importance in Africa; in Asia, the rapidly emerging economies of China and India show that the need for water of sufficient quality is becoming a development constraint; and in Europe, North America, Australia and Japan, water resources have for a long time been recognized as essential for social well-being, and this recognition is now expressed in institutional changes, such as the European Water Framework. In addition, investment decisions everywhere are made against the background of increasing uncertainty due to ubiquitous changes, such as climate change, economic globalization, and land-use intensification. This diverse set of challenges is met with an equally diverse set of solutions and approaches. This volume provides a good sample of the many of issues that are dealt with in the context of IWRM.

## Remote Sensing for Environmental Monitoring and Change Detection

edited by Manfred Owe & Christopher Neale

**Publ. 316** (2007) ISBN 978-1-901502-24-4; 288 + viii pp. Full price £55.00, IAHS Members' price £41.25



Remote sensing technology has evolved into an integral research tool for the natural sciences. Disciplines such as climatology, hydrology, and studies of the terrestrial biosphere have all developed a strong remote sensing analysis component. Moreover, remote sensing has facilitated our understanding of the environment and its many processes over a broad range of spatial and temporal scales. This is an important part of hydrological research, especially in water resources management, environmental monitoring and prediction, and the detection of environmental change. This publication is a compilation of papers that were presented at the symposium on Remote Sensing for Environmental Monitoring and Change Detection organised by the IAHS International Commission on Remote Sensing. The 30 contributions cover approaches using the thermal infrared, microwave and radar; studies monitoring vegetation, snow and ice, and evapotranspiration; and the combination of remote sensing techniques and GIS for hydrological applications.

## Global Scientific Challenges: Perspectives from Young Scientists

One of the events organized to celebrate the 75th birthday of the International Council for Science (ICSU) was a two-day (4–6 April 2007) conference for young scientists to discuss topics of interest to all scientists. The conference was held appropriately in Lindau, a small German medieval town on the shores of Lake Constanz, which is renowned for hosting annual meetings in which young scientists interact with Nobel Laureates. The 142 participants at this conference from 71 countries were nominated by ICSU National Members, International Scientific Unions and Interdisciplinary Bodies. I was one of three participants nominated and kindly sponsored by IUGG (alongside Dr Laura Sánchez, Deutsches Geodätisches Forschungsinstitut Munich, Germany, and Dr Thomas Mölg (Climate Research, University of Innsbruck, Austria).

Many of the participants, myself included, were rather apprehensive as we arrived for the conference opening ceremony and reception, as this was totally unlike any event we had attended before. Scientific disciplines represented at the conference ranged from astronomy to zoology, and from history of science to human geography, so what could we discuss with each other: what ground did we have in common? However, our fears rapidly disappeared due to the informal environment created by the conference organisers and we soon became used to talking to a nanotechnology specialist at breakfast, a medical researcher at lunch, and a social scientist at dinner. Senior scientists and ICSU administrators did participate in the conference but their contributions were generally discreet and limited and this created a very open, non-judgemental atmosphere in which everyone felt he or she could contribute freely.

The conference agenda addressed themes of interest and relevance to all scientists: international and trans-disciplinary co-operation, public engagement, science for policy, working with the private sector, and scientific freedom and responsibilities. Most themes were addressed in the traditional fashion by the conference as a whole through a series of short presentations followed by questions and comments from the audience. The first theme was addressed through smaller parallel workshops to which many delegates contributed and which were, for many, the highlight of the conference. At one of these workshops I gave a joint presentation with Laura Sánchez entitled *Trans-disciplinary collaboration: a perspective from the Geosciences*. From my experience as one of the members of the IAHS Hydrology 2020 Group\*, I outlined some perspectives on the need for, and barriers to, collaboration, and ways of overcoming these and Laura presented an example of trans-disciplinary collaboration in the form of the Global Geodetic Observing System (GGOS).



Overall the conference was an empowering and humbling experience, giving participants an opportunity to step outside the narrow day-to-day confines of their disciplines. It re-invigorated my interest in science and reinforced the messages that scientists can make a difference and that we have a duty to communicate our science. I was deeply impressed by the truly international nature of the conference, the excellent content and delivery of the presentations, and by the amazing science that is conducted in difficult conditions in less economically developed countries (LEDCs). Although there were no formal outcomes of the conference, there were numerous “softer” outcomes. As a result of the conference, each participant now has an address-book of worldwide contacts and will probably approach their daily scientific work in a slightly different way. For me it highlighted the importance for the development of early career scientists of working in different countries and interacting with different groups, and I resolved to be more supportive to future requests to work with my group.

So what messages are there for IUGG (and IAHS)? A number of relevant themes were noted in the closing plenary session including: increasing the great potential of scientists in LEDCs (e.g. by encouraging exchanges and conference participation, and campaigning to increase open access to resources); the importance of science communication (e.g. using the Millennium Development Goals to frame the relevance of science); removing some of the institutional barriers to transdisciplinarity (e.g. developing indicators of transdisciplinarity). From the conference my impression is that geoscience, the essence of IUGG, has a healthy scientific future as it is well-positioned for trans-disciplinary collaboration and funding.

For further information about ICSU and the conference see: [www.icsu.org/10\\_icsu75/75anniv\\_young.html](http://www.icsu.org/10_icsu75/75anniv_young.html)

Kate Heal, School of GeoSciences, The University of Edinburgh, UK. [k.heal@ed.ac.uk](mailto:k.heal@ed.ac.uk)

\*See Chapter 6 in *Hydrology 2020: An Integrating Science to Meet World Water Challenges* ed. by Oki, T., Valeo, C. & Heal, K. V. (2006) IAHS Publ. 300. 190 pp. ISBN 9781901502336

### Hydrological Sciences Journal

Volumes 1–47 (1956–2002) are now freely available online and open-access at [www.iahs.info](http://www.iahs.info) for everyone to view. Click [Publications](#) and then [Journal](#) to get to these volumes.

Funding for completion of the project to make all the HSJ backfile available online was provided by UNESCO Division of Water Sciences

## Young/Early Career Scientists Event at IUGG Perugia

This event aimed to discuss what IUGG can do to ensure that the future geoscience research community is strong, robust, and well prepared to tackle important questions. It comprised a panel discussion chaired by Kate Heal. Three panelists\* gave their outlook on several topics relevant to the geoscience research community, which were then discussed in an open forum.

### Topic 1: How can the best minds be attracted to geosciences?

The panelists and audience identified several factors that may hinder engagement of the best minds in the geoscience research, including: limited exposure to geosciences in primary and secondary education, lack of suitable role models, lack of awareness of the societal relevance of geosciences, and higher salaries in industry. Whilst there was general agreement that geoscientists should take every opportunity to raise awareness of the value and interest of geosciences, a teacher representing IRIS (Incorporated Research Institutions for Seismology) suggested that existing conferences should include sessions to support educators and the dissemination of geoscience teaching tools.

### Topic 2: What is the best preparation for interdisciplinary research?

Strong arguments were made for first becoming an expert in one area, but developing flexibility and awareness for interdisciplinary group work as auxiliary skills. A good grounding in mathematics was considered important to

assist communication between different scientific disciplines, but it is probably also important that mathematics is taught within an applied context so that its relevance is clear. The benefits of studying abroad were noted. Symposia focusing on big topics, such as climate change, that can only be addressed by multiple disciplines could also foster interdisciplinary research.

### Topic 3: What can IUGG and young scientists do for each other?

Initially this question appeared to be a call to involve younger researchers to ensure the ongoing operation of IUGG, however, passionate comments from IUGG President Uri Shamir made it clear that the needs are of a much broader nature. Many of the senior scientists present clearly cared very strongly for the geoscience community and in fostering the careers of individual members for the good of the individual and collective. This is perhaps not self-evident to younger members of the research community. An important first step for interactions between IUGG (and other geo-organizations) and young scientists is to have more engagement from younger researchers themselves, but from the low turnout of this group at this meeting (only 20% of the audience of about thirty people), this is a challenge itself.

A number of actions were suggested to increase the engagement of younger researchers within IUGG. Rebranding "young" scientists as "early career" scientists and encouraging them to be convenors in collaboration with more experienced colleagues might increase interaction. Particular attention should be paid to engaging with early career researchers from less-economically developed countries, e.g. through travel grants and campaigning for free access to information and internet resources. Finally, events that are perceived as of direct utility by early career researchers, e.g. relating to career development, peer-networking, and mentoring from senior scientists, could be included at existing conferences.

*Alan Jones and Kate Heal, both The University of Edinburgh, UK  
Daniel Pringle, University of Fairbanks Alaska, USA*

\* Panelists: Masaki Hayashi (Associate Professor, Department of Geoscience, University of Calgary, Canada), Kalachand Sain (Group Leader, National Geophysical Research Institute, Hyderabad, India) and Simona Stefanescu (Senior Scientist and PhD student, National Meteorological Administration, Bucharest, Romania).



Panel discussion during the Young Scientists Event  
(Photo: Tom Beer)

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Contact details for all the IAHS National Representatives and Correspondents are available at [www.iahs.info](http://www.iahs.info)





## Henry Darcy Medal awarded to Lars Gottschalk by EGU

The European Geosciences Union recently awarded its prestigious Henry Darcy Medal to Professor Lars Gottschalk. Since I have had a privilege of knowing Lars quite well since the early 1980s, when we collaborated in the IAHS Hydrology 2000 Working Group, I gladly accepted an invitation to deliver a *laudatio* at this ceremony.

Born and raised in Skåne (Sweden), Lars studied at Lund University, but decided to extend his studies in Moscow. For a Swede to go to the USSR in the 1970s was neither usual nor easy. The iron curtain did exist and attempts to cross it raised suspicions on both sides. But the risk turned out to be worth taking. Lars got acquainted with the Soviet stochastic hydrology, which was virtually unknown in the West. He mastered the difficult Russian language, indeed very remote from Swedish and English. But what was most important, he met a beautiful young lady, Irina, who became his life-time companion – wife and collaborator.

Lars received his PhD degree from Lund. Since the early 1980s he has been Professor of Hydrology at the University of Oslo, and since the mid 1990s, a part-time scientific collaborator at CEMAGREF, France (in Lyon and Antony). His long-term French connections rhyme with the nationality of the patron of the medal, who studied wells in Dijon and developed the well-known Darcy Law.

For over three decades, Lars has made valuable contributions to the development of hydrological sciences, and in particular to stochastic hydrology. A long list of his scientific interests contains, among others: hydrological applications of the theory of probability and stochastic processes; analysis of spatial-temporal hydrological fields; regionalization; gridding runoff data; applications of EOF; runoff regimes; physically-based stochastic models; and data assimilation.

Being a citizen of Sweden and professor in Norway, Lars has operated in wealthy, well-developed, and well-organized countries. Yet, he has been aware that being a part of wealthy Scandinavia is – in mathematical terms – an initial and boundary condition. Recognizing the difficulties of hydrological research in less endowed countries,

he has entered into intensive, and mutually beneficial, collaboration with hydrologists in Egypt, Mali, Poland, Russia, and India, and for several years now – with Central America, and Costa Rica in particular.

A few months ago, at a large UNESCO FRIEND conference in Havana, Cuba, I was really pleased to see Lars, Irina, and their collaborators from Costa Rica and France, and Lars's former students from Norway, backing many valuable contributions. Their work was very visible and attracted considerable interest at this large event.

Lars has provided international leadership in hydrological sciences. He has served as a long-term secretary of ICWRS, and vice-president of IAHS. He co-led the large, international NOPEX experiment (in the GEWEX family of projects). He has supervised many doctoral theses. Some of his students have achieved considerable success, such as, for instance the Tison Award of IAHS.

Lars has chased neither money nor distinctions. Having achieved a lot, he remains a modest man and he may be a bit embarrassed finding himself in the spotlight. He has been driven by curiosity to know more, to understand better. He has cherished and supported the scientific interests of his family. Not only Lars, but also his wife Irina and their son Michael, have doctoral degrees; achieving 100% PhD coverage in the family.

I wonder what short list of terms could describe Lars. Perhaps seeking (and finding) harmony in life and work. Perhaps consequence, persistence, long-term dedication, stability, and confidence.

The name Lars (Laurentius) comes from a Latin term – laurel, denoting a distinction of no monetary value but of much symbolic meaning, given to a winner of an ancient poetry contest or a sport competition at Olympia. I am very pleased that I can witness the bestowing of a well-deserved, contemporary laurel – the Darcy Medal – upon a great scientist, and my friend, Professor Lars Gottschalk.

Zbigniew W. Kundzewicz, Polish Academy of Sciences,  
Poznań, Poland, and  
PIK, Potsdam, Germany

### **Water and Urban Development Paradigms: Towards an Integration of Engineering, Design and Management**

*International Conference — 15 to 19 September 2008 — Leuven, Belgium*

Organizers: Katholieke Universiteit Leuven, Free University Brussels, (Belgium) and the European Joint Research Centre, Ispra (VA, Italy)

This international conference intends to bridge the gap between the disciplines of water management, ecology and the approaches of engineering, urban design and spatial planning. Sessions will develop a series of themes, discussing the historical relationship between water systems and human settlements, and related management problems regarding urban floods, water use and water sanitation. In each session, presentations are invited on problem definition, technical and design-based solutions, but also on boundary conditions of exogenous, political or economical nature. It is hoped that this interdisciplinary information exchange and communication will lead to discussion and will contribute to a better

integration of approaches currently considered in the separate disciplines of water management, water engineering, spatial urban planning and design and aquatic ecology. Also aspects of meteorological, demographic, political, economical, and educational and life-style related nature will be considered in the analysis of solutions to current and emerging urban water problems. This, in the longer term, might lead to new paradigms in managing water in the urban environment.

Full information at: <http://www.urbanwaterconference.be>

Email: [contact@urbanwaterconference.be](mailto:contact@urbanwaterconference.be)

# Sediment Dynamics in Changing Environments

International Symposium — 1 to 5 December 2008 — Christchurch, New Zealand

*"Change cannot be avoided. Change provides the opportunity for innovation. It gives you the chance to demonstrate your creativity."* Keshavan Nair

Mankind is facing changes of unknown magnitude and speed in the 21st century. We are just beginning to grasp the magnitude of our impact on the environment and the related risks for our societies – and the whole globe.

This century will be a century of changes – of changing environments. We have a choice to partly control these changes by our present actions, and to estimate and prepare for/adapt to these global changes. As more scientific evidence accumulates about the magnitude and speed of past environmental changes from sedimentary histories and sediment archives we can learn to manage present and future changes. This century must be a century of concerted research and actions in order to control and adapt to environmental, economical and social changes – involving scientists from all disciplines – in particular water-related and Earth surface processes sciences.

On behalf of the International Commission on Continental Erosion (ICCE) we would like to invite you to Christchurch in December 2008 to share your knowledge of *Sediment Dynamics in Changing Environments*.

## Scientific Programme

To understand sedimentary systems in changing environments, we need to advance our knowledge of sedimentary processes and systems and in particular of scaling issues in sedimentary systems. This knowledge, derived from historical information and analysis, and system analysis and modelling should enhance our ability to assess impacts of Global Change on erosional systems. Finally we need to find ways to link our understanding and our models of sedimentary systems with impacts on human environments – including improvement of management options, hazard and risk assessment, and feedback into policy frameworks. The Scientific Programme will be organised around four themes.

### 1. Scaling issues in sedimentary systems – from point to continents

We invite papers tackling problems of understanding and scaling erosion, transport, and deposition processes within sedimentary systems, including:

- Transfer of local process understanding to larger scale systems
- Global changes and their local effects
- Coupling and decoupling of erosional processes on different scales
- Complex system behaviour and changes in system states
- Temporal scales in sedimentary systems – extreme events vs long-term changes

### 2. Dating and source tracing technologies.

This session will explore the utility of dating sediment sinks such as flood plain profiles, lake, and coastal-shelf sequences to reconstruct long-term catchment erosion and sediment yield histories. Also studies on source tracing/fingerprinting for understanding catchment sediment generation and dispersal are invited.

### 3. Global Change and erosion.

Papers are invited on the effects of climate and land-use changes on erosion and sedimentation processes, including:

- Global erosion as affected by climate change

- Relative importance of land-use and climate change for sedimentary systems
- Sensitivity of sedimentary systems in different environments
- Erosion and the carbon cycle

### 4. Linking Erosion with environmental and societal impacts: Sediment production, River regulations, Depositional environments, Hazards & Risks, Management & Policy

Political and environmental management agendas often move in advance of the science base. It is critical to improve linkages between science outcomes and decision making on various levels. We invite papers on linking sedimentary systems with socioeconomic systems, including

- Sediment production and its impacts on societies
- Sedimentary systems and catchment management
- Sedimentary systems and environmental hazards and risks
- Erosion and risk mitigation
- Developing tools to meet policy targets in areas such as erosion, transfer of sediment-associated contaminants
- Bridging the gap between research and practice for delivery of improved strategies for sustainable development

## Scientific Contributions and Proceedings Publication

The Proceedings of the Symposium will be pre-published as an IAHS Red Book. The price of the volume will be included in the registration fee and a copy of the Red Book will be provided to each participant.

Participants wishing to contribute a paper should submit an abstract in English (maximum 250 words) to:

The Conference Office, University of Canterbury  
Private Bag 4800, Christchurch, New Zealand  
email: [icce2008@uco.canterbury.ac.nz](mailto:icce2008@uco.canterbury.ac.nz)  
Tel: +64 3 364 2534; Fax +64 3 364 2324

<b>Deadline for abstracts</b>	<b>30 November 2007</b>
<b>Replies to authors</b>	<b>1 February 2008</b>
<b>Deadline for full papers</b>	<b>1 April 2008</b>

After reviewing the abstracts, papers of 8–10 pages length will be invited for publication in the Red Book.

## Venue and Social Programme

The Symposium will be hosted at the University of Canterbury campus, located in the heart of the Christchurch suburb of Ilam, located approximately 4 km west of the City Centre.

The mid-symposium field trip will take us to the gravel-bed rivers of the Canterbury Plains which act as a conveyor belt transporting sediment out of the uplifting Southern Alps into the Pacific Ocean. We will also visit the Canterbury coastline and observe the intense coastal erosion and transport happening in that area. Several evening events will be included in the conference programme, including an Ice-Breaker reception and a Conference Dinner.

More information at:

<http://www.civil.canterbury.ac.nz/~icce2008.htm>

## Calendar of Meetings Organized/Sponsored by IAHS

Details of these plus many non-IAHS meetings are provided at the IAHS web site: click on meetings

2007	Conference	Contact details
Geneva, Switzerland 12–14 November	ESA Second Space for Hydrology Workshop: <i>Surface Water Storage and Runoff: Modelling, In Situ Data and Remote Sensing</i>	<a href="mailto:envmail@esa.int">envmail@esa.int</a> <a href="http://earth.esa.int/hydrospace07">http://earth.esa.int/hydrospace07</a>
Tullamore, Ireland 13 November	Irish National Hydrology Seminar: <i>GIS in Hydrology Applications, Modelling &amp; Data Issues</i>	Dr John Martin, Secretariat Irish NC of IHP & ICID E <a href="mailto:john.martin@opw.ie">john.martin@opw.ie</a>
Fremantle, Western Australia 2–7 December	GQ 2007: <i>Securing Groundwater Quality in Urban and Industrial Environments</i>	Viv Baker, tel: +61 8 9333 6274; <a href="mailto:viv.baker@csiro.au">viv.baker@csiro.au</a> or Greg Davis, tel: +61-(0)8-9333 6386; <a href="mailto:greg.davis@csiro.au">greg.davis@csiro.au</a>
Roorkee, India 18–21 December	<i>Water, Environment, Energy and Society (WEES-07)</i>	Dr Sharad K. Jain, National Institute of Hydrology, Roorkee-247667 (Uttaranchal), India tel: +91 (01332) 277281/276417; fax: +91 (01332) 277281; <a href="mailto:wees2007@gmail.com">wees2007@gmail.com</a>
<b>2008</b>		
Oxford, UK 8 January	<i>The Use of Historical Data in Rainfall and Flood Forecasting</i>	Harvey Rodda, Hydro-GIS Ltd, 10 Coles Lane, Chalgrove, Oxon. OX44 7SY, UK tel: +44-1865-400675; <a href="mailto:harvey.rodda@hydro-gis.co.uk">harvey.rodda@hydro-gis.co.uk</a>
Manaus, Brazil March 2008	IAHS-WMO Conference "Advances in Hydrometry"	Pierre Hubert, IAHS Secretary General; <a href="mailto:iahs@ensmp.fr">iahs@ensmp.fr</a>
Toronto, Canada 14–16 May	<i>4th International Symposium on Flood Defence</i>	Tracy Waddington, <a href="mailto:twaddington@pacicc.ca">twaddington@pacicc.ca</a> <a href="http://www.flood2008.org">http://www.flood2008.org</a>
Ohrid, Macedonia 27–31 May	BALWOIS 2008 Conference: <i>Water Observation and Information Systems for Decision Support</i>	Marc Morell, <a href="mailto:secretariat@balwois.org">secretariat@balwois.org</a> <a href="http://balwois.viabloga.com">http://balwois.viabloga.com</a>
Bled, Slovenia 2–4 June 2008	<i>XXIVth Danube Conference</i>	
Istanbul, Turkey 18–20 June 2008	IAHR Groundwater Symposium: <i>Flow and Transport in Heterogeneous Subsurface Formations: Theory, Modelling &amp; Applications</i>	<a href="http://www.iahr-gw2008.net">http://www.iahr-gw2008.net</a>
Kampala, Uganda 25–28 June	<i>Groundwater and Climate in Africa</i>	Richard Taylor, Department of Geography, University College London, UK tel: +44 207 679 0591; fax: +44 207 679 4293; <a href="mailto:r.taylor@geog.ucl.ac.uk">r.taylor@geog.ucl.ac.uk</a>
Prague, Czech Republic 15–18 September	HydroPredict'2008: <i>International Interdisciplinary Conference on Predictions for Hydrology, Ecology and Water Resources Management: Using Data and Models to benefit Society</i>	Mary C. Hill, US Geological Survey, USA, tel: +1 303 541 3014; <a href="mailto:mchill@usgs.gov">mchill@usgs.gov</a> Karel Kovar, Netherlands Environmental Assessment Agency, The Netherlands tel: +31 30 274 3360; <a href="mailto:karel.kovar@mnp.nl">karel.kovar@mnp.nl</a>
Kyoto, Japan 1-3 October	<i>HydroChange 2008</i>	Dr Makoto Taniguchi, tel: +81 757072255 <a href="mailto:makoto@chikyu.ac.jp">makoto@chikyu.ac.jp</a>
Capri, Italy 14–16 October	<i>The Role of Hydrology for Water Resources Management</i>	Crescenzo Violante, IAMC-CNR, Calata Porta di Massa, Porto di Napoli I-80133 Napoli, Italy tel: +39 0815423847; fax: +39 0815423888; <a href="mailto:crescenzo.violante@iamc.cnr.it">crescenzo.violante@iamc.cnr.it</a>
Christchurch, New Zealand 1–5 December	ICCE International Symposium: <i>Sediment Dynamics in Changing Environments</i>	Jochen Schmidt, NIWA, PO Box 8602 Christchurch, New Zealand tel: +64 (0)3 343 8058; fax: +64 (0)3 348 5548; <a href="mailto:j.schmidt@niwa.co.nz">j.schmidt@niwa.co.nz</a> <a href="http://www.civil.canterbury.ac.nz/icce2008/">http://www.civil.canterbury.ac.nz/icce2008/</a>
<b>2009</b>		
Hyderabad, India 7–12 September	8th IAHS Scientific Assembly	Pierre Hubert, IAHS Secretary General; <a href="mailto:iahs@ensmp.fr">iahs@ensmp.fr</a>

### The Role of Hydrology in Water Resources Management

International Conference — 14 to 16 October 2008 — Island of Capri, near Naples, Italy

The efficiency and reliability of the management of water resources systems depend much on the quality of the hydrological information on which the planning and management of such systems is based. So, one of the main tasks in hydrology is to investigate the spatial and temporal distribution and quality of the Earth's water resources at all scales to provide data for a sustainable management of water resources, as well as for the planning, construction and operation of hydraulic structures and systems, taking into account climate change.

The requirements of society, agriculture and industry demand the design and construction of water-management projects. The responsibility for their implementation rests with politicians, water authorities, consulting engineers and building contractors, etc. This implies that the optimum results for the planning and management of water resources systems can best be achieved by cooperation between those involved in hydrology and water management with those versed in economics, ecology and the social sciences. Unfortunately many political, economic and social decisions with significant impacts on the environment and so water resources are still made without sufficient input of hydrological expertise. The implementation of projects often leads to conflicts between managers and hydrologists. Managers often wish to implement projects quickly and at low cost, while hydrologists and environmentalists would like greater attention given to the principles of sustainability and ecological compatibility.

The purpose of this symposium is to discuss how hydrologists can exert more influence on the management of hydraulic and water management projects and to address how water resources managers can capitalise on the available hydrological expertise.

Contributions from hydrologists are expected to consider:

- What can hydrology offer to water managers at the different levels?
- What hydrological inputs are needed to attain the goal of IWRM?
- Are hydrologists sufficiently involved in planning and managing of hydraulic and water management projects?
- How can hydrologists influence the process of planning and managing hydraulic and water management projects?
- Are the principles of sustainability and environmental compatibility sufficiently considered?
- Which research activities are necessary for future IWRM?

Contributions from water managers should consider:

- What are their requests to hydrology and to hydrologists?
- What information can water managers offer to hydrologists?
- Which contributions can be offered to hydrologists and environmentalists during the planning and managing processes?
- Have hydrologists contributed constructively in the past?
- How can hydrologists foster progress in water resources management by developing new and innovative methodologies?
- What experiences have been gained from cooperation with hydrologists up to the present?

The Symposium will be organized by the IHP-Committee of Italy, sponsored by IAHS and co-sponsored by UNESCO. The symposium papers will be post-published in the Red Book series of IAHS.

Abstracts should be submitted to:

Crescenzo Violante, IAMC-CNR, Calata Porta di Massa, Porto di Napoli, I-80133 Napoli, Italy  
[crescenzo.violante@iamc.cnr.it](mailto:crescenzo.violante@iamc.cnr.it) tel: +39 0815423847; fax: +39 0815423888



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Dr Pierre Hubert, Secretary General IAHS, at [pjv.hubert@free.fr](mailto:pjv.hubert@free.fr) or Ecole des Mines de Paris, 35 Rue St Honoré F-77305 Fontainebleau, France

Registration, please use the form at the web site and contact::

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