Circulation

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The 1975–76 Drought:
a contemporary and retrospective review

Drought conditions affecting large parts of the country during the spring of 2011 provide an appropriate backcloth to the release by the Centre for Ecology & Hydrology of a major report on the 1975/76 drought which, at the time, was considered to be the most severe such event experienced across much of the UK. Given its extreme intensity and broad spatial extent, the documentation of the drought remains relatively limited; this is particularly true in relation to material reviewing the wide range of its impacts.

To redress the balance, Part I of this publication comprises a contemporary, but previously unpublished, report by **John Rodda**. Part II, authored by **Terry Marsh**, capitalises on hydrometeorological data collected over the last 35 years to provide a retrospective review of the drought with a particular focus on whether the singular severity ascribed to the 1975/76 requires revision.

The report is published as part of the National Hydrological Monitoring Programme and copies can be downloaded from: **http://www.ceh.ac.uk/data/nrfa/nhmp/other_reports.html**

President's piece

Since my last President's Piece we have had a good number of national and regional meetings, and your Main Committee have been keeping busy with initiatives ranging from the international to regional. This Piece reflects some of the matters of general interest, while there will be an opportunity to review the year's developments when we hold our AGM on 20 September (see flier enclosed with this issue).

There was an interesting opportunity to reflect on some of the characteristics and functions of BHS at the end of June in Melbourne, Australia. IAHS (the International Association of Hydrological Sciences) held a meeting to discuss the formation of a network of National Hydrological Associations (NHAs). Sadly, the meeting was rather poorly attended owing to difficult logistics, but enough countries were represented to allow some interesting comparisons and discussions. BHS emerged as one of the largest NHAs globally, chiefly on account of its large practitioner base of agency and consultancy staff, accounting for some 85% of its membership (according to our recent membership survey).

Meetings such as our recent successful joint BHS/CIWEM event addressing the translation of hydrological research into practical applications, and the practitioner response to it, help maintain the vitality of our Society by promoting dialogue at that critical research/applications interface. Many other hydrological societies are considerably smaller and much more focused on research alone. Let's remember that BHS is a fairly rare type of hydrological society and continue to make the most of that. A Melbourne meeting report from Helen Braithwaite appears elsewhere in this issue (page 16).

Back at home, it was a pleasure to be involved in a national hydrometry meeting which was well attended by 60+ delegates from a range of backgrounds, but with particular representation from the national hydrometric agencies, and including some visitors from the Office of Public Works (Ireland). While this *Circulation* carries a meeting report from the event, it is worth noting that it was organised in direct response to member feedback telling us that we should hold more meetings on hydrometry topics. It was therefore good to get positive feedback from the meeting, and I look forward to the announcement of plans for a follow-on meeting in the coming months.

At Main Committee in early July, we discussed a proposal to offer a limited fund of financial support for prospective hydrology Masters students seeking support for study in the coming academic year. The initiative was presented as a trial for the coming academic year only, and arose in the context of (a) an unexpected surplus being achieved in our 2010/11 finances and (b) a clear expectation that fees from 2012 onwards are likely to be much higher than in 2011. Around the time of our national meeting in early May on 'hydrology in a changing economic climate', I received numerous expressions of concern from various quarters regarding the support available for training the would-be hydrologists of the future. This scheme is a response to those concerns. Our support will be limited to £1000 per successful applicant in order to spread the benefit of these awards, and maximise the benefit of expenditure of Society funds. Many thanks to Neil Macdonald and Hannah Cloke for help in getting this scheme up and running… we await applications with significant interest. A flier included in this issue of *Circulation* gives further details. This initiative represents new territory for BHS. We will undertake an evaluation of its success in late 2011/early 2012 before deciding on whether to attempt any repeat.

Another new development is the inclusion in this issue of *Circulation* of a new regular feature — a hydrological review (page 30) courtesy of the National River Flow Archive in Wallingford. This material is brought to BHS through the NRFA's National Hydrological Monitoring Programme, and I hope

it will be valued as a useful source of authoritative information by many members.

Finally, this is my last President's Piece. It's been a busy couple of years for me, but I think also a period in which it's been possible to usefully ask a lot of questions about what BHS does and how, and a time in which various seeds have been sown with a view to strengthening the Society for the future. It's been a pleasure to work with an enthusiastic and energetic team to take the Society forward, and I know there will be some very valuable developments to look forward to in the coming year as my successor, Bob Sargent, and next year's committee progress a number of new and existing initiatives.

Andrew Black
President

Global Water Security

A request for water professionals to get out of the box and inform the wider society of the issues!

Joint CIWEM/BHS Meeting
Bristol University
20 January 2011

In recent years there has been growing international public concern about climate change, global warming and the increasing challenges of global water security. In highlighting these challenges, the Royal Academy of Engineering, the Institution of Civil Engineers and the Chartered Institution of Water and Environmental Management jointly produced a report in April 2010 for the Government Chief Scientist, entitled 'Global Water Security: An Engineering Perspective'. This meeting aimed to cover some of the key elements of the report.

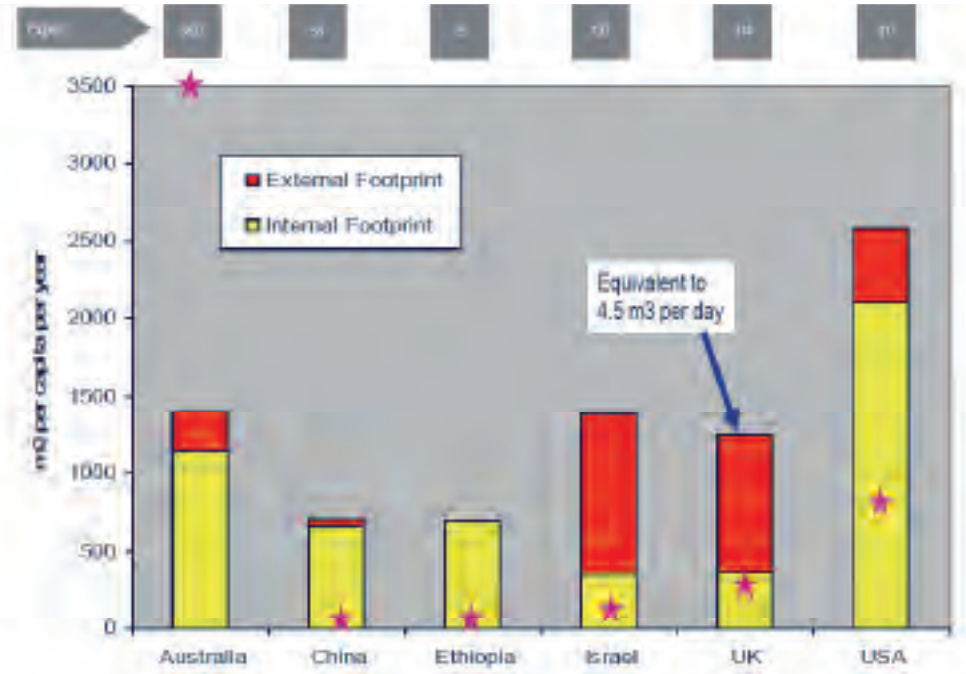
Roger Falconer (Cardiff University) started by introducing the concept of global water security and identifying some of the challenges currently facing the world. At present, around 1.2 billion people have no access to safe drinking water and more than half the hospital beds in the world are filled by people with water-related diseases.

Roger suggested that water is at the centre of everything, enabling energy, trade, health and food production. Pressures on water supply are increasing and predictions that the global population is expected to increase by 50% over the next 50 years could prompt a doubling in world food production. Additional pressure on food production, particularly in rapidly developing countries, is occurring in the form of increased meat consumption. As people strive to increase their standard of living their diets also change. This in turn puts greater pressure on water use as the production of meat requires more water than other food products.

Roger explained the concept of virtual or embedded water, defined as the total amount of water used in the production of a good or service. He noted that a pair of jeans could contain 10 850 litres of embedded water while a cup of coffee could contain as much as 140 litres. Solutions to the growing crisis include promoting integrated water management from cloud to coast. This involves encouraging all water practitioners, from clean water to sewage, to talk to each other and integrate concepts. In addition to this, the issues of water security must be elevated up the global agenda and the concepts of the water footprint and virtual water as well as the sustainable use of water sources should be promoted more widely.

Water conservation, water re-use and desalination may only be short term solutions to long term problems. The contentious subject of addressing world population growth could be a long term solution and may not just be an issue for the developing world!

Michael Norton MBE (Halcrow)



The water footprint (Source: Hoekstra & Chapagain, 2008)

started by referring to the 2009 Reith Lectures by Professor Martin Rees, who said that at the current rate of progress humans are in danger of causing the 6th great extinction witnessed on earth.

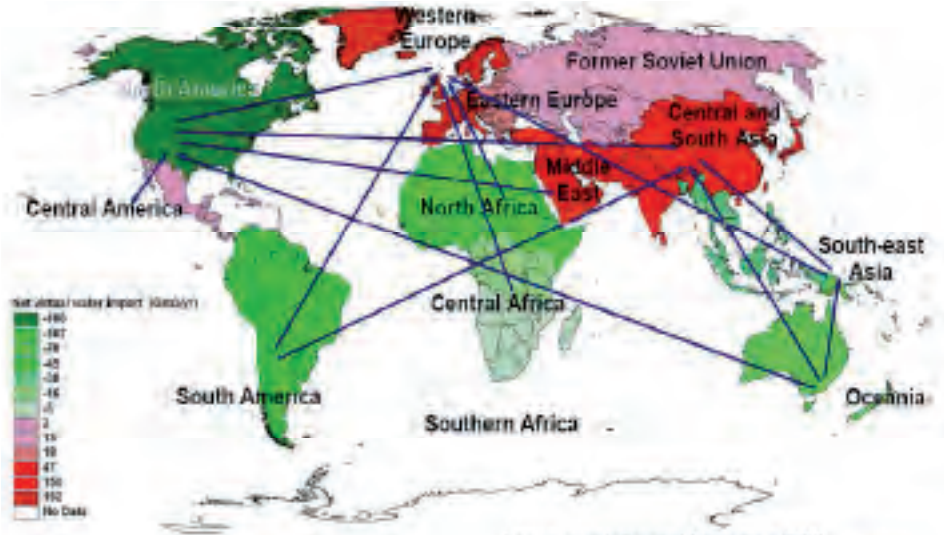
Global water abstractions are strongly linked to food production, with 69% of global water abstractions supporting agriculture. Yet, worldwide, a third of food products are wasted! With increasing water scarcity, a combination of population increase and climate change could have a devastating impact on future global water security. Michael pointed out that the problem is not just confined to the developing world but also closer to home, e.g. in the UK where higher summer temperatures combined with less summer rain will have significant impact*. Michael presented an intriguing graph of water footprints for various countries around the world, including the UK, USA and Australia. The embedded water footprint of each person in the UK is equivalent to approximately 4.5 $m^3 d^{-1}$, compared to only 0.15 $m^3 d^{-1}$ that we directly consume. Two-thirds of this water footprint is from other countries. The water footprint of a USA citizen is double that of a UK citizen.

The graph also summarised the heavy reliance of Australian industry on exports, with an annual exported water footprint of 3827 m^3 per person per year. This is over 12 times higher than that of the UK!

Suggested solutions to the problem were centred on bringing increased attention to the issue, exploring how water security is currently managed and looking at the role of both government and society in bringing about change. This may include changing the way society values water. Should water be valued as a human right or an economic good? As water becomes scarcer will it gain more in value? Michael made an interesting 'value for money' comparison between the cost of 1 m^3 of water (the volume each of us uses directly over one week) and alternative food products costing a similar amount, for example, a pint of beer or a sandwich.

Suggestions for long term sustainable global food production included identifying countries best suited

(*see also page 26 - *Ed.*)



Flows of virtual water (Source: Hoekstra & Chapagain, 2008)

to growing specific crops for a global population and providing the necessary support, trade barriers and subsidies to make it work.

Paul Horton (CIWEM) explained how there are still plenty of hurdles to jump before the importance of global water security and the implications of increasing water scarcity are fully recognised and acted upon by world governments and policy. There are little in the way of legally binding documents to force or encourage governments to act and little enthusiasm from governments to make commitments to change. The difficulty in getting countries to discuss and develop trans-boundary water and land use management agreements is a particular issue that needs to be addressed. The recent UN convention on climate change attracted around 30 000 delegates and hundreds of global NGOs yet little in relation to the issue of water scarcity was discussed. However, on a more positive note, the convention did include a four-day session called 'Dialogues for Water' and CIWEM supported the Water and Climate Coalition who were part of this dialogue.

Paul questioned the likelihood of Kyoto 2 taking place. What might the consequences of not tackling the issue of climate change head-on be to the global community? Closer to home, water doesn't seem to be high on the agenda either. The UK recently published a 25-year food security plan but failed to consult the water industry as part of this.

Ending more optimistically, Paul gave examples of the EU Water Framework Directive and EU Climate Change adaptation to illustrate how countries can integrate and adapt together as a result of EU policy. With water at the centre of these policies the overall resilience of the wider EU can be improved, despite the inevitable challenges that will be encountered along the way. The next step will be to put water security at the heart of EU Trade Policy, the Habitats Directive, EU objective for Territorial Cohesion, the Common Agricultural Policy (CAP), the implementation of renewable energy targets, and so on. The presentations were followed by a lively Q&A session which included many questions relating to 'what can we do?'

There was a general view that the water community should not sit around waiting for politicians to 'do something'. Instead, we should get out there to raise awareness and initiate action outside of our own 'comfort zones'. Currently, much of the emphasis on water security is coming from industry and business rather than governments. Industry seems to be recognising the benefits of water security and may help lead

the way to promote it to the wider community. Can we help them?

If this article has inspired you to get more involved in promoting the issue of global water security please get out there and help push it up the global agenda. Further information, plus a link to the Global Water Security report, can be found at: **http://www.ciwem.org/policy-and-international/international/global-water-security.aspx.**

Jo Robinson & Jackie Turner
South West Water



The International Symposium on "Weather Radar and Hydrology" (WRaH 2011) was jointly convened by the Royal Meteorological Society and BHS in April 2011 and held at the University of Exeter, UK. WRaH 2011 is the 8th in a series of International Symposia which started at the University of Salford in 1989 and marked a return to the UK after 22 years of successful symposia around the world.

The focus of WRaH 2011 was to provide a forum for the exchange of experiences and ideas on the use of weather radar in hydrology with a particular emphasis on user applications for flood forecasting and water management. To stimulate the interchange between researchers and practitioners, costs were kept at a minimum to ensure wide participation and delegates encouraged to stay on site to promote a 'community' atmosphere. This approach was successful and resulted in over 140 presentations and 250 delegates from governments, academia, research organisations, national hydro-meteorological services and consultancies spanning four continents.

Delegates began arriving on the Sunday afternoon and were welcomed by glorious sunny weather which continued for the five days of the symposium. **Malcolm Kitchen** (Met Office) in giving the first keynote presentation reflected on the UK experience of radar rainfall estimation. The early days were focused on expansion of the weather radar network to gain the current national coverage we enjoy today. This network provides high spatial (1km) and temporal (5 minute) estimates of rainfall in real-time and is used by most large organisations in the water industry. Whilst the qualitative benefits of radar rainfall data have been clear for decades their quantitative use has been limited by lack of accuracy. Over the last 15 years there has been a slow improvement in accuracy, partly driven by the engagement with the hydrological community. Malcolm surmised that there was a bright outlook with benefits to hydrology through new radar technologies (e.g. renewal of the UK radar network which will include upgrading to dual-polarisation), better rainfall estimation algorithms and improved forecast rainfalls through assimilation of radar data by Numerical Weather Prediction (NWP) models.

Continuing the theme of national radar networks, **Jonathan Gourley** (National Severe Storms Laboratory, USA) outlined the National Mosaic & Multi-Sensor QPE project (http://nmq.ou.edu/). This provides a real-time environment for the scientific community to develop, test and assess advanced techniques in quality control, data integration, precipitation estimation and nowcasting using a network of radars across the USA. Further afield, **Gyuwon Lee** (Kyungpook National University, Korea) outlined the challenges of bringing together several radar networks operated by different agencies within a new national Weather Radar Centre.

Robert Thompson (University of Reading) detailed a novel method for detecting and correcting for radome and storm attenuation by using radar gates at long-range which sample above the rainfall and are normally not of interest. This is being rolled out on the UK radar network so will hopefully lead to more accurate radar rain-rates. **Miguel Rico-Ramirez** (University of Bristol) used the Thurnham radar in Kent, the only dual-polarisation radar in the current UK network, to show how dual-polarisation can be utilised to improve radar processing (e.g. clutter identification) and rainfall estimation. The Rainfall Estimation sessions closed with an interesting talk on 'Product Regeneration' by **Frederic Fabry** (McGill University, Canada) which prompted a lively discussion. In particular Fred argued that we don't make enough use of the time dimension when producing real- or near real-time radar rainfall products and that periodic regeneration over long periods of radar data could also have benefits.

The second keynote of the opening day was given by **Michael Bruen** (University College Dublin) which focused more on hydrological modelling applications. A literature survey highlighted how the number of papers with radar and hydrology keywords had grown exponentially over the last 40 years with emphasis moving from general issues to specific ones and applications to physical processes. Particular applications were naturally suited to exploiting the spatial radar rainfall fields with distributed, or networks of lumped, hydrological models proving useful in understanding critical source areas of sediment or phosphorus, for example.

The first day culminated in an Ice-Breaker event at the Met Office where its Chief Executive, **John Hirst**, gave a welcoming address. Delegates could then tour the joint Environment Agency and Met Office Flood Forecasting Centre and the development radar (in the car park!) which is used for testing as part of the UK Radar Network Renewal Programme.

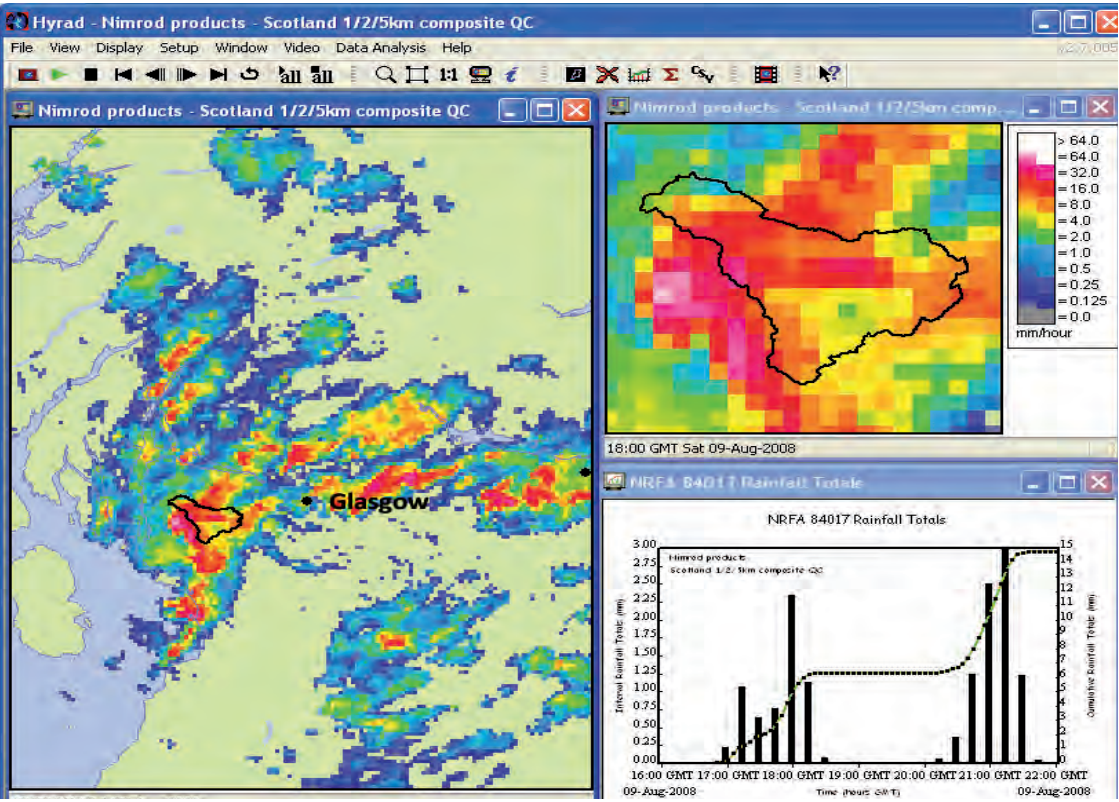
The Tuesday session theme was 'Uncertainty in Rainfall Observations and Forecasts' and started with an excellent keynote presentation by **Urs Germann** (MeteoSwiss). To quote the abstract "Understand, minimise and honour: Different in character and forlorn if alone, together they build the mandatory threesome to deal with uncertainty in hydrological applications of radar precipitation fields, be it measurements or forecasts". Results from several European projects (COST-731, D-PHASE and IMPRINTS) were used with a focus on the particular situation in a mountainous region. **Clive Pierce** (Met Office) discussed the latest developments of the STEPS (STochastic Ensemble Prediction System) which provides 0–6hr nowcasts of rainfall across the UK. The talk focused on the different methods being investigated for generating ensembles that took account of radar observation uncertainty. **Jarmo Koistinen** (Finnish Meteorological Institute) described a probabilistic rainfall warning system that had a novel interface which allowed individual users to set their warning requirement (e.g. location, period of day you would like to be warned, rainfall threshold, risk threshold). As of 2010, the system had 3000 test users who were warned via mobile phones.

Tuesday afternoon featured the field excursion to Lynmouth which was organised by **Mark Russell** (Environment Agency). Lynmouth was the scene of a devastating flood in 1952 which caused the greatest loss of (UK) life from a fluvial flood in historical times. There were no warning systems in place at the time of this flood and it provided some of the early motivation for using weather radar within hydrology and, in particular, flash flood forecasting. **Malcolm Kitchen** (Met Office) gave an overview of the meteorological background to the event and **Tim Wood** (ex-Environment Agency) gave an insightful summary of the resulting flooding and the challenges that remain for flood forecasting and warning in the steep, small and rapidly responding catchments that typically abut the Devon and Cornwall coasts. Tim also gave a history of flood warning technologies including showing artefacts like the 'acoustic coupler' and early forms of mobile phones and Polaroid cameras (using your armpit to help develop the photo in cold weather!).

Wednesday morning saw the focus shift to 'Urban Hydrology and Water Management Applications'. **Hans Verworn** (Leibniz University of Hannover, Germany) gave the opening keynote which outlined the challenging spatio-temporal rainfall requirements for urban applications and the recent improvements made in data processing that allow rapid dissemination of radar rainfalls for such uses. **Jesper Nielsen** (Aalborg

University, Denmark) considered high-spatial resolution data (up to 100 m) for urban drainage system modelling and concluded that a sub 5-minute resolution is really needed for sub 1km radar data. Two different rainfall nowcasting algorithms were considered by **Alma Schellart** (University of Bradford) for a small (<10 km^2) urban catchment in Yorkshire and concluded that the lead-time warning for the catchment could be improved by 15 minutes when compared to using observed rainfall only. **Murray Dale** (Halcrow) showed that bathing water quality predictions using radar rainfall data were generally better for small catchments than those using raingauge-only inputs. These radar-based predictions are used to update electronic bathing water quality signs in Scotland.

The remainder of Wednesday focused on operational rainfall and flood forecasting. The keynote presentation of **Bob Moore** (CEH Wallingford) gave a UK operational perspective on weather radar and hydrology, covering historical developments leading to the Hyrad weather radar display and monitoring system (see below), and use of catchment rainfalls within regional flood forecasting systems. Recent developments have focused on using radar rainfall with distributed hydrological models as a natural approach to area-wide flood forecasting at both gauged and ungauged locations, including the assessment of forecast flood severity. The Grid-to-Grid Model (G2G), a distributed rainfall-runoff and routing model, was outlined and results over England, Wales and Scotland presented.



Screenshot of radar data from the Hyrad system used by environment agencies for flood warning across England, Wales, Scotland and Belgium.

Witold Krajewski (University of Iowa, USA) presented the radar rainfall compositing products and the physically-based distributed flood forecasts that are published on the web by the Iowa Flood Centre for the entire state. **Sue Ballard** (Met Office) discussed the progress being made on data assimilation of radar data within NWP with the future vision being a 6-hour high-resolution (~1.5 km) NWP forecast run every hour.

An invited talk by **Craig Woolhouse** (Environment Agency) highlighted that floods are the natural hazard with the largest economic damages across Europe with €69 billion of losses between 1998 and 2009. The importance of providing timely and accurate flood forecasts will only increase as people face greater flood risk from climate change and sea level rise and is why, in partnership with the Met Office, UK weather radar network renewal and development has been commissioned. **Graeme Boyce** (Flood Forecasting Centre) reported on the operational experience of using radar data with the G2G distributed hydrological model across England & Wales and highlighted the importance of understanding model inputs when assessing model outputs, particularly when using countrywide models.

Sunmin Kim (Kyoto University, Japan) explained the challenges of urban flood forecasting in Japan and used as a case study a major flash flood that occurred within 7 minutes of the observed rainfall and caused 5 fatalities. Urban hydrological models have been developed that can recreate the flood and a network of X-band radars are being deployed that will rapidly disseminate observed and nowcast rainfall to extend flood warning lead-times. The AIGA flood warning system, developed by Cemagref and Meteo-France, was presented by **Pierre Javelle** (Cemagref, France). A simple distributed hydrological model is used and the severities of forecast floods at ungauged locations are issued in real-time for the Mediterranean region of France. **Michael Cranston** (SEPA/Scottish Flood Forecasting Service) summarised the recent rapid development of flood forecasting capabilities in Scotland and gave a look forward to 5-day countrywide forecasts using the G2G model.

The final day began with a session on 'Flash Flood Applications' and a keynote by **Dong-Jun Seo** (University of Texas, USA) highlighting how in the USA the focus has moved from 'direct insertion' of radar data and QPE to 'data assimilation' with the aim of fully utilising the information content of radar data in the end-to-end hydrological forecasting process. The closing session was on 'Storm Rainfall and Flood Response'. **Efrat Morin** (Hebrew University of Jerusalem, Israel) considered using historical radar data for a convective storm over a particular 94 km^2 semi-arid catchment and then altered the properties of the storm to understand the flooding potential of different storm to catchment configurations. **Marco Borga** (University of Padova, Italy) used the concept of 'spatial moments of catchment rainfall' along with the HYDRATE database of 25 floods across Europe to conclude that the spatial variability of storm rainfall affects flood response more significantly than the motion of the storm.

The oral sessions summarised above were complemented by three well attended poster sessions. The Symposium programme and short abstracts (oral and poster) are available at **www.wrah2011.org**. Short 6-page papers will be published in early 2012 as an IAHS 'Red Book' Symposium Proceedings. A selection of extended papers will be published in a Special Issue of the *Hydrological Sciences Journal* of IAHS.

WRaH 2011 proved to be a very successful, well attended symposium and highlighted the fact that the number and variety of hydrological applications of weather radar is growing apace across the world.

Within the UK, the Radar Network Renewal Programme, together with continuing developments in the application of weather radar by agencies and organisations responsible for flood warning and water management, will ensure that radar hydrology continues to be a valued research area in future years.

The support of BHS and RMetS in bringing WRaH 2011 to the UK and helping to make it an international success is much appreciated, as is the 'Inter-Agency Committee on Hydrological Use of Weather Radar' under whose umbrella it was initiated and coordinated.

Steven Cole
Technical Secretary for the WRaH 2011 Local Organising and Scientific Committees
Centre for Ecology & Hydrology, Wallingford

UK Hydrology in a changing economic climate

BHS half-day discussion meeting ICE, 3 May 2011

BHS recently held a discussion meeting to consider some of the challenges presented by the reductions in funding stemming from the October 2010 Comprehensive Spending Review (CSR). BHS President Andrew Black provides an account of the presentations, discussion and ideas for moving forward at the meeting.

Uncertainty and concern would be the best words to describe the backdrop to this meeting. There can be few in UK hydrology who have not heard of reductions to budgets at the UK environmental agencies, job losses in both public and private sectors, reductions in research budgets and also in support for MSc training. The aim of this BHS meeting was to provide a forum for some details to be presented to an interested audience, and an opportunity for some discussion about how to respond to the challenges currently being faced. The audience numbered 30 — fewer than at a typical technical meeting — but this was not a normal meeting. I for one regard the level of attendance as a positive reflection of the importance of the issues to be discussed. It was noticeable that many of those attending were doing so simply as interested or concerned individuals. Others spoke of attending to get a sense of how their peers were regarding an unfolding situation or, in the case of some student or recent graduate members, to get any clues about where their next job might come from. The meeting was to consider changes to recent arrangements, but these were identified as representing opportunities as well as challenges.

The meeting had five speakers. **Oliver Harmar** and **Rod Furnell** led off for the Environment Agency (EA), representing broad hydrological and narrower hydrometric perspectives, respectively. Oliver started off by making a very positive case for the role of hydrology in the EA: a relatively modest 180 staff full time equivalents (320 individuals in all) but making a critical contribution to the delivery of many of the EA's corporate objectives. In response to its funding reduction this year of 18% in revenue and 27% in capital spending, there would be more partnership working (e.g. for local service delivery), streamlining of data supply and data collation mechanisms, and more focus on high-risk areas. Localism and the Big Society were mentioned as having potential in relation to closer working with communities and possible volunteer roles in hydrometric observations.

Rod Furnell mirrored Oliver's presentation by outlining a situation of seeking — indeed planning — to deliver an enhanced hydrometric service with decreasing resources. The current staff complement in hydrometry is some 290, though this includes some overlap with the figures above. Key elements of the management approach are to make more targeted use of site visits, using a tiered approach to QA depending on internal customer requirements, and expecting to operate a 'one in, one out' system to requests for additions to hydrometric networks. Further elements of the approach involved more use of new and alternative technologies, which would have implications in terms of the required staff skill sets. Elements of both presentations were developed further at the forthcoming BHS day meeting in Birmingham on 21 June (see page 20).

Nigel Goody presented a brief update on the situation at SEPA. Staff numbers in hydrology have fallen from 100 some two years ago to approximately 80, including some changes in management arrangements. Two years ago, SEPA commenced a new scheme for the training of a new generation of hydrologists, to address a skills shortage, via relevant MSc courses at Dundee and Stirling universities. A planned third intake to this has had to be cancelled owing to budget cuts. The hydrometric network had been cut by approximately 50 sites

(or 12%) and others have been mothballed or downgraded from full-calibration to level-only: generally the picture was one of considerable uncertainty .

Daniel Johns spoke on behalf of Defra, outlining proposals for a new 'payment for outcomes' approach to supporting flood defence work which had been consulted on around the turn of the year. This was an opportunity for those not familiar with the plans to understand the underlying rationale behind them. He explained that the change was not merely a function of the CSR but could be traced in part to the Pitt Review which arose from the summer 2007 flooding — one of the sources of support for greater localism in flood management. The context of government plans for flood defence was also partly provided by the question of the extent to which communities should be dependent on government support: totally — or should people carry some of the responsibility themselves?

Under the new arrangements expected, some schemes will still be able to secure 100% funding support from central government but, in future, partial support would also be offered for schemes which can justify only a more limited share of funds, with the progress of these schemes then becoming dependent on local authorities, businesses or communities being able to raise the required balance. Daniel argued that this system would deliver greater certainty compared with its predecessor, more transparency, greater fairness, more local choice and better value for money. Regarding choice, he argued that where schemes were not going to warrant a high level of grant support, the clarity and stability of assessments may provide a stimulus for alternative, lower-cost solutions to be pursued.

Finally, BHS President-Elect **Bob Sargent** presented a view which on the one hand emanated from a consultant's perspective but also provided a wider and personal view. Bob presented a fairly clear assessment that times were tough for the consultancy sector. One of the responses of the larger consultants has been to send work offshore, e.g. to India, where a well educated and highly skilled workforce is able to undertake many types of hydrological analysis at a fraction of the cost of doing this work in the UK.

Bob likened the potential of this shift to the loss of manufacturing from the UK in the 1980s. He cautioned that any such moves would present long term problems in the industry as fewer young hydrologists would be employed to develop the skills needed in the UK. He also flagged the use of framework agreements as an impossible obstacle to UK small and medium enterprises (SMEs), despite government rhetoric that policy supports SMEs. Action, he suggested, was lacking, e.g. at the EA and also in Local Authorities. More positively, he flagged the markets for UK hydrology overseas in addressing the increasing water resources and flooding problems, e.g. in China, but warned that competition from other countries was fierce. He compared the lack of strategic approach from the government in the UK with that in Singapore which he suggested had excellent, government-backed integration of research and university teaching to address the needs of export markets, supported by memoranda of understanding with governments, which traditionally may have been regarded as UK markets.

Discussion was extensive and this is but a summary of some of the key issues to emerge.

Raising the profile of hydrology: there was considerable support for the idea that hydrologists should be active in raising awareness of hydrology. Schools were an obvious arena for this, but it should not be assumed that material we might generate would necessarily be taken up. Health and safety concerns stemming from involvement of volunteers was a recurring theme of the meeting, justified e.g. by a case where a child's thumb had almost been lost in falling on the sharp rim of a rain gauge.

There was concern as to whether the new flood risk management funding would give any greater support to deprived communities. Daniel Johns was clear that this was one of the objectives of the new arrangements.

There was a call for a thorough market assessment of the export opportunities facing the UK consulting community. It was argued that China was presently very keen to attract the benefits of technology worldwide, and that this could be to mutual benefit.

There was no agreement as to whether current numbers of rain or river level gauges were too high or not high enough (NB — there would be no debate of this at some other recent hydrological meetings, perhaps defined by a different audience!) but there was a consensus that

involving members of the lay public, whether children or adults, was a good thing in terms of promoting the understanding of hydrology (not least at the local level) and the role of hydrologists.

Two participants bemoaned the difficulty of accessing hydrological expertise when making enquiries of the EA: enquiry centre staff seemed to lack an appreciation of this expertise, and there was a suggestion that one role of the consultant was to help bridge the gap of understanding between a professional or institutionalised view of hydrology and a local perspective. Naturally, others were happy to defend the role of the EA in this discussion.

More critically, there was a view from a number of experienced figures within the audience that perhaps we as a scientific community were losing our way. Questions about the value of some commissioned research were raised; distinctions between pure research and mere repetitions of old questions and possibly old methods were emphasised. Reading between the lines, there seemed to be the suggestion that if research could be directed to more fundamental questions, then better progress could be made even if a reduction in research budgets has to be faced. Time did not permit this theme to be more fully explored, but there are ways in which members can influence the direction of future research activity, for example in the formulation of a new research strategy for the next decade, say. Please contact me if you would like to discuss.

Discussion of research led on to only a brief mention about the MSc funding situation. NERC will no longer be supporting any MSc training. Several members have written to me to express concern about this development, given the great value delivered to individuals and their employers particularly in the consultancies and agencies. These MSc courses have provided advanced technical training for generations of hydrologists and have a strategic value to UK hydrology. While various other funding remains in place for MSc programmes around the country, research council funding helped mark out a number of programmes as being of exceptionally high quality when viewed against subject-specific training criteria and, arguably, has helped attract the high calibre talent into the British hydrology which we know today. Again, this is an issue which BHS may be able to help address: please contact me if you have views or suggestions.

In summary, the meeting heard concerns that our national hydrometric networks had to continue to serve the needs of the user community, including the support of areas of developing science such as flood risk forecasting for localised intense storms. There was concern that appropriate skills training had to be actively protected to maintain the fundamental strength of the hydrology community of the future. The cut to MSc funding is seen as a direct threat to that. We saw the outline of how the EA intended to respond to reductions in funding, and how Defra intended to achieve better value for money from the floods budget. We heard concern about the position of the UK in a competitive export market where our national research capabilities ought, but will not necessarily, give us cause for optimism. There was a clear sense

UK Hydrology 2020: views of the future

informed by opinions expressed at our May 3rd meeting

- Based on sound science and appropriate data
- Addressing the changing priorities of society
- Practised by a highly skilled workforce
- Increasingly transparent: making hydrological work open to the public and seeking their inputs
- Better communicated and more accessible, so that individuals and communities can relate to hydrology at the local level
- Better structured to support fundamental research requirements, and the uptake of research into problem-solving
- Increasingly international, in terms of flows of work into and out of the UK, but the balance of trade being somewhat dependent on how the UK responds to international opportunities

that good science and outreach activities were necessary to pave the way for a sustainable future.

It will fall to Main Committee to coordinate actions to take forward some of these issues. I shall endeavour to keep members informed as we seek to make progress in the coming weeks and months.

Andrew Black
President
a.z.black@dundee.ac.uk

River temperature: research and management in a changing climate

BHS National Meeting
University of Birmingham
8 May 2011

This event was well attended by delegates from academia, consultancy, industry and environmental regulation, with specialisms in hydrology, engineering, forestry science, ecology, climatology and freshwater biology. Papers and posters presented insightful and holistic views on the complexities involved in understanding and managing river temperature.

Harriet Orr (Environment Agency) opened the meeting with an outline of operational perspectives on water temperature. The presentation focused on the application of knowledge required to meet environmental protection objectives. In particular, links to EU Directives were drawn upon to illustrate the scale of impact of changing river temperatures upon national operations.

Impacts of changing water temperatures on freshwater fish were addressed by **Iain Malcolm** (Marine Scotland) with an emphasis on salmonids and the Scottish River Dee. The application of a GIS-based modelling approach to improve understanding, prediction and assessment of implications for salmonids at the catchment scale was demonstrated. The presentation also highlighted the need for mitigation of extreme thermal events.

Ana Casado (Université Blaise-Pascal) added an international perspective by presenting data acquired from the Sauce-Grande River, Argentina, which is regulated by the Paso Piedras reservoir. The effects of meteorological variables on water temperature were assessed using a sensitivity index based upon conditional probability of the occurrence of river and air temperature regimes.

The sensitivity of stream temperatures to different riparian land management strategies was discussed by **David Hannah** (University of Birmingham) who informed delegates of the fine scale process drivers of stream temperature in relation to energy fluxes. Studies in the Scottish Highlands showed the varying effects of heather moorland, coniferous and semi-natural forest on headwater stream temperature.

Ian Cowx (University of Hull) focused on links between temperature regimes and cyprinid fish life cycles. An inverse correlation between river discharge and fish size was identified. This was attributed to a trade-off between growth and the energy cost of swimming against high currents. The importance of the timings of high discharges for hatching fish was also emphasised, due to the inability of immature individuals to survive in high flows.

George Mitchell (Atkins) introduced an industrial perspective to the meeting with a case study of a physically-based model to assess the feasibility of utilising the docks at Canary Wharf, London, as a sink for heat energy generated by the surrounding buildings. The model was also applied to assess the use of riparian shading in river side channels to mitigate thermal extremes.

Moving from the UK to the

Austrian Alps, **Lee Brown** (University of Leeds) presented work that identified the role of a reservoir in modifying river temperature dynamics. Late night water releases induced a secondary temperature peak in the usual diurnal signal, while dam spilling of water in summer months generated warmer temperatures than those in natural systems.

The day was concluded with **Paul Whitehead** (University of Oxford) who discussed the effects of temperature on chemistry and water quality using a modelling approach. The INCA model (Integrated Nitrogen in Catchments Model) was used to address the impacts of increasing water temperatures on nitrogen levels in rivers. Additionally, the River Kennet was used as a case study to highlight the impacts of warming water temperatures on dissolved oxygen levels.

On behalf of my fellow delegates, I would like to thank the conference conveners **Grace Garner**, **Phillip Blaen** and **Kieran Khamis** for organising such a successful and timely event.

Faye Jackson
University of Birmingham

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At the IAHS Plenary meeting in Melbourne, the following UK hydrologists were elected to posts:

Adrian Collins - Vice President of ICCE
Corinna Abesser - Vice President of ICGW
David Hannah - Vice President of ICSW
Kate Heal - Vice President ICWQ
Wouter Buytaert - Secretary ICWQ"

Instream barrier assessments

Instream barriers can be a major obstacle for fish migration. Their modification — or removal — is widely seen as a 'quick win' in the first round of River Basin Management Plans under the Water Framework Directive (WFD). **Janet Duncan** and **Andy Gill** from Atkins describe a new survey technique to identify an appropriate course of action.



Kirkton Weir, River Almond, Scotland
Main constraint: Almond Valley Heritage Centre use leat channel and turbine to produce electricity
Option recommended: Formal fish pass

Large-scale surveys have identified the locations of many such structures in UK rivers and the Environment Agency (EA) has recently estimated that there are some 26 000 throughout England and Wales.

The challenge is to prioritise catchments and to assess identified structures to establish whether it is technically, environmentally and economically feasible to modify or remove them, in order to improve the hydromorphological and ecological functioning of that water body. We at Atkins have recently applied an integrated barrier assessment methodology* (to assess the viability of barrier modification or removal) to 40 structures in projects for both the EA and SEPA.

The most recent 14 'rapid style' assessments in Scotland included a desk-based study and site visit by a multidisciplinary team of ecologists, geomorphologists and civil engineers, together with independent fisheries advisers. The baseline condition and upstream and downstream impact zones at each site were established to determine the most suitable management option in each case: (i) do-nothing, (ii) full removal, (iii) partial removal and (iv) formal or informal easement type fish pass (or a combination of options).

Assessment of the viability for removal or modification must



Kentchurch Weir, River Monnow, Monmouthshire
Option recommended: Full weir removal



Boulitbrooke Weir, River Lugg, Herefordshire
Main constraint: Bridge is a heritage structure.
Option recommended: Fish pass

*Shaw J., Skinner K., Humphreys A. and Sewell R., 2011. Instream barriers assessment – A multidisciplinary approach. River Restoration Centre 2011. Available at http://www.therrc.co.uk/rrc_conferences.php



Severnacres Weir, Ayrshire, Scotland
Main constraint: Potential for extensive upstream channel adjustment
Option recommended: Partial removal with informal fish easement



Hatchery Weir, Suirstavat, Scotland
Main constraint: Feasible but natural barrier upstream.
Option recommended: Do nothing

consider all human, ecological, geomorphological and technical feasibility factors (see Figures). Individual structures will need to be assessed on a case-by-case basis due to unique locations and environments. A range of constraints to barrier removal have been identified, from heritage to infrastructure protection and hydropower. Alternative options include partial removal and fish pass solutions. The drivers within the WFD for instream barrier removal / modification offer significant benefits for fish migration and hydromorphology throughout the UK.

Janet Duncan and Andy Gill

Network of National Hydrological Associations

BHS was approached earlier this year by IAHS – the International Association of Hydrological Sciences – in relation to a possible network of National Hydrological Associations (NHAs). All national associations around the globe have been approached, along with some regional bodies in countries where there is no appropriate national body. Associations were invited to send representatives to an initial meeting of the embryonic network on 30 June at Melbourne University, in the immediate run-up to the Assembly of the International Union of Geodesy and Geophysics.

When IAHS was established back in 1922, there were few, if any, NHAs. However, things have changed markedly in this regard in more recent times, and there are many associations which promote the science and practice of hydrology at all levels. Over the years, IAHS has collaborated with many of these NHAs, particularly when organising symposia and scientific assemblies in various countries.

The IAHS proposal is to develop a framework to foster direct contact between NHAs, rather than relying on the current arrangement by which NHAs may communicate indirectly with IAHS via national correspondents. IAHS President, Gordon Young, has been particularly complimentary of the highly organised structure of BHS and the valuable experience it would be able to offer to other NHAs. The IAHS proposal is for a loose but effective Network of NHAs, relying largely on electronic forms of communication,

but perhaps featuring occasional meetings.

Andrew Black asked Helen Braithwaite (nee Procter) if she would represent the BHS at the initial meeting due to her involvement with the society in previous years and also for geographical reasons. Helen was formerly the Hon. Secretary of the BHS South East Section for a number of years and is now based in Adelaide, Australia, where she is continuing her hydrological career with Sinclair Knight Merz, an environmental and engineering consultancy.

The meeting was chaired by Gordon Young, the President of IAHS and Arthur Askew, ex-President of IAHS. Pierre Hubert (IAHS General Secretary) was unfortunately absent due to travel restrictions resulting from the volcanic eruption in Chile. Ten representatives were in attendance from various national and regional hydrological bodies based in Australia, Denmark, France, Germany, India, Italy, the Netherlands and the UK. Each body gave a presentation detailing key information on their associations, including aims and activities, organisational structure and status within the country, date of establishment and brief history, membership and source of financing. There was also a presentation from Ian Littlewood on the PUB initiative, and the lessons which PUB might offer in the development of a role for the NHA network.

It was interesting to hear about the diversity of the NHAs in the different countries and also the level of establishment and membership. Some of the issues include the extent of water-related coverage by the various engineering bodies in individual countries, determining levels of overlap and need for NHA provision. Also, the variety of objectives, e.g. the Italian Hydrological Society explicitly aims to internationalise Italian hydrological research, and the scope of NHA activities, e.g. the Association of Indian Hydrologists offers training programmes for national audiences. It was very clear that BHS was one of the largest societies and other NHAs were interested in the structure of BHS and the way the society operates. Of particular interest was the number of consultants that the BHS has in its membership and the origins of this: several of the other associations represented had a research-only membership, with engineering bodies tending to provide for the collective needs of practitioners.

The meeting concluded with a discussion on the aims, vision and purpose of the NHA network in the future and the next meeting is proposed to take place in Gothenburg in July 2013. The meeting will take place in parallel with the next IAHS scientific assembly. Meantime, Andrew Black will be continuing the dialogue with IAHS in the next few months, as a contribution to the debate IAHS will need to decide on the aims and objectives of this network.

Helen Braithwaite
Adelaide, Australia

Flood Risk Management Teaching and Learning Network

– have your say!

Consultations are underway regarding the establishment of a network of academics and practitioners involved in teaching various aspects of flood risk management (including coastal). We would value your opinions as BHS members. The best way to do this, and to make sure you are kept informed, is to have your say via the second phase of online consultation at the following link:

https://www.surveymonkey.com/s/2VPY78M

If you would like any further information please contact Dr Nevil Quinn nevil.quinn@uwe.ac.uk or 0117-328 6562

Scottish Hydrological Group visits White Cart Flood Prevention Scheme in Glasgow

On Wednesday 11 May, a group of 30 people visited the White Cart Flood Prevention Scheme currently under construction. Attendees included people from SEPA, Councils, consultants and universities, representing the diverse membership of the SHG. The visit was guided by **Alan McGowan**, Halcrow project manager and **Stuart Slaven**, Halcrow Public Liaison officer and was also attended by **Bill Douglas**, representing Glasgow City Council.





Inlet to flow control structure at Kirkland Bridge storage area (above) and flood wall under construction in Cathcart .

The £50m White Cart Flood Prevention Scheme includes three flood storage areas and 8.5 km of direct defence in urbanised areas. It is nearing construction and the visit was timely organised to provide a full appreciation of the challenges associated with such a diverse civil engineering project and how the Client-Consultant-Contractors have collaborated all the way along to minimise impact on the environment and on local residents and businesses.

The visit included a first stop at Kirkland Bridge dam, where flows are controlled by an 8 m high, 150 m long earth dam and three hydro-brakes, providing storage of up to 1.1 million cubic metres of water. The reservoir was put into action for the first time in February earlier this year, which avoided significant potential flooding further downstream in Glasgow. We then visited the area of Spean Street in Glasgow Cathcart where flood walls are currently in construction. We could appreciate why the contractor, Volker Stevenin, had to work from the riverside due to limited access to work areas.

With nice sunny weather, the visit was well appreciated by all and we all thank **Lynn Dow** of ICE Scotland for co-ordinating the bookings for the day.

Pascal Lardet,
SHG Committee and visit organiser.



Flood walls completed in Spean Street

Responsible peatland management and growing media production

International Symposium, Quebec City, Canada 13–17 June 2011

This meeting was organised by a Canadian committee, including members from academia and industry, and The International Peat Society and The International Society for Horticultural Science. The Symposium was divided into two main parts, a workshop looking toward sustainable peatland management in Canada and an international symposium.

The Canadian workshop was organised by Dr **Line Rochefort** and Dr **Michelle Garneau** and aimed to facilitate the exchange of information, statistics and know-how on Canadian peatland management. It was a fascinating two days, within which we heard presentations from every province from east to west.

It was amazing to hear the area of wetlands within Canada, the different ecotones present, the varying policies between provinces, current pressures, restoration activities and the wealth they generate from activities such as cranberry farming and oil extraction. There was also an opportunity to visit a local peatland, Grande plee Bleue, to hear about the previous and current research, and the future plans for an education centre.

The second half, the international symposium, provided an opportunity to learn more about responsible peatland management, including environmental, social and economic values, peat usage and growing media practices, throughout the globe. Given this broad remit there were 13 sessions: fen restoration, restoration and rehabilitation of bog peatlands, boreal peatlands: use management and conservation, peatlands management in the energy sector, rewetting of peatlands, cultivation of *Sphagum* and biomass production, production of berries in bogs, carbon and climate change, future of regulations and certification of growing media based on peat and other materials, compost and alternative substrates, properties of organic soils and growing media, technology and innovation and management of tropical peatlands.

This broad range of sessions allowed you to learn about many different aspects of peatland management outside your normal research area. Furthermore, it provided an excellent forum to meet stakeholders and researchers interested in the various aspects of peatland management.

While there were four parallel sessions, each morning began with two plenary speakers: **Jean Caron** and **Nigel Roulet** talking about 'Responsible growing media manufacturing in North America' and 'Peatlands, climate change and carbon' respectively on the first day and **Michael Raviv** and **Jean-Pierre Reveret** talking about 'The future of composts as ingredients of growing media' and 'Society and sustainable management of peatlands' on the second day. These gave interesting overviews of various aspects of peatlands before the delegates divided among the various sessions. At the end of the conference there were several field trips, giving delegates an opportunity to visit some of the sites mentioned in various talks throughout the conferences.

Consequently, it was a very enjoyable and informative symposium and a unique opportunity to learn about all aspects of peatlands and network with people involved in their development, restoration and research. I thank the BHS for providing some support which allowed me to attend.

Alona Armstrong
University of Glasgow.

Providing an efficient and effective hydrometry service

BHS National Meeting
University of Birmingham
21 June 2011

This timely national meeting was organised to facilitate a series of presentations and discussions about the provision of hydrometric services at a time of concern that funding pressures may lead to significant changes. The data generated by the networks underpin the work of hydrologists across the spectrum of activities, and so it was no surprise that an audience in excess of 60 attended. BHS President **Andrew Black** opened the meeting with an observation that half of the delegates were from the Environment Agency, which clearly reflects a large proportion of hydrometric experience.

Stewart Child (Hydro-Logic) chaired the first session, on Issues and Changes, kicked off by **Dave Stewart** (EA) talking about recent improvements in field operations under the ubiquitous financial pressures of recent times. The EA have managed to successfully implement a risk-based approach to site visits across the gauged network to decrease costs (~£800 k) and focus effort to ensure (and indeed improve) data quality across the range of their sites. Key measures were decreasing the site visit frequency of low risk sites, and carefully selecting dual-sensor sites to manage the risk at critical sites. **Harry Dixon** (CEH) noted the risk of losing staff familiarity at sites.

The increasingly common use of Acoustic Doppler Current Profilers (ADCPs) was explored with great interest by **Gareth Varney** (EA), noting an increase in fixed station use from zero in 2003 to 172 in 2011. A useful summary of the benefits was provided, including application in tidal (bi-directional) sites, improving ratings at conventional sites and where variable backwaters are present. Counter-balancing this are numerous challenges including the establishment of the index-velocity rating required for ADCP application, increased training requirements, manpower and resources. **Terry Marsh** (CEH) had a pertinent question as ever regarding the effective measurement flows at drowned weir sites, with Gareth stating that a judgement call and site-specific issues determine applicability of the ADCP approach.

Martin Dibley (Hydro-Logic) presented some interesting findings on the effects of fish pass modifications to existing gauging structures or implications for new ones to include passes, given the plan to include such features on all EA sites. The impact on smaller channels may not be so large as previously thought, and existing guidance may require updating to facilitate effective fish and eel pass modifications where sensible solutions are feasible and would allow effective continuation of the flow record. Interestingly, Martin found consistent spot gauging results using both the 0.6 and 0.2–0.8 depth methods for velocity measurements.

The Scottish Environment Protection Agency (SEPA) was represented by **Karin Grust**'s informative talk on the use of ADCP in Scotland. The technology now accounts for two-thirds of SEPA's spot gaugings, but has presented new challenges, including the need for access to both river banks and sediment rich measurement limitations. The benefits are clear, with access to sites without cableways, significantly more information available on the variable river flow profile, and the ability to gauge much higher flows. Karin had conducted research comparing different flow measurement technologies, concluding that there were no obvious discrepancies between the results generated by rotating element and ADCP instruments.

Linking to Karin's presentation,

the EA perspective was provided by **Nick Everard**, with discussion of the essential technical detail of ADCP use, limitations and benefits. Important information on effective extrapolation of data across the dead zones at the top and bottom of the river profile was given, with evidence that flow profiles can vary considerably from the text book profile: there is a requirement for intelligent and informed users to specify appropriate extrapolations here. Again a comparison was drawn against conventional current meters and the assumptions of representative depth of measurement were made by Nick: he found that significant differences can be made by measuring at 0.6 of the depth compared to 0.2–0.8, again reflecting flow profiles. **John Millar** of the Flood Forecasting Centre quizzed Nick on the measurement of out-of-bank flows, with the answer summarised by 'good but not ideal'.

In the afternoon session, the UK's national hydrometric network and associated dataset was showcased by **Harry Dixon** of the National River Flow Archive, based at CEH Wallingford since 1982. The data held over 1444 stations and over 53 000 station years from as early as 1841 (Wendover Springs, before you look on the NRFA website). The NRFA's clearly defined strategy was outlined, which interacts strongly with the data-providing agencies to ensure integrated monitoring at a national scale is continued. The promotion of consistent practice in hydrometry was emphasised, clearly with the data collection and station management being at the core of making data useful. The NRFA's data management, synthesis and analysis processes were illustrated, together with how the end product is distributed to users for a variety of applications. A question on whether sub-daily data holdings were the target of the NRFA was answered negatively by Harry, who explained that the changeover would be impossible under current resource availability and quality would not be maintained. Uncertainty was highlighted by **Nigel Goody** (SEPA), who emphasised the need to communicate the 10 to 30% errors in measurement, which are nevertheless excellent in an international context.

Rob Grew and **Richard Davis** outlined the implications of Government austerity measures on hydrometry across the EA, with a need for more efficient field servicing, and focused investment in appropriate technology, including telemetry. The recent review of the £18 million and 290 staff hydrometry budget included a full review of the existing network which, together with highlighting gaps for investment, also found some sites that could be closed without significant loss to the network. Although savings have been made, a smaller network producing better, easier-to-access data was preferable. **Jamie Hannaford** (CEH) sagely suggested that the ongoing review of site importance is critical and that a dynamic network is also important to balance resources when future users are unknown.

The HiFlows-UK project was reviewed on the occasion of its tenth anniversary by **Zdenka Rosolova** of JBA. Three updates have been conducted since the inception, with the latest dataset (v3.1.1) released in July 2011 (see also page 32) containing data to September 2009 from 953 stations that has been subject to 'vigorous QA'. The importance to national productivity was highlighted from the thousands of design flood estimates using the statistical techniques of the Flood Estimation Handbook annually. Plans for the future include an annual update, a review of ratings at included stations (and developing ratings at some level-only stations), handover to the NRFA, and a focus on small and urban catchments where there is a dearth of good quality data.

In the final main paper, **Andrew Black** led by example to give a fascinating insight into the challenges of undertaking hydrometry in severe winter conditions experienced through significant personal experience when, and I quote, "like-minded rational individuals may have gone home.....!". The winter of 2009–10 saw the deepest snow accumulations since the 1980s with >1 m reported in many areas, and widespread disruption to records (3 months interruption was commonplace). Problems included freezing hydraulic controls and ice jams for river data, AWS data being unreliable and of course health and safety issues of working in such harsh conditions. However, Andrew's message was typical of him and was one of persistence and the benefits reaped, including the importance of data during these periods, groundwater emergence being observed from snowmelt patterns, the observation of changing ratings and increased local knowledge of the subject catchment. Some discussion reflecting varying experiences of rainfall

radar in periods of snowfall, and the role of observers for measuring lying snow depth, ensued.

During the 'Soap Box' session, **Alec Willis** (Hydro-Logic) made the case for considering MCERTS accreditation for hydrometric monitoring. He explained that this system had already been implemented for sewage treatment works discharge monitoring, and that its introduction on a wider hydrological canvas would increase the understanding which could be attached to flow measurements obtained under MCERTS. The system applies both to companies providing accredited services and the individuals undertaking the measurements.

Stewart Child summarised recent advances in the development of international standards relevant to hydrometry. This includes those for fixed Doppler and echo correlation, updates to standard weir design, stage-discharge relationships, use of ADCPs and time of flight ultrasonics, together with gauging station establishment. He concluded the meeting with a call for steps to be taken to raise the standing of hydrometry — a point for delegates to consider as they dispersed for home.

Reflecting on the day as a whole, there was real benefit in bringing together a strong body of UK-wide monitoring agency hydrometry specialists with hydrologists from a wide range of institutional affiliations; the meeting as always provided a good networking opportunity, and the fears that some may have had regarding the implications of funding cuts were substantially allayed. The innovations and developments being reported on represented the culmination of many years (often decades) of work, always focusing on achieving a better understanding of hydrological behaviour while striving to achieve value for money, minimise adverse environmental impact, and characterising as wide a range of catchments as possible.

The focus on quality is obvious across the industry, at least those represented at the meeting.

David Mould
Wallingford HydroSolutions

A follow-on meeting, taking a more detailed or hands-on approach to selected hydrometric issues, is planned for late autumn/winter 2011, to be held in Wallingford. Please contact Dr Harry Dixon at the CEH National River Flow Archive if you would like to know more during the planning of this meeting, and/or make any offers or suggestions for the programme: harr@ceh.ac.uk .

IAHS General Assembly

Melbourne, Australia
28 June–7 July 2011

Another 'IUGG' down under

In attending the IUGG/IAHS General Assembly in Melbourne in early July, 2011, I was returning to Australia for a another 'IUGG'. The previous General Assembly was held in Canberra in 1979, 32 years ago, and was the first of the nine IUGG General Assemblies that I have attended to date. Inevitably, I made comparisons and the many differences between the two meetings rapidly became apparent. Perhaps the most striking and obvious contrasts relate to the venues and, as befits a British preoccupation, the weather.

In 1979 the Assembly was held in December, during the Australian long vacation, and a flight to the austral summer was a welcome break from winter in the UK. The weather in Canberra was sunny and warm, although an excursion to the Snow Mountains did see us drive through a snow storm. This year we exchanged the UK summer for cold, wet

weather with overcast skies, which made even this year's UK summer seem good. Melbourne of 2011 is a busy cosmoplitan city, with modern infrastructure and many high rise buildings. The city centre Convention Centre, where the Assembly was staged, with its adjacent hotels providing accommodation for delegates, contrasted greatly with the almost rural campus of ANU, where the 1979 Assembly was based, and the surrounding open spaces of Canberra.

In 1979, the main post office in Canberra was still housed in a single story colonial style building with a tin roof. Most delegates at the Canberra Assembly were accommodated on the campus and only a few people stayed in hotels. The sessions were held in various University Buildings and the nearby Academy of Sciences headquarters close to Lake Burley Griffin. Much time was spent crossing the impressive campus and the hydrologists enjoyed a customized social programme. That included evening barbecues and a one-day field excursion, which incorporated a visit to the coast, some research catchments and Frank Dunin's famous forest lysimeter.

Although other Assemblies such as those held in Vancouver in 1987, Boulder in 1995 and Birmingham in 1999 were campus-based, it appears that the more impersonal Convention Centre model, with its inevitable high registration fee, is, perhaps sadly, now becoming the norm. Almost 2000 delegates attended the Canberra Assembly in 1979, but for Melbourne this increased to about 3200, providing some measure of the expansion of the Geoscience community, as represented by IUGG.

Expansion of numbers and the passing of the years have resulted in major changes in the structure of the scientific programme of IAHS General Assemblies. In Canberra, the IAHS programme focused on a single symposium : 'The Hydrology of Areas of Low Precipitation'. Even this was apparently something of a radical departure from past practice, as it seems that previously emphasis had been on Inter-Association Symposia and IAHS would not have had its own symposium. This broad-based symposium provided scope for participation by all Commissions and generated a single, albeit relatively thick, red book.

In Melbourne things were very different. The IAHS programme included four symposia and 14 workshops as well as two Inter-Association symposia and four Inter-Association workshops. There were six pre-published red books. This major expansion of the programme, with its numerous parallel sessions meant that planning a personal programme for the day in Melbourne was often a complex task. It was sometimes necessary to move between sessions and it was often impossible to attend all the presentations that might be of interest. Looking back, the past model of single symposium with no choice, although clearly rather too restrictive, did, nevertheless, seem to have some advantages. It is perhaps time for IAHS to reflect on the relative merits of the lumping and splitting approaches to programme planning for future General Assemblies. As a fairly young hydrologist in 1979, I felt that my age group were in a minority. Looking now, from the other end of the age spectrum, it seemed that the younger generation were much more in evidence at Melbourne. This trend is clearly to be welcomed and needs to be further encouraged at future assemblies.

The theme of the Melbourne IUGG was 'Earth on the Edge — Science for a Sustainable Planet'. This was reflected in the themes of many of the IAHS symposia and workshops, with several giving emphasis to the impact of climate change and living with such change. My own interests meant that I devoted much of my time to attending two workshops organised or co-organised by ICCE, the International Commission on Continental Erosion. The first of these, for which I was a co-convenor, focused on 'Tracer Applications in Sediment Research'. This extended over two days. This workshop proved highly successful and drew participants from many different areas of the world, with good representation of younger researchers. The papers focused on two major themes. The first was concerned with the use of fallout radionuclides to study soil and sediment redistribution in the landscape and the second dealt with sediment source fingerprinting. The latter contributions were particularly interesting, as much new work from different areas of the world, including Europe, Australia, Asia, Africa and Central and South America was showcased. This included the use of compound specific stable isotopes to fingerprint sediment mobilised from land under specific crops.

A paper by **Adrian Collins** from the UK gave details

of what must be seen as a major advance in source fingerprinting studies, by providing a comprehensive state-of-the-art framework for statistical testing and manipulation of the input data and source modelling. A useful feature of this workshop was that the time slots allocated for individual presentations were extended from the standard 15 minutes to 20 minutes, to allow more time for the discussion that should be a key element of any workshop. This practice should be adopted more widely for workshops at IAHS Assemblies.

The second workshop was organised jointly by the International Commissions on Water Quality (ICWQ) and Continental Erosion (ICCE) and extended the PUB (Prediction in Ungauged Basins) theme to water quality and sediment fluxes. It addressed the theme 'Water Quality and Sediment Prediction in Ungauged Basins'. This workshop comprised two main sessions and the second session, which dealt with sediment prediction, included a set of very interesting presentations. Those by **Murugesu Sivapalan** and **Scott Wilkinson**, providing excellent examples of contrasting approaches to modelling the sediment delivery system, proved particularly interesting.

In addition to these two workshops, I was able to dip into the programmes of several other symposia and workshops to update myself on recent developments and to attend several poster sessions. Here, the symposium on the 'Assessment of Water Quality under Changing Climate Conditions' and the workshop on 'Revisiting Experimental Catchment Studies in Forest Hydrology' proved particularly worthwhile for me. Equally, the Union Symposium on 'Do we really know the Hydrological Cycle' provided several very stimulating presentations to which must be added **Demetris Koutsoyiannis**'s Union Plenary Lecture on 'Hydrology and Change'. This lecture stressed the need for a new approach to change, embracing multiscale change and recognising that long-term change is more frequent and intense than commonly perceived, thereby making prediction of the future more difficult and uncertain. Demetris argued that change and uncertainty are central components of hydrology.

General Assemblies are also occasions for business and plenary meetings of Commissions and plenary meetings of the Association and I attended both the ICCE Commission meetings and the two IAHS Plenaries. The first of the latter focused on the election of officers of the Association and Commissions and, since **David Hannah**, the UK National Representative for IAHS, was unable to attend the Melbourne Assembly, I was designated the UK voting delegate. Overall, the UK fared quite well in the elections with UK-based hydrologists filling several posts (see page 14) . The voting also approved the upgrading of the Working Group on Statistical Hydrology (STAHy) into a full Commission on Statistical Hydrology. As a member of the IAHS Bureau, by virtue of my role as chair of IAHS Ltd, I also attended the two IAHS Bureau Meetings which bring together all the Officers. Important outcomes of these meetings included arrangements for the wrap-up of the PUB decade, which will be marked by a major symposium to be held in Delft in October 2012. This will also mark the 90th anniversary of IAHS. A Task Force, populated by younger hydrologists and charged with developing a new initiative to succeed PUB, was also established. This new initiative will be launched at the next IAHS Scientific Assembly, which will be held in Gothenburg, Sweden, in 2013.

The venue for the next IUGG General Assembly, to be held in 2015, will be Prague, Czech Republic. This venue should prove more accessible to UK participants than Melbourne and it is to be hoped that local costs will prove less. In recent months Melbourne has achieved the status of being the 7th most expensive city in the world and this was very clearly evident during my stay and in the cost of registration, etc. Prague currently ranks 55th in the same list, although it is identified as being to be the most expensive city in Central Europe.

I would like to take this opportunity to express my gratitude to BHS and the Exeter Fund for the generous support which assisted me to travel down under and attend the Melbourne General Assembly.

Des Walling
University of Exeter

Travel grants

Travel grants are awarded from the Society's general funds to help BHS members whose travel expenses to attend scientific meetings are not met by an employer. Applicants should have been members of the Society for at least six months. The amount will depend on the nature and location of the meeting and the case put forward.

Priority is given to members under 35 or retired from employment, who are presenting papers and who have not previously received support from BHS. Successful applicants will be expected to write a short report for *Circulation*. Travel grant applications should be made to the Hon Treasurer at least two months before the conference or meeting.

The Exeter Fund, administered by the Society, offers grants to British hydrologists to take part in IAHS / IUGG events.

To apply, use the form at *www.hydrology.org.uk/about_awards.htm* or contact **Nigel Goody**, SEPA, 7, Whitefriars Crescent, Perth PH2 0OPA *(tel 01738 448806, email: nigel.goody@sepa.org.uk)*.

AGM

The 29th Annual General Meeting of BHS will be held at Birmingham University, within the 'lunch break' of the National meeting on hydroecological tools for river basin planning (further details on the separate flier). Please try and come to air your views on the future progress of the Society.

PhD Abstracts

We announced in recent issues of *Circulation* that we would investigate the possibility of featuring newly awarded PhDs by reproducing appropriate abstracts. To start what we hope will be a self-perpetuating exercise, here is the first.

Bayesian calibration of fluvial flood models for risk analysis

Lucy Manning
University of Newcastle

Flood risk analysis is now fundamental to flood management decision making. It relies on the use of computer models to estimate flood depths for given hydrological conditions. The correct calculation of risks associated with different management options requires that the uncertainty in the computer model output is carefully estimated. There are several sources of uncertainty in flood models, including structural uncertainties in the model representation of reality, uncertainty in model parameters, and observation errors. We refer to the first of these as "model inadequacy". The work described in this thesis concerns the calibration of computer models to describe fluvial flooding, taking into account model inadequacy and paying particular attention to the requirements of risk analysis calculations.

A methodology which has had some success in other application areas is Bayesian model calibration, using Gaussian process representation both for the error arising from model inadequacy, and to emulate the computer model output. The effectiveness of this methodology is demonstrated for steady state flood models, both of a series of laboratory experiments, and of a historical flood using a satellite image of flood outline for calibration. Extension of the methodology to calibration of dynamic models using gauged data is not straightforward, but is achieved for flood models by means of an emulator, which replaces the computationally expensive hydrodynamic model with a time-dependent transfer function. This permits calibrated prediction of floods using historical gauged data, both in the existing channel and after modelling potential modifications to the channel. It is shown that calibration without inclusion of a model inadequacy function cannot match measured data. Finally, application of the methodology is demonstrated in the context of a calculation of probability of inundation in the channel, both with and without modification.

The elephant in the climate figures

What will be the biggest impact of climate change?

Flooding? Sea level rise? Nice warm summers? Surely not nice warm summers, they're the good news, aren't they? Or could they be the elephant in the climate figures — big and scary and getting almost no attention. **David Evans** asks us to think hard about some serious issues arising from the latest UKCIP projections.

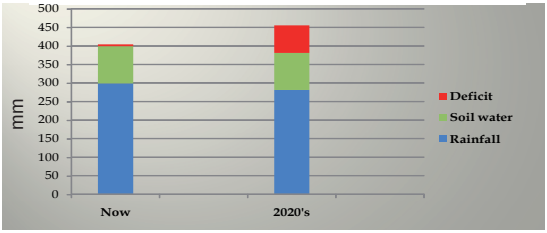


Fig 1 *Summer water balance for the Anglian region*

Summer Desiccation

The figure above shows an approximate summer water balance for Anglian region in the climate we know:

Evaporation	= 400 mm	(the life process of the plants)
Rainfall	= 300 mm	
Soil water	= 100 mm	(from last winter's rain)

So deficit = 0. Basically, nature does the watering and we take it for granted.

But there is little to spare — by the end of summer lawns are brown, soils are cracking and natural flows are at rock bottom. Some crops already have to be irrigated, though the quantities are small. We are nearer the edge than we realise.

But if the climate projections are right, those nice warm summers will become much drier. For example, in the 2020s:

E = 400 + 14% = 456mm	(Reading University, based on UKCP09)
R = 300 – 6% = 282	(UKCP09)
S = still 100	

The unmet deficit becomes 74 mm, water the plants will need, and not get. So what, that's just 3 inches. But 74 mm in 6 months over Anglian region works out to — wait for it — 10 900 Ml/d. (No, I didn't believe it either, but check the sum: Anglia is 27 000 km^2).

The same sum, with 2050s predictions gives a hypothetical withdrawal of 151 mm. Hypothetical, because Anglia's total (winter) water resource is 150! Think about it. And what starts in Anglia will spread westwards.

The withdrawal due to climate change is like a sort of diffuse abstraction. The figure opposite compares the 2020's withdrawal (74 mm and rising) with water supply in Anglia (around 1700 Ml/d, or 11.5 mm over 6 months). The 74 is total loss; the 11.5 almost all comes back, somewhere, sometime. Anybody worried about the effects of abstraction should worry a whole lot more about desiccation due to climate change. (But you don't have to worry about water supply, because that depends on winter rain, not summer).

Of course there are caveats. In particular, notice the word 'potential'. That is how much more would evaporate if there was enough water to evaporate. But sometimes there won't be — actual evaporation stops when the soil becomes parched. And what happens then to the plants in your garden? It looks like the same could happen to a lot of our crops and our green environment.

All this at a time when population will be even bigger and the world food situation unlikely to be rosy. I don't know about you, but it scares me!

There is one bit of comfort: in farm fields after harvest nothing is growing anyway. The sun can blaze all it wants and it doesn't matter. That will take some of the edge off summer desiccation, but working it out is a big job.

But the bottom line is that climate change will make summer water more and more scarce, and it is the crops and the green environment that will take the brunt.

Corroboration

If you doubt this, consider Fig. 3 on the next page, reproduced from

EA's *Water for People and the Environment* (2009). There are no numbers — just agroclimatic zones; the darker the colour, the greater the irrigation need. For perspective, the baseline conditions have led to:

- Around 1000 farm reservoirs in Anglia alone;
- A comparable amount of groundwater abstraction;
- Conflicts with the environment, and irrigation restrictions in dry summers.

Just how are the 2020s conditions going to be addressed, let alone the 2050s?

"But agricultural demand is too small to matter"

One reason we are not seeing the elephant is that agriculture accounts for only about 1% of licensed abstraction, and we look no further. But that is only the top-up irrigation practised by a small minority of farms. The vast majority of agriculture is rain-fed and the numbers are big. In Anglia, agriculture and the green environment between them take some 450 mm/year as evaporation. This is fully consumptive. Water supply takes about 23 mm/year, almost all of which comes back. So which is the dominant use?

If the climate were stable the big numbers would remain just part of the background and we could carry on ignoring them. But the climate is not stable — and it's the big numbers which are predicted to change, not just the little 1%. Hence the elephant.

What to do about it?

1. Question the climate figures.
This all hangs on UKCP09. Will it really come true?

2. Stop making it worse
There seems to be universal clamour for demand management. But water supply is non-consumptive. Wherever it comes via reservoirs the abstraction can be from higher flows and the subsequent returns (both effluents and leakage) increase low flows. Even coastal effluents are ready-made water resources waiting to be reclaimed; if the elephant is real they will be lifelines in the future. Water supply via reservoirs is thus not the villain but the goose that lays the golden eggs of summer water. Reducing water supply makes things worse.

(Yes, there are some serious, high-profile, over-abstractions. These are mostly from groundwater, which, unlike surface water, is intrinsically damaging. They need fixing, but they are very much the minority; do not let the tail wag the dog! And do proponents of demand management know that, in the main, they are calling for low flows to be even lower?)

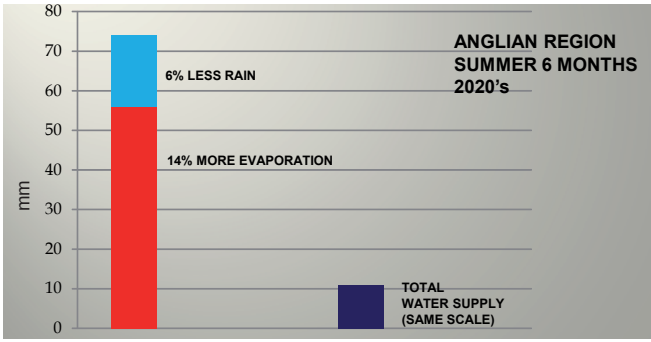


Fig 2 *Potential withdrawal due to climate change*

3. 'More crop per drop'
There is a big role here for the agricultural community:

- Developing drought-resistant crops (but they will still need water);
- Irrigating more efficiently (but farmers are quite efficient already);
- Building more farm reservoirs (but these are tiny relative to the predicted deficits);
- Moving production north? (but look at a map and consider the terrain; how practical is this?);
- Planting earlier (but winters will still be cold and dark).

All these will help, as will food efficiency, but they won't be sufficient. So we also need:

4. 'More drops for the crops'
In eastern England it looks like we will need all of those coastal effluents. What other summer water is there? (Except in the lower Trent, which in summer is largely returned flows from the Midlands anyway). But Fig.2 suggests effluent reuse will not be enough, so what then?

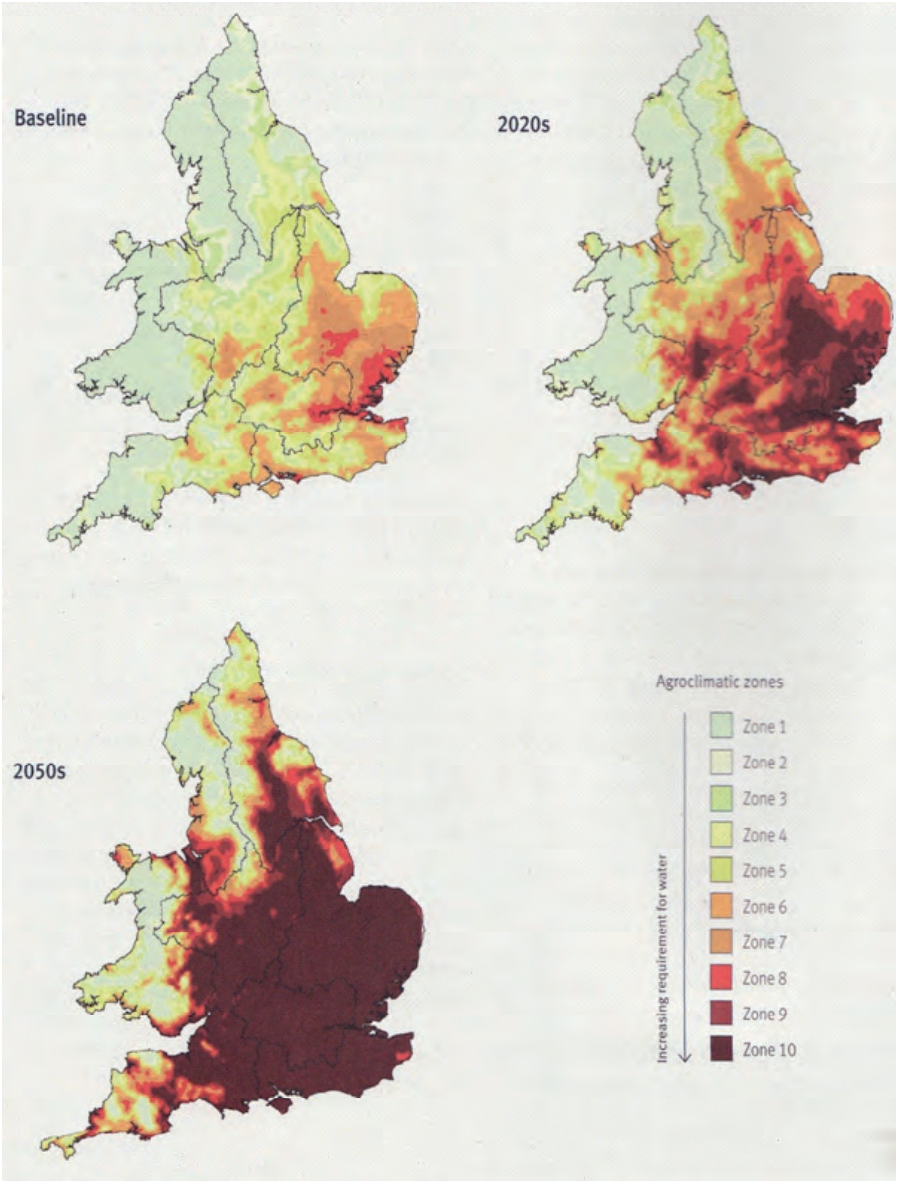


Fig 3 *Potential changes in summer growing conditions (Source: EA, 2009)*

Happily, even in dry Anglia, nature gives us 1900 l/p/d (*EA 2001 Water Resource Strategy*). Compare that with domestic *use* of around 140 and domestic *consumption* of say 14 at the very most. So there's plenty of water, at least relative to water supply. The problem is that it all comes in winter, so any reliable supply needs storage. Natural groundwater storage is fully (sometimes over-) used. There might be some scope for artificial recharge,

but the practicalities are limiting. And that leaves reservoirs.

Reservoirs get a bad press. One reason is that all the downsides (financial, social and environmental) are obvious and they occur 'up front', whereas many of the benefits are not perceived until later.

Reservoir benefits include:

- The water supply it is built for;
- Second uses of the returning flows, both in the environment and by subsequent re-abstraction; and
- greater security of water supply the more storage there is, the more reliable the supply.
- The lake itself (wildlife, recreation, boost to local economy, effect on property values),

Once filled, reservoirs become cherished assets — **and** they lay the golden eggs of summer water. We should welcome reservoirs, not oppose them.

5. Be realistic about the green environment
It looks like it might change colour. Are we trying to conserve the unconservable?

6. Start planning
If UKCP09 is anything like right, we need to think big and think positive. We need to integrate our efforts with agriculturists, conservationists, water suppliers and others. We need to do it on a national scale and, as big developments can take decades, we need to start now.

Is there any alternative to strategic national water resource planning?

David Evans
davidevans.water@btopenworld.com

PS This analysis is simplistic and all the numbers are ballpark. It will not be right in detail. But can anyone out there show it to be wrong in principle?

Editorial

As part of our current recruitment drive, we are updating our Membership Application form, in particular to make the default option that new members submit their email addresses and agree to register on the BHS Mailbase. So it seems timely to (tactfully) remind existing members who have not yet joined that it is in both your interest and ours that we have as complete a network as possible. In this way we can do our part in ensuring better 'knoweldge exchange' (the new 'buzz word' in official circles) and, hopefuly, you will find that your society has a lot more to offer.

Celia Kirby

Congraturlations to

Prof Paul Jowitt,Civil engineering at Heriot Watt University and President of ICE on the award of CBE in the birthday honours for services to technology, Edinburgh

New members

Julia Amos.....Loughborough University
Sara Barsley.....British Waterways, Warwick
Steve Birkinshaw.....Newcastle University, Keswick
Ursula Buss.....Environment Agency, Peterborough
David Carruth.....SRK Consulting, Cardiff
Piotk Grabowiecki.....University of Salford
Dawn Harrison.....Met Office, Exeter
Jennifer Harrison.....Newcastle University
Charles Hodge.....Independent Consultant, Edinburgh
James Latham.....Hyder Consulting Ltd, Birmingham
Tom Lester.....Hyder Consulting, Leicester
David Mould.....JBA Consulting, Skipton
Dirk Mallants.....SCK CEN, Belgium
Julia Toone.....Loughborough University
Chih-Wei Tsai.....University of Sheffield
Lisa White.....YSI Hydrodata, Letchworth

The National Hydrological Monitoring Programme

This Programme is undertaken jointly by the Centre for Ecology & Hydrology and the British Geological Survey, both component bodies of the Natural Environment Research Council. The NHMP monitors hydrological conditions and water resources status throughout the UK and publishes a range of reports which are publically available through the National River Flow Archive's website (see below). As part of the NHMP, monthly Hydrological Summaries for the United Kingdom have been published since 1988.

NRFA website:
http://www.ceh.ac.uk/data/nrfa/index.html

The NHMP is a collaborative project which relies on the support and cooperation of the principal measuring authorities throughout the UK: The Environment Agency, Scottish Environment Protection Agency, the Rivers Agency (Northern Ireland) and the Met Office. Additional data relating to reservoir stocks are provided by the Water Services Companies, Scottish Water and Northern Ireland Water.

Beginning with this issue, UK Hydrological Bulletins (a synthesis of the Hydrological Summaries) will be routinely featured in *Circulation*.

UK Hydrological Bulletin: January-July 2011

Thus far, 2011 has been an exceptional year in hydrometeorological terms. During the third week of January sustained frontal rainfall, together with a significant snowmelt contribution in northern Britain, generated notably high runoff rates, with widespread flood alerts. However, synoptic patterns changed decisively in mid-February, heralding a prolonged period when most rain-bearing Atlantic frontal systems followed tracks away from the British Isles.

England & Wales recorded its driest March since 1961 and April was the warmest in the 352-year Central England Temperature series. Hydrologically, the most evident impact of the developing drought conditions was on river flows in responsive catchments. New minimum April runoff totals were recorded for rivers in the Midlands and the South West and estimated outflows from Great Britain as a whole fell below previous late-April and early May minima (see Fig. 1). This implies a major, and seasonally early, contraction in the stream network and a substantial (albeit temporary) loss of aquatic habitat.

May saw an extreme accentuation in the usual north-west to south-east rainfall gradient across the country. Scotland reported its highest May rainfall in a series from 1910 whilst a substantial proportion of eastern England registered <20% of the average. In parts of Kent only 4 mm were recorded — a dramatic contrast to north-west Scotland where some localities reported May totals two orders

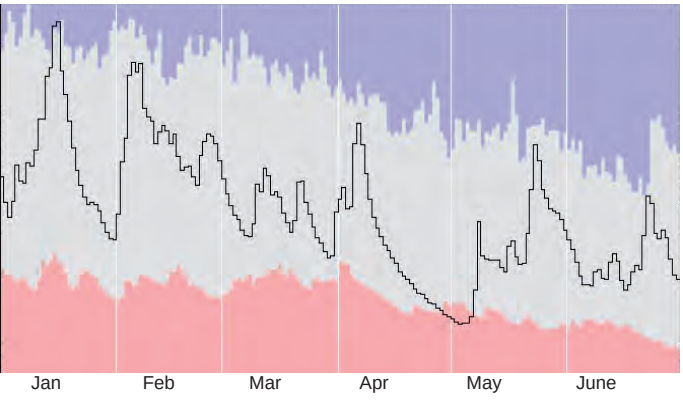


Fig. 1 *Estimated daily outflows from Gt. Britain (the envelopes show por max and min)*

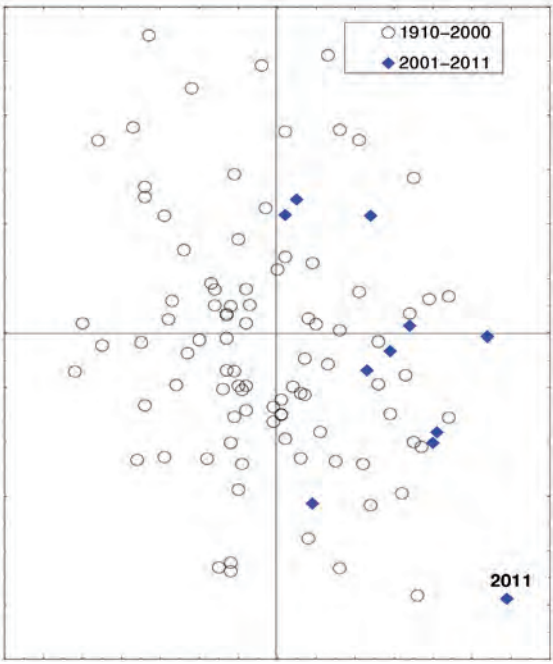


Fig 2 *Spring rainfall and temperature anomalies for England, 1910-2011 (Data source: Met Office)*

of magnitude greater. The remarkable May rainfall patterns served to decrease the spatial extent of drought conditions but increased their intensity in eastern, central and southern Britain where rainfall deficiencies could be traced back to December 2009.

The combination of record temperatures and low rainfall produced an outstandingly arid spring across much of southern Britain, England particularly (see Fig. 2 above). In some eastern areas, end-of-May soil moisture deficits were the highest on record (Fig. 3) confirming the severity of the agricultural drought and triggering concern for crop yields, cereals in particular. The risk of forest and heathland fires had also increased markedly.

At the national scale, June was a relatively wet month with unsettled conditions continuing well into July. The welcome rainfall arrested the steep decline in rivers flows and early-July reservoir stocks for England & Wales as a whole were marginally above average around month-end. Nonetheless, runoff over the March–June period was still the lowest for England since the intense drought of 1976 and stocks in many central and southern gravity-fed reservoirs remained seasonally depressed. After very meagre replenishment through the spring, groundwater levels were also notably low in many index wells and boreholes across the English Lowlands.

Aided by considerable inter-connectivity of supply sources, UK water resources are generally resilient to even exceptional within-year rainfall deficiencies. However, with soil moisture deficits in early July still well above average in many eastern and central areas, the seasonal recovery in runoff and recharge rates may be considerably delayed. In such circumstances, the autumn and winter rainfall will be especially influential in determining the water resources outlook for 2011.

Terry Marsh
tm@ceh.ac.uk

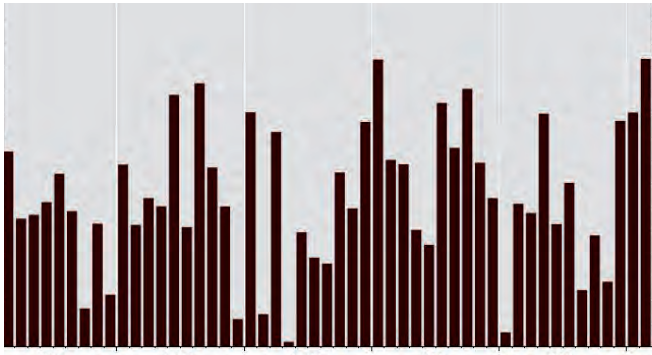


Fig 3 *End-of-May soil moisture deficits for the English Lowlands (Data source: MORECS – for a grass cover)*

Stop press....

HiFlows-UK

Those of you who carry out flood estimates may like to know that the Environment Agency's HiFlows-UK website has been updated with another years worth of annual maxima and peak flow data for England, Wales, and Northern Ireland. It now contains data up to 30 September 2009, and also includes peak flows from the Cumbria floods in November 2009.

The data can be downloaded from **www.environment-agency.gov.uk/hiflows/91727.aspx.**

Future funding of flood and coastal erosion risk management in England

A new partnership approach to funding flood and coastal resilience in England was announced on the 23 May 2011. This affects how much national capital funding can be allocated to individual flood and coastal management projects. Further information is available from the Defra internet site: **www.defra.gov.uk/environment/flooding/funding-outcomes-insurance/**

And finally....

As good citizens, we need to pay our taxes (not least to help keep hydrology alive in the UK!) but does everyone know that you can get your HMRC Tax Code adjusted to claim for professional fees. This applies whether you are on PAYE or Self-Assessment — just contact your local Tax Office for further details. BHS subs are gratifying small but still worth claiming for in these 'strained' times!

Forthcoming events

International Conference on Groundwater in Fractured Rocks

Prague, Czech Republic, 21-24 May 2012

For more information and abstract submission:
http://web.natur.cuni.cz/gwfr2012/

Note: Abstracts are due by 30 September 2011

Copy deadline for* Circulation *No. 111
21st October 2011

Diary

20 Sept 2011
BHS Annual General Meeting
Location: University of Birmingham
12.50 p.m.(but please check time nearer the event)
Contact: Claire Walsh
(Tel: 0191 222 6618)

20 Sept 2011
Hydroecological tools for river basin planning
BHS National Meeting
Location: University of Birmingham
Contact: Chris Bradley
(Tel: 0121 414 8097)

28 Sept 2011
Droughts: Research and Management
BHS National Meeting
organised by: BHS Pennines Section
Location: University of Liverpool
Contact: Dr Neil Macdonald
(Tel: 0151 794 2510)

17–18 Nov 2011
Integrating multiple facets of river corridor development
Conference organised by University of Sheffield (URSULA project)
Location: St Mercure St Paul's Hotel, Sheffield
Contact: Jenny Chambers
(Tel: 0114 222 5725)

21 Nov 2011
Natural Hazard Partnership
Joint meeting: BHS South West Section / CIWEM Rivers & Coastal Group . Site viist to Flood Forecasting & Hazard Centres.
Time: 14.00
Location: Met Office, Exeter
Contact: Peter Dempsey
(Tel: 01392 884254)