Circulation

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Did you know
that Bob Dylan's website is called "Expecting Rain" www.expectingrain.com/

**Any more 'hydrological ephemera' lurking out there? Please feel free to let the Editor have details at your convenience.*

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Massive new grant for flood risk management

More than £8.7 million has been awarded recently by the EPSRC to an existing research consortium for further investigations into prediction, prevention and mitigation of flooding. This national interdisciplinary consortium was set up in 2003 (with funding from EPSRC, EA, Defra, UKWIR, Scottish Executirve, NI Rivers Agency and NERC) to combine the strengths of basic and near-market researchers, with academics working alongside appropriate stakeholders and users in both public and private sectors*. The new award runs through to 2011.

Specific science issues include land use management, floodplain inundation and operational management, plus the wider aspects of whole system modelling and policy, planning and governance. Upland land management continues to be a major element of the work, with experimental research at Pontbren providing a focus for collaboration. The research proposed also includes work directed at urban flood management and reflects the need for an integrated and holistic approach to urban flooding. It also capitalises on the rapid advances in

technology and communications for real-time urban flood forecasting, prediction and mitigation, particularly in those urban areas designated as high risk. Advances in dual polarisation weather radar should help develop a proactive real-time strategy for managing urban flood risk.

This new research phase will concentrate more on coastal flood management, especially the development of operational tidal surge forecasting. Advanced methods will be developed for integrating large scale wave modelling with intermediate scales and scales local to the shoreline and structures. The challenging problem of breach modelling will also be addressed but the particular problem of scour seaward of structures is the subject of the NERC FREE EPIRUS project which also directly involves members of the consortium and includes uncertainty aspects via the use of ensemble models.

An important aim is also to contribute to the formation of policy within the insurance industry and to the decision-making processes such as the reports/ consultation papers *Shoreline Management Plans*, *Foresight Future Flooding* and "*Making Space for Water"*.

Ian Cluckie
Chairman, EPSRC Flood Risk Management Research Consortium

*Please see www.floodrisk.org.uk for a full list of consortium members

PETER WOLF MEMORIAL CELEBRATION

A memorial celebration for Prof Peter Wolf, who sadly died last year (see *Circulation 95*) is being held at the Athenaeum Club in London on the afternoon of Sunday 2nd March. BHS members who knew Peter and who wish to attend should contact his widow, Dr Janet Wolf at j.e.wolf@city.ac.uk or 02083 406638 to request an invitation, which will be provided by the Athanaeum (numbers are limited).

New members

Robin Drayton Ayre.....Mouchel Parkman, Bradford
Jessica Amy Barton.....Twickenham, Middlesex
Fay Campbell.....JBA Consulting, Edinburgh
John William Dunn.....Cambridge
Laura Henderson.....Mott MacDonald, Cambridge
Matthew Johnson.....Loughborough University
Lloyd Jones.....Environment Agency, Maes Newydd
Emma Joanne Naden..... Crewe, Cheshire
Marek Nekula.....Mott MacDonald, Inverness
Olakunle Olawole.....Birmingham
Barbara Orellana.....Imperial College London
Edmund Penning-Rowsell.....Oxford
Neil David Redgate.....NDR (Environ. Services) Ltd, Highland
Rob Stroud.....Waterman Quadrant,Cardiff
William Turner.....Water Bank, New Mexico

Keep up to date!

Would **all** members please think about registering on MyICE, as outlined in the enclosed flyer, so that you can update your contact details and pay your subs! This facility is now available to Associated Society members as well as ICE members.

President's piece

As I write this article, people in many parts of England, and to a lesser extent Wales, are again anxiously watching the weather forecasts and monitoring the Environment Agency's *Floodwatch* website. Yes, the theme of the 'piece' this month must be floods – with the UK again facing flood risks. At one stage there were 15 'Severe Flood Warnings' (meaning "*Act now! Severe flooding is expected with extreme danger to life and property*"), mainly on the Severn and in Yorkshire, 117 'Flood Warnings' ("*Flooding of homes and businesses is expected. Act now!*") and 169 'Flood Watches' ("*Flooding of low lying land and roads is expected*"). The current flooding is nothing like as severe as that experienced in June and July last year, which led to over £3 billion in insurance claims, but with some 9000 families still living in caravans or temporary accommodation after the summer of 2007 floods, is this an early indication that climate change is already manifesting itself? I think not, but will come back to this later.

It is ironic that after the two dry winters of 2005/06 and 2006/07, with a number of hosepipe bans in the south east and Thames Water applying for a Drought Order, we are now faced with the hydrological opposite. However, these two extremes of droughts and floods do remind Government and the public that hydrology is an important issue in this country, and such concerns are probably no bad thing for our corporate careers.

What can be said of the flooding of summer 2007? There was a very dry spring in April and early May, but this was followed by the wettest summer on record; the rainfall total for May–July in England and Wales exceeded anything seen previously in the 241 year record from 1776 and, since 1879, no May–July rainfall has been within 100 mm of the 2007 total[1,2]. All of England and Wales experienced above average summer rainfalls, and much of central and southern Britain registered more than twice the 1971–2000 average. However, the areas most severely affected were the Severn and Avon catchments (in places more than 3 times the average), southern and eastern Yorkshire and northern Lincolnshire (2.5 to 3 times the average) and the upper Thames catchment (also 2.5 to 3 times the average). This record rainfall fell in three distinct widespread storms, the first on the 14–15th June, affecting mainly western and southern Yorkshire and which saturated soils. This was followed on 24–25th June by a more severe storm over southern Yorkshire and the Humber estuary, when Hull received 100 mm in 12 hours (1 in 500 year storm), and Hull, Sheffield and many other areas were severely flooded. The final storm on 19–20th July hit Gloucestershire, Worcestershire and the Cotswolds, and led to dramatic flooding of Tewksbury in particular and led to the closure of Severn Trent's Mythe water treatment plant, cutting off water supplies to over 350 000 people for up to 17 days, near failure of National Grid's Walham electricity switching station, and 40 000 customers had no electricity for 24 hours after Central Network's Castle Meads substation was flooded.

These two major flood events resulted in the deaths of 13 people, caused damage to approximately 48 000 homes and 7000 businesses, and direct insurance losses of some £3 billion, in addition to the huge indirect costs of loss of production caused by people being off work, trapped on flooded motorways, closure of railway lines and so on. The events have served as a very real 'wake up' call to central and local government and have already led to a plethora of 'lessons learned' reports from the Environment Agency, Severn Trent Water, the City of Hull, Gloucestershire Police, etc. as well as the first interim report by Sir Michael Pitt[1].

What can we as hydrologists contribute to this debate? I know that many EA hydrologists are already contributing to the very important post-flood analysis, and welcome the hydrological review undertaken by Terry Marsh and Jamie Hannaford at CEH[2], but should we be going further? I believe that we should, and at the recent BHS committee meeting proposed that we

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[1] Cabinet Office, 2007. *Learning lessons from the 2007 floods*. An independent review by Sir Michael Pitt.

[2] Marsh T.J. and Hannaford, J., 2008, *The summer 2007 floods in England and Wales – a hydrological appraisal*. Centre for Ecology and Hydrology, Wallingford.

should submit written evidence to the Pitt review, where consultation is open until 31st March. I have offered to draft a BHS submission over the coming weeks, which I would then try to circulate widely to interested BHS members. If you would like to be involved in this process, please contact me by email (frank.farquharson@btinternet.com) and if you wish to send me written contributions for inclusion in a BHS submission, please feel free to do so.

What are the issues that I feel that we as hydrologists should be covering, and which of Sir Michael Pitt's current 15 Urgent Recommendations and 72 Interim Conclusions relate to hydrology? Well, of Pitt's 15 recommendations, the majority concern operational matters, although two do touch on hydrology: the need to consider groundwater flooding more urgently, and the need for the EA and researchers to consider whether urban areas at risk of storm water flooding can be identified, and early warnings of such events developed.

There are quite a few hydrological 'hooks' within the 72 interim conclusions, and our submission must address such issues as climate change, more on surface water flooding, more effective use of floodplains, wetlands and other natural storage areas to "slow flood response", reservoir flood safety, and 'garden-grab'. This latter term relates to an increasing tendency for people with large gardens to sell off all or part of their gardens for new housing, a process that passes through planning laws easily as gardens are deemed to be 'brown land'. In addition, there is growing concern over the issue of people paving over their front gardens to provide off-road parking, a particular problem in large cities, and one where Pitt recommends a change in planning laws.

There are many areas where we as hydrologists can make reasoned submissions, suggesting what can make a difference to flooding, and what in our opinion can not, with our opinions backed up by hard scientific evidence. A huge number of organisations and individuals (over 600 to date) have submitted evidence to the Pitt review and to the associated House of Commons EFRA select committee review on flooding. Whilst much of this material has been of value, in my experience there are certainly many erroneous and opinionated submissions being written, and it is important that flood risk management be dealt with at the catchment level. Thus many individuals, parish councils and farmers have argued that "if only the channel past my farm/house/village/factory had been dredged and the culverts cleared, I would not have been flooded", yet if flood water is evacuated more effectively from rural headwater tributaries, downstream flooding of larger urban areas may be worsened. There is certainly a need to look more closely at using lower value agricultural land, water meadows and woodland for flood storage, adopting the "Making space for water" principles.

Just to finish my ramblings, I posed the question right at the start of this piece, were the summer 2007 floods an early indication of climate change? I firmly believe that the evidence suggests that this is not the case, but rather that 2007 was an extreme example of natural climate variability.

Why do I suggest this? Well for one reason, many (but certainly not all) of the global climate models upon which we are making judgements about the future climate of the UK in the 21st century suggest we will experience warmer, but wetter, winters and significantly warmer but drier summers. Certainly in a warmer summer air masses can hold greater precipitation, but models suggest more frequent small scale summer thunderstorm events, whereas during both the June and July floods, what we experienced was slow moving, widespread frontal rainfall, albeit with embedded convective cells. The summer 2007 rainfall was far from typical of what we are led to believe may happen later this century, and appears to have been caused by the jet stream being much stronger than normal, and located much further south than normal.

Frank Farquharson
President

More on floods.....

Oliver Pollard has kindly suggested that we include a link to the Environment Agency's web site that reviews all the emajor flood events that occurred in the UK during the summer:

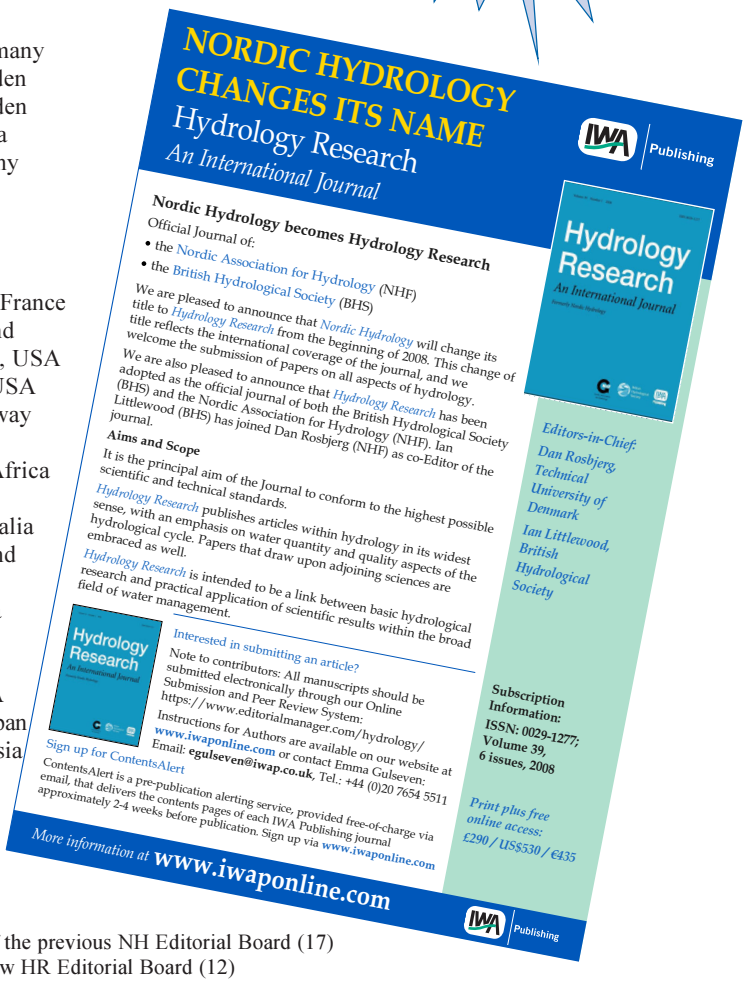
http://www.environment-agency.gov.uk/subjects/flood/1867303/

Hydrology Research

Our new journal is now well and truly established — see the (reduced) copy below of the official flyer issued by the publishers, IWAP.

Ian Littlewood, the BHS Editor, reported at our recent Committee meeting that the first issue of the re-launched journal was due to appear shortly. Ian also told us that he has set up a UK Steering Committee to guide the journal in its early days. The full Editorial Board is as follows:

András Bárdossy[1], Germany
Lars Bengtsson[1,3], Sweden
Sten Bergström[1,3], Sweden
Günter Blöschl[1], Austria
Ludwig Braun[1], Germany
Ann Calver[2,4], UK
Jesús Carrera[1], Spain
Ian Cluckie[2,4], UK
Barry Croke[2], Australia
Christophe Cudennec[2], France
Jónas Elíasson[1,3], Iceland
Efi Foufoula-Georgiou[1], USA
Rien van Genuchten[1], USA
Lars Gottschalk[1,3], Norway
Alan Gustard[2,4], UK
Denis Hughes[1], South Africa
Jetse Kalma[1], Australia
George Kuczera[1], Australia
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Miguel Mariño[1], USA
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Liliang Ren[2], China
K. D. Sharma[2], India
Jim Shuttleworth[2], USA
Kuniyoshi Takeuchi[2], Japan
Valery Vuglinsky[2], Russia
Howard Wheater[1,4], UK
Paul Whitehead[2,4], UK



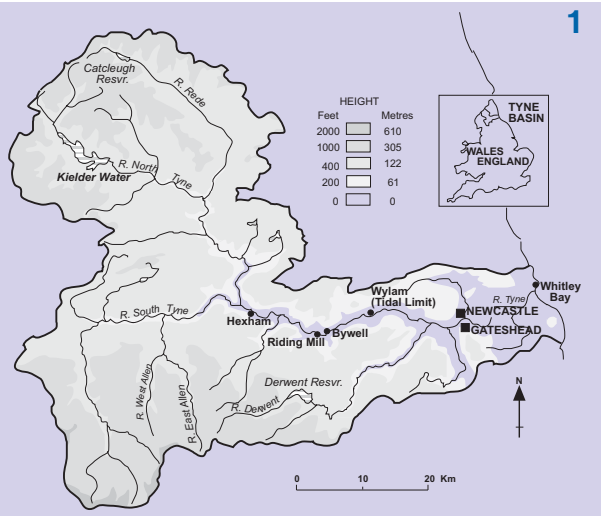
1. Continuing members of the previous NH Editorial Board (17)
2. Members joining the new HR Editorial Board (12)
3. Nordic-country member (5)
4. UK Steering Group (5)

A fishy tale

Salmon are mysterious – especially in their ability to navigate from the open ocean back precisely to the reach of river from which they set out as smolts one to three years previously.

The precise senses and cues that they use to swim from sea to estuary and from estuary to freshwater river are still uncertain. It is also a mystery why salmon (and sea trout) remain in an estuary and suffer stress and mortality when there is no significant physical barrier to their upstream progress. This has been the case in the Tyne estuary in hot dry summers such as 2003 when the estuary experienced high temperatures and low dissolved oxygen. In that year nearly 1200 dead salmon and sea trout were found in the upper reaches of the estuary. Two questions arise: what are the cues that salmon use to move from estuary to fresh water, and, could releases of freshwater be made from Kielder Water (Fig. 1) which would encourage fish to move out of the oxygen depleted estuary to comparative security in the river.

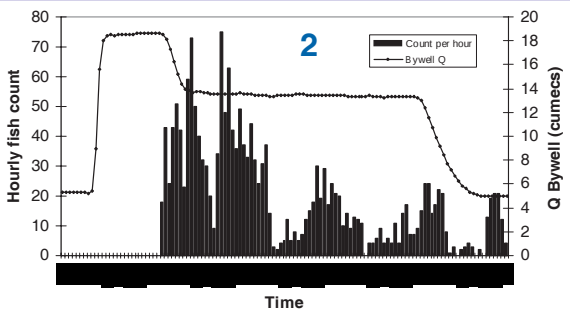
The main data source to answer these questions is a fish counter at Riding Mill which until now has provided inconclusive answers to these questions. There are two principal sources of difficulty. Firstly, the number of fish in the estuary is unknown and, irrespective of environmental conditions in the estuary or in the freshwater river, varies from day to day and from month to month. Secondly the counter is 11 kilometres upstream from the tidal limit at Wylam and any movement of fish across the counter could be interpreted as arising from fish encouraged to move from the lower freshwater river rather than from the estuary.



The River Tyne catchment

A recent Environment Agency project has investigated the links between fish movement at the counter and a range of environmental variables, including various attributes of river flow, river and tidal water temperature, tidal levels, cycle and atmospheric conditions. Inspection of the data suggested a strong link between the number of fish moving and the occurrence of both natural spates and Kielder releases. A database was therefore set up of nearly 100 events, evenly divided between releases and natural spates and covering a 10 year period. Results show that the daily fish count at Riding Mill increased on average by a factor of two following a Kielder release and by a factor of four following a natural spate. The number of fish passing declined thereafter but remained above pre-spate levels for several days. The longer the interval between releases or spates, the bigger is the response. The lower the initial flow the bigger the response.

However, effects are not felt at Riding Mill until nearly a day after the rise in discharge. The lag is explained by the combined time taken for the release/spate wave to progress downstream across the tidal limit and into the estuary, the time for fish to sense the change and to respond, and the time to swim upstream to Riding Mill. The effects are most clearly seen in the effects of a Kielder release at the end of the dry 2003 summer (Fig. 2). An initial flow of approximately 5 cumecs was increased by the release to 18 cumecs for a day, followed by a further three days at 14 cumecs before returning to 5 cumecs.



Hourly fish count at Riding Mill following the arrival of a Kielder release on 12 September 2003 (record 12–17 Sept)

From Figure 2 the following observations are made:

- No fish were moving in advance of the release. In fact not a single fish was recorded crossing the counter from 3 September until 13 September.
- In addition, no response was recorded with the arrival of the release wave at 09.00 on 12 September, nor indeed through the greater part of the higher release flow.
- Fish movement commenced abruptly at 0300 on 13 September, a delay of 18 hours and reached a first peak of 73 fish per hour at 1100 on 13th.
- The pattern of movement thereafter consisted of a series of diurnal peaks and troughs in fish numbers.
- Over the period of the release a total of over 1700 fish passed the counter.
- Fish continued to pass but at reduced numbers even when the flow had returned to its initial level.

These observations confirm that fish are unresponsive to the passage of the release wave in the freshwater river. The delay in response appears to confirm the impact of the release on fish in the estuary and their subsequent movement into the freshwater river. The release appears therefore to have attracted at least 1700 fish from the stressful and potentially lethal conditions in the estuary.

The evidence from these and numerous other releases and natural spates have provided the basis for recommendations on adjustment of the Kielder release policy in terms of the interval the releases should be made, for what duration and at what discharge.

David Archer
JBA Consulting
South Barn, Broughton Hall,
Skipton, BD23 3AE



Photo: David Carrick

The River Tyne is now the Number One salmon fishing river in England and Wales with over 3000 fish caught in most years. Fish mortality in the estuary has serious economic as well as environmental implications.

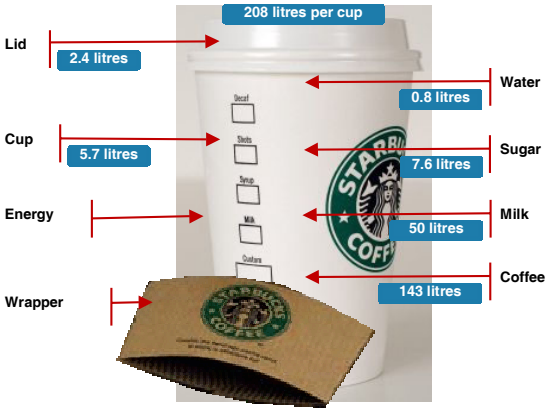
How Green is Your Water ?

BHS South East Section meting
ICE London, 15th November 2007

There is a growing requirement to consider the ecological footprint of the United Kingdom, both in terms of water requirements for food consumption and also in the water industry with respect to water supply and treatment. This event focused on two different aspects of assessing the environmental implications for water supply and demand.

The first presentation was given by **Stuart Orr** (Freshwater Policy Officer, World Wildlife Fund). Stuart examined the draw on global water resources from a UK country perspective to assess the water required to meet UK consumption and aimed to illustrate the role water plays as an invisible and forgotten aspect of various commodities in our economy. Fundamental to this scenario is assessing the way that food and fibre production can drive the over-abstraction of freshwater ecosystems. This is based on a pragmatic assessment and one that takes into account the dynamic way in which water interacts and exists on earth. WWF's

Next time you buy a Latte, consider this!



Selected Products and Water Use

Product input	*Raw material input*	*Water to produce*
1 cotton T-shirt	4 oz. ginned	500–2000 litres
1 litre of Coke	2 oz. sugar	175–250 litres
1 oz slice of cheese	6 oz. milk	40 litres
1 1/2 lb hamburger	8 oz. of beef	3000–15 000 litres

conclusion is that while water footprint reductions are beneficial overall, it is reductions in water footprint from places of unsustainable water use, poorly managed water systems or areas of water scarcity that are both desirable and meaningful.

The presentation concluded that a multitude of acute pressures on global water resources and the resultant strain on humans and ecosystems worldwide make it less tenable than ever to take water's movement within food trade for granted. The UK is an affluent nation with a highly diverse consumption pattern. This includes large quantities of livestock products, tea, cotton and cocoa to name a few, originating from 177 countries. Stuart showed that the average water footprint of a UK citizen is 4,950 litres per capita per day. The period of analysis for this report is 2000–04.

Tom Wood (Environmental Consultant, Atkins) gave an overview of carbon accounting and the use of the carbon footprint in the water industry.

The carbon footprint is defined as the total emissions of all greenhouse gasses expressed in carbon dioxide equivalents for the entity being considered. This may include ongoing operation-related emissions as well as initial construction-related emissions for new construction schemes. In each case these will typically include emissions from energy/fuel consumption, transport of staff/equipment/materials and the emissions embodied in materials. Carbon footprints have been calculated based on published emissions conversion factors (DEFRA) and default values for

embodied carbon from original 'life-cycle analysis' studies. Carbon footprinting tools have been generated to bring these values together and apply assumptions specific to each case. The difficulties of choosing and applying values for embodied carbon were discussed.

There are increasing requirements from the regulators of the UK water industry to include social and environmental costs (including the shadow price of carbon) in decision-making processes. Atkins has worked with water companies to quantify carbon emissions in relation to water company leakage levels, proposed water resource schemes and demand management measures. In addition, Atkins has looked at the carbon emissions which might result from regulations under the Water Framework Directive, concluding that industry emissions may rise significantly.

In the future, it is expected that economic decisions in the UK water industry will be made increasingly with the shadow price of carbon included. It is also expected that policies will be appraised with a view to the implications in terms of carbon emissions. The water industry will certainly have to operate as part of a low (or reduced) carbon economy.

For any questions please contact: tom.wood@atkinsglobal.com

Helen Procter
Atkins Ltd

The American Geophysical Union (AGU) Fall Meeting

10th–14th December 2007
San Francisco

The AGU Fall meeting was attended by approximately 15 000 researchers from all over the world. For this reason, this report will primarily focus on the sessions which relate to my personal research area, the seasonal prediction of river flows.

The meeting opened with an Icebreaker Reception on the Sunday evening. On the Monday morning presentations were given on the US contribution to International Hydrology. **Gordon Young** detailed the US contribution, both organizational and intellectual, to the International Association of Hydrological Sciences (IAHS). A talk by **Charles Vörösmarty** on major transformations of the global water system made an important point on how human activity is altering the system without sufficient knowledge of how it will respond. **David Gochis** spoke about the North American Monsoon Experiment (NAME), which aims to improve predictions of warm season precipitation in North America. The research so far has advanced the understanding of the atmospheric, oceanic and land surface conditions during the monsoon in the south-western U.S. and the areas surrounding the Gulf of California. NAME is also transferring the scientific advancements towards societal applications such as water resources management. Leading on from this, a presentation given by **Peter Webster** highlighted that the implementation of hydrological forecasts was the most difficult thing to achieve. Examples of how to represent forecasts graphically were given for forecasts issued for the Ganges in Bangladesh.

On Monday afternoon we displayed our poster research in the session *Multi-model Ensemble Forecasts for Climate and Streamflow*. Our work involved the use of the DEMETER multi-model ensemble climate dataset to drive a rainfall–runoff model for the River Dyfi basin in Wales. One conclusion drawn was that raw multi-model precipitation data cannot be used directly to skilfully forecast runoff in temperate basins. Feedback was given and gratefully received on the research.

A Hydrology lunch was held on the Tuesday, at which a few distinguished researchers were recognised for their contribution to

hydrology. An interesting poster by **Tim Owen** described the new National Integrated Drought Information System (NIDIS) United States drought portal. This service provides details of arising and current droughts for the US. In the afternoon a lecture was given by **Mark Serreze** on Arctic Climate Change. A startling fact was the recent rapid loss of sea-ice over the past 30 years, to an extent comparable to the area of 48 contiguous US states.

On the Wednesday there were two parallel sessions covering the theme of *multi-model ensemble streamflow forecasts*. **Lifeng Luo** identified the three uncertainties of Ensemble Hydrologic Prediction — the hydrological model and its parameters, the hydrological initial conditions and the atmospheric forcing. The development and evaluation of a seasonal hydrological ensemble prediction system over the Eastern U.S. was also presented. In another talk, he displayed a model-based Drought Monitor and Prediction System (DMAPS) for the US. At several months lead time, DMAPS was able to accurately forecast the evolution of a drought.

Rick Lawford discussed the drought information which is required by various end users on the Canadian Prairies. Certain user requirements identified are informing users when they are in a drought, the severity of the drought and when the drought will end. (It was noted that the last point requires users to have reliable forecasts of precipitation!)

A major part of the meeting revolved around the poster sessions. These were certainly very beneficial, not only to learn about the work displayed but also to meet fellow researchers in the field. The AGU Fall Meeting was a wonderful experience, especially in terms of being able to disseminate the research which we are doing to the wider community. It also gave the opportunity to embrace developments in other areas of the Earth Sciences. I would like to deeply thank the BHS for awarding a travel grant which gave me the opportunity to attend the 2007 meeting.

David Lavers
Centre for Ecology and Hydrology

In-situ hydrological monitoring

BHS Pennines Hydrological Group
Leeds University, 17th January 2008

The morning started with registration, a chance to meet other delegates, have a coffee and look around the exhibition stands provided by our sponsors:

Simon Wills – OTT Hydrometery
John Bolton – MGS
Nick Martin – SonTek YSI

Robin Guy from Mouchel gave a short talk welcoming everyone to the proceedings and outlining the plan for the day; he was followed by **Graham Clark** from the University of Leeds Geography department talking about the skills in their department and the MSc courses available.

The first talk "*Great Fen Restoration – Hydrological Monitoring below Sea Level*" was given by **Rachael Rees** (Mouchel) and **Nick Martin** (SonTek YSI). The Great Fen is an area in south- east England in which an ecological restoration scheme has begun, attempting to re-create fens, swamps, wet grassland and open water on land that can be released from agricultural production.

Mouchel have been commissioned to install flow monitoring stations and undertake calibration measurements at nine sites within the Great Fen area. Flow measurements in an area 3 metres below sea level has its problems: the water movement is slow with both positive and negative flows. Water levels are maintained throughout the area using a pumping regime.

The nine sites are being measured using SonTek Sideways Lookers, Argonaut – SW and Starflows. **Nick Martin** (SonTek YSI) gave a short talk explaining the installation of the Sideways Lookers and the Argonaut – SW, the theory behind how they work and any problems which may be encountered.

Calibration gaugings at these sites have to be undertaken at low and high flows. These are carried out using the Acoustic Doppler Current Profiler (ADCP) and have been planned to coincide with pumps running which generates a range of steady flows to facilitate the calibration gaugings. However, it is difficult to gauge at the highest flows with all six pumps running as there would need to be a very large amount of water in the system to maintain the water levels needed for the site.

More calibration gaugings are planned for the future. Bi-monthly maintenance visits and on-site beam checks are being carried out to ensure the quality of the data is good and solar panels will be installed so that batteries will not have to be changed on a monthly basis.

The second talk of the day "*When a Flood Peak is not a Flood Peak*" was given by **Richard Maxted**, Environment Agency. Richard talked about the rainfall events in June 2007, mainly concentrating on the affected areas in Yorkshire. This consisted of two rainfall events within the month. Several days of rain occurred in mid-June, followed by concentrated localised rainfall in late June, such that the ground already saturated by the earlier event caused many rivers to reach record levels and in certain areas leading to a 1-in-200 year event.

Collecting data in these conditions proved to be very challenging. Some sites had missing data altogether, caused by a number of problems including measuring equipment being ripped out and damaged by flood waters and equipment failing and being drowned out under a large amount of water.

Check gaugings were carried out, but finding a safe place to gauge from in such extreme conditions proved very difficult, and even impossible in some cases. When they were carried out, turbulence in the water caused the ADCP to miss data and drop out.

The next challenge was where to place the flow peak. With data collected from the ultrasonic gauging, ADCP and from ratings equations all creating different sized peaks, where on earth do you place the rating curve? The data are very complex in flood conditions, with many factors having to be taken into account. Flood data are always a compromise; it is important therefore to recognise uncertainty and accept compromise and imperfections.

The third talk of the day "Y*ear-round Monitoring of the Hydroecology of an Alpine Glacial-fed Braided River*" was by **Neil Dickson** of Leeds University. Alpine river systems have a unique flow regime, characterised by glacier melt and rainfall. In these conditions, only specialised taxa are adapted to exist in the extreme conditions making them useful indicators for climate change.

Working at 2000 metres above sea level on the Odenwinkelkees Eisboden plain, Grossglockner range, in the Austrian Central Alps, the project aimed to develop a quantitive hydroecology model of an alpine river system to develop an understanding of hydro-ecology interactions and provide useful predictive outputs.

The work included downloading data loggers, dGPS surveying, installing additional temperature loggers and invertebrate sampling. Variable conditions made these tasks difficult, especially in the winter time when there were issues with access, heavy snowfall made sites difficult to get to and low temperatures reduced battery life on equipment and contraction of sockets on linking cables. Snow buried some of the equipment and GPS records were not accurate enough to find them. However, data were obtained during these visits plus sufficient experience to make improvements for future visits such as cable connections with low thermal expansion coefficients, dGPS logging of all equipment positions and transmitters on equipment that allow tracking (PIT tags).

The final talk was "*Automated Observation of a "remote" UK Upland Catchment*", by **Ian Marshal** of Lancaster University. The aim of this study was to characterise inputs and outputs of a 'system' in the Peak District to enable a better understanding of complex events and extract climate change signals.

The site chosen was Crowden Great Brook, where currently there are seven nodes, one with a GSM modem

to communicate alarm events back to base, four to measure temperature, battery voltage and soil moisture. There are two additional rain gauges and plans to add an extra transect during summer 2008.

There were a number of problems, for example, with equipment damaged by moving boulders, being flooded out and by people picking them up to see what they are. So the need for these alarms to sound and indicate problems is essential as the data are retrieved only every two months or when repairs are required. The data recovery is used to update the control rules for the alarms, so more data available enable the rules to be much improved and the data to become more useful. For example, using a fixed threshold generated too many 'low battery' alarms. Looking at the data it can be seen that the batteries are low due to diurnal fluctuations; it is colder during the night but they then recover during the day. Using this information the rules can be refined and the 'low battery' alarm set at a lower threshold. Other sites are now being established in the Lancaster and Upper Teesdale areas to observe how the equipment performs in different sites.

The 'sensor network' technology is maturing to the point where it can assist with new science. Available technology can support many useful adaptive behaviours, but software must be commissioned for each site.

Field trip to Hatfield Moor

Robin Guy gave a brief introduction to the site before **Kevin Bull,** the Site Manager, gave a guided walk and history of the site. Hatfield Moor is a part of the Humberhead Peatlands Nature Reserve; together with Thorne Moor, they comprise the largest area of lowland raised bog in Britain, occupying some 3318 ha, the majority of which is managed by Natural England. Peat has been taken from the site for hundreds of years, initially by local people as fuel, but extensive abstraction has damaged the site and in some areas less than one metre of peat remains. Peat cutting has now ceased on the Thorne and Hatfield sites.

Before the extensive peat extraction took place, the moors formed a raised bog. The aim of current conservation management therefore is for the site to retain suitable conditions for the development of a raised bog and its vegetation. To do this the land has been re-wetted; a high water level has to be maintained which is achieved in the form of peat dams creating 'paddocks' of wetted areas.

Mouchel were awarded the contract to install and monitor a number of gauge boards and boreholes with diver data loggers and barometric divers in a number of different areas throughout the site. Further sites were installed for the Environment Agency to calculate daily surface water flow using Thalamedis and Starflow loggers. A Starflow logger site was seen during the guided walk and **Claire Anderson** (Environment Agency) gave a short talk about these surface water sites. During the guided walk nested borehole sites were also seen and **Oliver Pattenden** (Mott McDonalds) talked about what was expected for the site.

Nichola Turner
Mouchel

Books

Apologies to members who subscribe to the hydrology mailbase as they will have already received a flyer about ***Managing water resources in a changing physical and social environment,*** edited by P.J. Robinson, J.A.A. Jones and M-K Woo. However, for the rest of you, please note that there is a special price for BHS members at £17.50 post free.

The book has been compiled by the Commission for Water Sustainability and comprises 16 chapters written by both engineering and geographical hydrologists, practitioners and academics. Topics range from water ethics to flood modelling and water management theory, and geographically from Europe and the Americas to China, India and Africa. Full details and order form on: http:/ watersustainability.ph.unito.it

Jim McCulloch has kindly reviewed Ian Strangeways' ***Precipitation Theory, Mesasurement and Distribution,*** published by Cambridge University Press, at £70.00 (ISBN-13 987-0-52185117-6 hardback).

"Strangeways' interesting monograph on precipitation ranges from the ideas of Greek philosophers on the origin of natural waters to a

present day understanding of the components of precipitation — rainfall, hail, snow and mist. While water was managed very effectively in Persian, Egyptian, Sumarian, Chinese, Greek and Roman times using qanats, irrigation channels and dams, interest in the actual measurement of precipitation seems to have been minimal.

Yet, in any serious study of the environment, knowledge of precipitation is essential. Research in hydrology requires measurement of the input to the hydrological cycle in say, a complete river basin or catchment, to be as accurate as possible. Ian, during his time as the engineer at the Institute of Hydrology leading development of instrumentation, was only too well aware of the difficulties inherent in the design of gauges and in the planning of complete networks of such devices to achieve the most accurate possible estimate of the areal rainfall over an experimental basin. The reader of this book will appreciate that the apparent simplicity of measuring rainfall as the catch in a bucket located at a single point contrasts with the scientific requirement to obtain, routinely, the best possible estimate of the rainfall and its variance over the entire area of the water catchment under study. Inevitably, inter-relationships with the other physical variables in the hydrological cycle must be understood; the need for knowledge of the physical processes inherent in measuring all these variables explains the physics throughout the book.

Ian presents his material in five parts: Past theories of rain and snow, (ancients and renaissance); Present theories of precipitation (and cloud formation); Measuring precipitation (at ground level and with radar and satellites);The global distribution of precipitation (including datasets, precipitation variability and extremes); and Future developments. After each chapter, a bibliography enables the reader to further his research.

Inevitably the contents range from design and mounting of gauges to considerations of radar measurements and of orbiting satellites. Ian mentions El Nino and La Nina, the Southern Oscillation and the North Atlantic, Arctic and Antarctic Oscillations together with extremes but does not venture into Global Warming which will undoubtedly interest readers once they have mastered the physics of measuring precipitation.

This book is elegantly presented and well edited and deserves a space in every hydrologist's bookshelf.

J S G McCulloch
Oxford

News from members

Prof **Paul Younger** of Newcastle University, former BHS Honorary Secretary, was recently elected a Fellow of the Royal Academy of Engineering. Paul was inducted as an FREng by HRH the Duke of Edinburgh at a ceremony held in London on 5th November 2007; a particular delight of the evening for Paul was toasting success with Mike Hamlin, who was BHS President back when Paul was Hon.Sec.

Unesco's International Water Prize for Water Resources in Arid Zones, was awarded on World Science Day for Peace and Development (10 Nov 2007) to the Centre for the Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA) at the University of Arizona, and the Centre for Hydrometeorology and Remote Sensing (CHRS) at the University of California, Irvine. The centres, under the guidance of Prof **Jim Shuttleworth** (SAHRA) and Prof S. Sorooshian (CHRS), are rewarded for strengthening the capacity to manage water resources in arid and semi-arid areas through a network of international and regional cooperation. These two centres provide valuable support to G-WADI, UNESCO/IHP's global network on water and development information for arid lands.

John Griffin (who edited *Circulation* until last year) is still at the Centre for Ecology & Hydrology in Wallingford but now in a different job. Instead of editing CEH external reports, leaflets and website (www.ceh.ac.uk), John has moved into the People & Skills section and is managing internal communications across CEH. The current restructuring means many staff movements and the closure of some sites, so it is important to keep all staff well informed to help the whole organisation work effectively. New facilities are going up on the Wallingford site for extra staff.

Power to the superscript!

Foxlease Cottage
Hazler Road
Church Stretton

As usual I was pleased to receive my copy of *Circulation* (No. 95) with its smart layout and immaculate editing (well done, Celia!). Pleasure turned to dismay when I saw the graph of streamflow on p. 23, which has mean monthly flows of the R. Tay expressed in units of Mm^3. When we apply a power to a unit, it operates on the prefix as well as the base unit. A Mm is 10^6 metres, therefore 1 Mm^3 has to be $(10^6 \text{ m})^3$, or 10^{18} m^3. This is a useful unit for expressing global water resources but is a little large for the flow of the Tay.

Of course, there will be cries of "but that's not what we mean; we mean a million m^3". This is not the first time I have seen this misuse of this unit, and that's what they always say. In that case, presumably 1 Mm^2 is a million m^2?

I assume we would all agree that 1 km^2 is 10^6 m^2. Having taught undergraduates in environmental and Earth sciences in three respected university departments, I know the difficulty of getting some of them to understand and remember that fact. If we are now trying to tell them that 1 km^2 is 10^6 m^2 but 1 Mm^2 is also 10^6 m^2, I fear we are going to confuse them (and many practitioners). If we need a symbol for a million m^3 (and I am far from convinced that we do) then it can logically only be $M.m^3$. However, the possibilities of this being mistyped, misprinted or misinterpreted are so great that it is best avoided. As we are already using superscripts for the symbols, just write 10^6 m^3 and have done with it.

Michael Price
michael.price_hydro@btinternet.com

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 **Peter Ede**, Mott MacDonald Group, Demeter House, Station Road, Cambridge, CB1 2RS *(tel 01223 463690, email peter.ede@mottmac.com)*.

Editorial

As well as this print version, we have sent a PDF of *Circulation* round to all members for whom we have email addresses. If you would prefer not to receive this electronically, please let Tim Fuller know. We plan to put past issues of *Circulation* on the BHS web site but will not use the web for the current issue until we have set up restricted 'Members only' access.

Several people have reported difficulties with the Membership Directory. May I remind you that we have issued a new PDF version (email from Tim Fuller dated 11/05/07) in which Tim offered to send hard copies to those that requested it: there was also a facility to update your details (but please see page 2).

Celia Kirby

Water Resource Associates

A network of consultants in hydraulics, hydrology, groundwater & environmental issues

Water Resource Associates [**WRA**] was formed in 1994 by a network of established individual consultants with world-wide experience of water issues. The company provides a specialist consultancy service in water supply, flood control, irrigation, groundwater, resource development, systems analysis and water quality modelling. Experience spans 110 countries covering all the major climatic regions of the world.

Areas of expertise include:

- Analysis & prediction of floods & droughts
- Water resource assessment & yield analysis
- Hydrological & Hydrodynamic modelling
- Development of hydrological software
- Hydrogeological investigations
- Water quality assessment and modelling
- Data capture, digitising & database design



WRA has developed a range of specialised hydrological & water resource assessment software:

- HYSIM - a hydrological catchment model for resource assessment and flow naturalisation
- HYDRO - for multi-purpose reservoir operation
- AQUATOR – for simulation of complex water resource systems and conjunctive use
- HERMES - a river water quality model
- LASER – a river and lake liming model
- CDIG - digitising software for hydrological data
- PTFIT - pumping test & well loss analysis
- WDT – well design guide and toolkit

WRA clients include the European Union, French Government, Severn Trent Water, Southern Water, South East Water, Bristol Water, UK Environment Agency, SNIFFER [Scotland and Northern Ireland Forum for Environmental Research], CEH & HR Wallingford, British Waterways, National Power, International Consulting Engineering firms, land and property developers, and the tourism industry.

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Forthcoming Events

8th IAHS Scientific Assembly

The next IAHS Scientific Assembly is to be held in Hyderabad, India, 7–12 September 2009, with the working title "Water: a vital resource under stress – how science can help?"
There will be 7 symposia and 11 workshops — please check www.appliedhydrology.org/iahs/index.html for further details

EGU General Assembly

Wien, Austria
13–18 April 2008
Members should note the following sessions:
Flood risk and uncertainty
Co-Convener: Paul Bates (paul.bates@bristol.ac.uk)
and **Linking geomorphological and hydrological processes at reach and catchment scales**
Convener: Damian Lawler (d.m.lawler@bham.ac.uk)

BHS Peter Wolf Symposium

This annual event, designed for postgrads and early career hydrologists, is to be held 5–6 June 2008 at the University of Edinburgh, School of GeoSciences, Drummond Street, Edinburgh — see flyer included with *Circulation*.

Diary

20th February 2008
BHS & Royal Met Soc
"Climate change: scenarios, impacts and adaptation"
Venue: Newcastle
Contact: Claire Walsh
(Tel: 0191 222 6618)

27th Feb 2008
Scottish Hydrological Group
"Delivering CAR in practice: challenges at the beginning of implementation of abstraction and impoundment regimes in Scotland"
Venue: Royal Over-Seas League, Edinburgh
Time: 6 or 6.30pm
Contact: Paul Hart
(p.hart@royalhaskoning.com)

BHS 2008
Sustainable Hydrology for the 21st Century
15–17 September 2008

Make sure you have this date in your Diary

Full details are given at
www.events.ex.ac.uk/bhs2008

Let's try and make this a bumper event, as befits the tenth anniversary of BHS residential Symposia

Copy deadline for Circulation No. 95
18th April 2008

13th March 2008
BHS South East Section
"Urban flood risk and PPS25"
Venue: ICE, London
Time: 6.30 pm
Contact: Helen Procter (Tel: 01372 756478)

19th March 2008
BHS South West Section
"Weather radar and rainfall"
Venue: University of Bristol
Time: 14.00
Contact: Peter Dempsey (Tel: 01392 884254)

25th March 2008
Scottish Hydrological Group
"Flood risk issues in northern Scotland"
Venue: Green House, Beechwood Pusiness Park, Inverness.
Time: half-day meeting
Contact: Paul Hart
(p.hart@royalhaskoning.com)

7th May 2008
BHS Midlands Section
"Surface-water quality: processes, models, management and policy"
Venue: Birmingham University
Contact: Damian Lawler (Tel: 0121 414 5532)

11th June 2008
BHS South East Section
"Flooding issues in the Thames Gateway"
All day meeting: site visit, practical demonstrations
Contact: Helen Procter (Tel: 01372 756478)