Circulation

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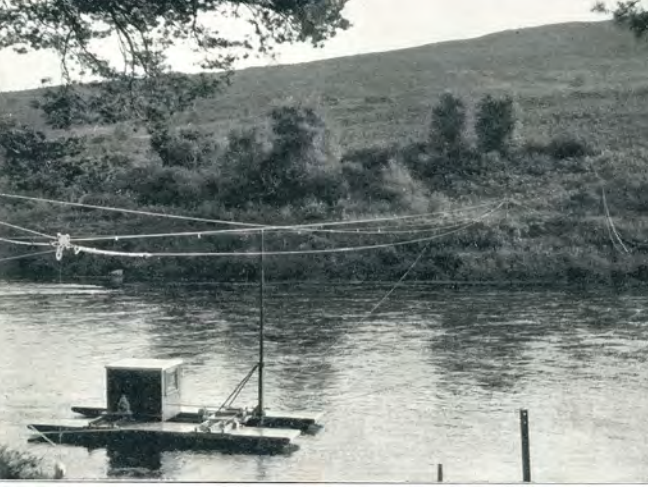
Circulation is indexed in *Geosystems' Hydrotitles* & *GeoArchive* and *NISC HydroROM.*

Improved access to NRFA river flow data

Improved access to NRFA river flow dataThe National River Flow Archive has recently doubled the number of downloadable river flow datasets available through its website (http://www.ceh.ac.uk/data/nrfa). The changes take the total number of gauging stations where daily flow data is freely downloadable to just under 400.

The National River Flow Archive, operated by the Centre for Ecology & Hydrology, provides a centralised source of flow data for rivers across the country, as well as a range of complementary datasets and guidance on the use of the data. At a time of greatly enhanced scientific, public and political interest in river flow patterns, the release makes it easy for policymakers, academics, the private sector and schools to access key hydrometric data.

The data release is the result of a joint initiative between the NRFA and its major data providers, the EA, SEPA and the Northern Ireland Rivers Agency. A pre-requisite for extending the number of daily flow time series available for downloading is the need to ensure that the data held on the NRFA are as complete and high quality as possible and are largely consistent



Gauging on the Dee at Woodend in the 1930s (photo from River Flow Records, 1935)

with the corresponding data held by the measuring authorities. Over the last three years the project has carefully evaluated more than 8,000 station years of data, leading to significant updates to the historical data archives held by both the NRFA and operational measuring authorities.

The newly downloadable stations include some interesting sites including, the Woodend gauging station on the River Dee in Scotland, the longest record in the group released. The site was set up in 1929 by Captain W.N. McClean, one of the early pioneers of UK river flow measurement (see photo). The changes mean that daily flow data from the majority of the stations in the 'UK Benchmark Network' are now downloadable from the NRFA website. This benchmark network of 'near-natural' catchments has been used for studies of long-term variability and changes in river flow patterns, enhancing understanding of the relationship between river flow trends and climatic changes.

The NRFA has an ongoing programme of data validation, improvement and release, driven by a long term ambition to make all of the archive's data openly accessible to potential users. The recent web release represents around 36% of the archive's primary flow data but users are reminded that they can view metadata for all of the NRFA registered gauging stations on the NRFA website and any of the archive's non-downloadable data can be accessed via the Data Retrievals Helpdesk: nrfa@ceh.ac.uk 01491 692599.

Harry Dixon
Centre for Ecology & Hydrology

New members

Jonathan William Basell.....Imperial College London
Natalie Brisland.....Wallingford Hydrosolutions
Alison Carswell.....University of Reading
James Cullinane.....Imperial College London
Jonathan Dick.....University of Aberdeen
Alexander Fionda.....Skelton-in-Cleveland
Anthony Guay.....Gifford, part of Ramboll,Southampton
Katie Scott Gutsell.....Leeds
Henry John Kelly.....Petersfield, Hants
Ann Barbara Kretzschmar.....University of Lancaster
Lindsay Newton.....Basingstoke
Irena Novakova.....Colchester
Richard O'Callaghan.....Environment Agency, Reading
David Rebollo.....Mott Macdonald, Cambridge
Bobby Richard Stuart Russell.....Euroconsult, Mott Macdonald, Amsterdam
Katarzyna Sawicka.....University of Reading
Jie Shi.....University of Cardiff
Luke Strickland.....Gifford LLP, Birmingham
Helen Lindsay Tapley.....Denbighshire County Council, Ruthin
Jade Ward.....Harrogate
Yunqing Xuan.....University of Swansea
Zed Diyana Zulkafli.....Imperial College London

President's piece

Those of you on the BHS mailbase system will have received a request recently to contribute evidence to the ICE's state of the nation report on water. This is intended by ICE to show what engineering needs to contribute to ensure the water infrastructure is able to serve the country and meet future predicted needs. In considering the Society's contribution the committee thought it should concentrate on what hydrology needs if it is to play its part.

It made for an interesting discussion in where we would like to see improvements and boiled down to four main areas:

- Maintaining and developing the skills base, which we thought should be focused on post graduate training – counter to the current trend in NERC funding – but also at schools where a hydrological understanding will be necessary for the future.

- Development and maintenance of a hydrological research programme, necessary to fully understand the impact of increasing water demands in an increasingly variable climate

- Maintenance of a long-term hydrological database – see above!

- Providing public access to hydrological data which, though slowly improving in some areas is still woeful in many areas (rainfall data and sub-daily data sprang to mind) and far from joined-up.

This summed up what I think we ought to be aiming for over the next few years in British Hydrology and I would be well pleased if we were to make significant progress in all of them.

Raising awareness of hydrological issues is certainly on our agenda, and it seems that hydrology itself is willing to give us a hand. With groundwater at an all-time low in the south east so near the end of the winter recharge period, water shortage could well be on the agenda this summer. At the other end of the country high runoff has been experienced and although widespread flooding seems to have been averted, it was a close thing. It used to be that hydrology was either floods or droughts, but now we seem capable of both at once.

There is no doubt Hydrology ought to be high on the agenda and we will do our best to make sure it is.

Bob Sargent
President

Change of Editor (NHF) *Hydrology Research*

Prof Dan Rosbjerg, Technical University of Denmark, stood down as Editor (NHF) at the end of 2011. The new Editor (NHF) is Prof Chong-Yu Xu, Oslo University. Dan had been Editor Nordic Hydrology, and then Editor (NHF) Hydrology Research, since 1986. There will be an HR Editorial to mark and celebrate his outstanding contributions to both NH and HR. We wish Dan a happy 'retirement' and extend a warm welcome to Chong-Yu. Chong-Yu is Professor of Hydrology in the Depatment of Geosciences, University of Oslo. A graduate of Nanjing University, Chong-Yu has been a very active researcher based in north-wst Europe since 1993. First at the Free University Brussels, then at Uppsala University before moving to Oslo. He has strong working links with the Chinese Academy of Sciences and with Nanjing, Wuhan and Hohai Universities. Chong-Yu's research interests include hydrological modelling at global, regional and catchment scales, for climate and environmental change impact assessment, model parameter regionalization, etc.

Climate change and water resources — a further comment

I share many of David Evans's concerns about the effect of climate change on recharge and have already said so[1] but I am disturbed by some of his comments and those of people writing in response (*Circulation* 110 and 111). To put it bluntly, surface hydrologists simply do not get it; perhaps this is because they have a different idea of time from groundwater people, who are more used to geological timescales.

Gravity tries to drive all rain into the ground — it fails either when the ground is impermeable (or frozen) or when the ground is permeable but the aquifer is already 'full' so that the local water table has reached the surface. This occurs at a low point, usually a valley and so results in a gaining stream. Put simply, the reason that very little of the Earth's liquid fresh water is on the surface is because surface water is water that the ground has rejected. If there is to be less effective rainfall, there will be less water for the ground to reject.

As the water table rises and falls with varying recharge, the length of the gaining reach will fluctuate; this gives rise to intermittent streams, in Britain, most notably the 'winterbournes' of the Chalk. With climate change predicted to cause greater variation in effective rainfall both between winter and summer and from year to year (as evidenced already by the difference, for example, over England between 2001, 2008 and this year) then irrespective of groundwater abstraction those stream networks are going to show greater change in response — and we have to get used to the idea.

When the supply of something is seen as unpredictable, the usual human response is to try to store it at times of surplus. David Evans believes that the storage should come in the form of reservoirs rather than aquifers. David's list of reservoir benefits includes:

- Secondary use of returned effluent. But this does – or should – happen whether the water source is surface or groundwater (incidentally, I agree wholeheartedly about the need to re-use coastal sewage effluent instead of pumping it out to sea — in many cases it could be used for groundwater recharge).
- The lake itself — beauty, amenity, etc. But what about the loss of farmland submerged beneath it? With growing population and dwindling available farmland (in UK and worldwide) we are going to need all the productive land we can get — and reservoirs usually take the best, easily farmed, land in valley bottoms.

A shortcoming of reservoirs is that unlike aquifers they hold very little water. Lowering the water table over the Chalk outcrop by 1 metre, for example, releases a volume of water equivalent to the gross storage of Kielder. As I showed some years ago[2] when our principal aquifers are getting down to their lowest drought storage levels, they still hold more usable water than do the country's reservoirs when they are full. Incidentally, the BGS study quoted in that paper, which I initiated for DoE and then the NRA, provided a model which the NRA and its successor were supposed to use to keep track of the usable water in storage in the Chalk. To the best of my knowledge it has never been either used or updated.

Another reservoir shortcoming is evaporation loss. For a reservoir with a surface area of around 2 km^2, a summer evaporative loss of 5 mm/day comes to 10 Ml/day. That may not sound much but it would supply a town of around 30 000 people and unlike mains leakage (see the comment from Mike Lowing) that water is gone forever.

In contrast to his paean about the benefits of storing water in reservoirs and using it for supply so that the effluent can be used to maintain river flows, David states that groundwater abstraction is 'intrinsically damaging'. So it is fine to interrupt and reduce the flow of a stream (often fed partly by groundwater!) by building a costly dam and flooding farmland but wrong to reduce the flow of a stream by taking some of the groundwater from its (free) natural reservoir with a cheap borehole?

A balance is reached in any groundwater flow system between

recharge areas and discharge areas. The process of discharge, concentrated via a stream, is much more efficient than recharge from effective rainfall, so that discharge areas are generally much smaller than recharge areas. With recharge declining, as David Evans predicts, there will be less water for the ground to reject and perennial discharge areas will get smaller. The wildlife that depends on those streams will adjust has it has done countless times in geological history. It may be a pity for those of us who like walking along streams, it may be bad news for anglers, but unless we can decrease the population, reverse the world-wide increase in per capita consumption, and develop high-yield crops that are less thirsty, there is precious little that we can do about it.

Mike Price
Church Stretton

[1]Price, M, 1998. Water storage and climate change in Great Britain – the role of groundwater. *Proc. Instn. Civ. Engrs, Water, Maritime and Energy Journal*, **130**: 42–50.

[2]Price, M, 2008. The wrong sort of rain. *Geoscientist*, **18**, 2 (February): 22–26.

Water footprinting – a useful tool?

The book review of the Water Footprint Network (WFN) Manual in November's *Circulation* aroused my interest and set off a chain of enquiry into aspects of water use which I hadn't previously thought much about. I offer a few personal thoughts in the hope that they will prompt you to do likewise.

Assessing water use - virtual water and water footprinting

Global demand for water is forecast to outstrip supply by 40% by 2030 due to factors such as population growth, climate change, and increased living standards. However there is generally little awareness that around 95% of water use is not direct consumption but takes the form of 'virtual'[1] water associated with production. 86% is used in the production of food, and 9% is associated with industrial production. A quarter of the water used is exported as product, and 76% of exported products are agricultural. So global agricultural trade effectively results in significant international water transfers[2]. Global trade is almost entirely driven by economic and political considerations, but water availability issues are likely to become increasingly relevant, calling for effective assessment and decision-support tools.

Virtual water use can be assessed in two different ways: water footprinting is inventory-based whereas impact assessment methods also take into account the environmental impact of products over their life-cycle (LCIA). The latter are widely used for carbon footprinting but are relatively new for water.

To provide a systematic framework for the calculations, the WFN method[3] for water footprinting uses colour coding to distinguish the different origins of water consumed. This apparently simple blue/green/grey classification has been picked up in a number of press items about the method[4], and provides an intuitively appealing attempt to 'sell' the concept. Simplistically, it is 'better' to use green water i.e. rainwater stored in soil moisture or captured directly, than to use blue water taken from lakes, rivers and groundwater. However, this is not always the case, and assessing the relative merits of even blue and green water use is highly complex and dependent on circumstances[5]. Both are aggregated into the overall footprint.

As a single value, the footprint cannot reflect variations in the actual availability of water over space and time. A large footprint in an area with plentiful supply is not in itself a problem, so comparisons between different geographic areas may be misleading. For example, the production of a kilo of English lamb has been calculated as requiring over 50 000 litres of water[6]. However, over 96% of this is green water, and most English lambs will be grazing rain-fed pasture where water

shortage is not an issue, so their footprint will have far less environmental impact than that of meat from animals fed indoors on irrigated crops. The impact of water use may also vary in time (seasonally and annually). An example is rice cultivation, which in Asia is commonly based on green water in the monsoon season, but requires irrigation using blue water, possibly from some distance away, during the dry season. Overall, one of the main criticisms of the footprinting method is the failure to reflect environmental impact.

The WFN manual demonstrates that the calculations required to build up the footprint are lengthy and detailed, and liable to be affected by limitations in the available data. Furthermore, last month's review highlighted hydrological reasons for concern over the methods and assumptions. This suggests that calculations should always be done by experienced practitioners. As Ian commented in his review, the WFN authors' claim to present the 'global standard' for water footprinting calculations seems somewhat premature. Nevertheless they deserve credit for setting out their methods as a basis for further refinement. In the meantime, footprinting should be very useful for carefully executed comparative studies.

LCIA methods do include an assessment of the impact of water use, including 'water stress' and its impact on issues such as human health and ecosystem processes. This is potentially very useful but will hugely increase the complexity and the need for care in interpreting results[7]. Judging by the lack of available results on the internet, use of LCIA methods for water is at a very early stage.

How is water footprinting being used?

As the WFN website makes clear[8], footprinting can, and is already being used at a variety of levels: product, corporate, national, and global, by individuals, businesses, and governments.

Interesting examples come from large companies, which are increasingly looking at their risk exposure at all stages of their product supply chains. The World Business Council for Sustainable Development has produced an on-line 'global water tool'[9] which allows companies to check whether their production sites are situated in areas of water scarcity. Other tools, including water footprinting, are listed in a recent WWF report[10]. SAB Miller PLC, a major food and beverage company, discovered that an alarming number of their production sites were vulnerable to future water shortages[11]. The company has accordingly used pilot footprinting projects in water-scarce locations to gain a much deeper understanding of how and where water is used, and where to target improvements. They found that 95% of the company's water footprint was due to growing agricultural ingredients for their products. This led to the conclusion that if irrigation efficiency could be improved, it would improve both security of production and sustainability. Whilst recognising the limitations of current footprinting methods, particularly in relation to grey water, they found them extremely valuable, and are supporting improvements to the methodology.

Shareholders and investors are increasingly interested in companies' exposure to risk in relation to water, as well as their sustainability record, and there are calls for more detailed regulatory reporting, particularly in the US. Bloomberg carried out a benchmarking study which included an assessment of companies use of water footprinting[12]. Companies are also seeking to manage reputational risk — the threat of negative publicity from unsustainable water use, and regulatory risk — increased tariffs and stricter limits on water quality and quantity[13].

The WFN website also provides links to a growing list of international footprint studies and comparisons. The authors are making considerable efforts to be internally consistent. A national footprint should include both internal water use and that used in other countries to produce the goods consumed. The UK water footprint (1258 m^3/head/year) is at the lower end of the range for industrialised countries, but around 75% falls outside the UK[14].

The use of water footprinting is also being promoted at EU level. Spain calculated its water footprint as part of its response to the WFD[15]. Water footprinting was also discussed in the 2007 EU report on the potential for water saving, which concluded that the process provided valuable insights into water use, but also highlighted a number of possible adverse consequences if the results were misused[16]. For example, it would be unsustainable to save

water in Europe by transferring production to other locations where the environmental damage would be greater. Footprinting in itself does not necessarily save water directly, but by increasing understanding can support other initiatives to increase efficiency. Water should not be considered in isolation from other aspects of production such as energy and raw material use.

Governments could potentially use footprinting to assist policy-making For example a dry Mediterranean country could explicitly choose to conserve scarce water by importing water-intensive products such as grain whilst exporting high value, low water fruit and vegetables, such as oranges. However, this would not reduce global demand unless production in the source country was more efficient. Mekonnen and Hoekstra[17] calculated that international trade in virtual water does reduce global water demand by 4%. This conclusion has led to calls for consideration of a more strategic international approach to water governance[18] as a means of coping with projected increases in demand. Hoekstra[19] argues that the river basin is no longer necessarily the best unit for managing water resources, making the point that a number of countries view water scarcity as so significant that they are prepared to consider major inter-basin transfers. This would require quite a paradigm shift!

What can/should hydrologists contribute?

Water footprinting is a complex and multidisciplinary tool, still undergoing development. The examples above demonstrate that it is being used and promoted by a number of organisations and companies, and has the potential to provide useful insights into efficient water management. In his review Ian highlighted some concerns about the detailed methodology proposed by WFN, and there are also numerous detailed decisions to be made in any assessment. Hydrologists have highly relevant expertise, and can and should be involved in both further developments and application. This is a good opportunity to demonstrate the relevance of hydrology to globally important issues, and to raise the profile of hydrology in the financial and business worlds.

Despite their limitations, the studies already carried out have undoubtedly increased awareness and understanding of water use, and how sustainable water use is fundamental to business as well as social wellbeing. This is something hydrologists should welcome.

At a personal level, am I any clearer how to make consumer decisions which might reduce my own water footprint? Researching this note has reinforced my view that the world is a very complex place! The SAB Miller footprinting report concluded that "water footprints are not yet effective tools for helping customers choose between different products". I am still dubious about Moroccan tomatoes even if they really do have a smaller water footprint than Moroccan grain crops. I much prefer the idea of tomatoes grown in the UK in a closed greenhouse environment, with rainwater harvesting, and utilising waste heat and CO_2 from the adjacent sugar refinery…….

But we can all do our bit everyday by conserving water, reusing as much as possible — and maybe growing our own tomatoes!

Hilary Smithers

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(1) i.e. water used to produce the product, often no longer contained in it. Waterwise : Hidden Waters (2007) suggests that the term 'embedded water' first coined by Allan in the 1990s, seems more appropriate — there is nothing virtual about irrigation water, for example!

(2) Mekonnen, M and Hoekstra, A, 2011, National Water Footprint Accounts: The Green, blue, and Grey Water Footprint of Production and Consumption, UNESCO.
(3) WFN manual: http://www.waterfootprint.org/?page=files/WaterFootprintAssessmentManual
(4) e.g. http://www.climatechangecorp.com/content.asp?ContentID=5957
(5) Waterwise 2007: Hidden Waters
(6) http://www.guardian.co.uk/sustainable-business/water-footprinting-local-issue/print
(7) POST Note 385, August 2011
(8) http://www.waterfootprint.org/?page=files/home
(9) Wall St Journal, 17/02/2009 : http://online.wsj.com/article/SB123483638138996305.html .http://www.wbcsd.org/Pages/EDocument/EDocumentDetails.aspx?ID=13693&NoSearchContextKey=true

(10) WWF 2011 Assessing water risk: http://assets.wwf.org.uk/downloads/deg_wwf_water_risk.pdf
(11). WSJ http://www.sabmiller.com/files/reports/water_footprinting_report.pdf
(12) Ceres: murky waters: corporate reporting on water risk, Feb 2010.
(13) WWF 2009: http://assets.wwf.org.uk/downloads/deg_wwf_water_risk.pdf
(14) http://ec.europa.eu/environment/water/quantity/pdf/water_saving_1.pdf
(15) http://www.waterfootprint.org/?page=files/Spain
(16) http://ec.europa.eu/environment/water/quantity/pdf/water_saving_1.pdf
(17) http://www.waterfootprint.org/?page=files/home Value of water research report series no50
(18) http://www.waterfootprint.org/Reports/Hoekstra-2011-Global-Dimension-of-Water-Governance.pdf
(19) Hoekstra, A.Y, 2011 Water, 3, 21-46. The global dimension of water governance….. http://www.waterfootprint.org/Reports/Hoekstra-2011-Global-Dimension-of-Water-Governance.pdf

UK Hydrological Bulletin: November 2011–January 2012

In climatic terms, 2011 was a remarkable year: provisionally it was the second warmest in the UK temperature record (in a series from 1910*) and the annual rainfall totals reflected an exceptional exaggeration in the normal north–west to south–east rainfall gradient across the UK. Provisionally, Scotland registered its wettest year on record but, with most rain-bearing Atlantic low pressure systems following tracks remote from the English Lowlands, rainfall deficiencies continued to increase in large parts of eastern, central and southern England.

Regional contrasts in rainfall patterns were particularly stark during the autumn. Whilst Northern Ireland recorded its second wettest autumn and western Scotland was also very wet, England recorded its second driest autumn since 1985. The dry autumn contributed to very notable rainfall deficiencies across a range of timeframes. Considering the March–November period for the Midlands, the lowest rainfall on record (established during the 1995 drought) was clearly eclipsed in 2011when extreme rainfall deficiencies also extended into Cambridgeshire, Bedfordshire and Northants. Importantly, in a water resources context, the lack of rainfall now extends across three winters: for England & Wales as a whole, the 24 months beginning in December 2009 were the driest (for accumulations ending in November) since 1974–76. For many central areas this period is vying with 1932–34 as the driest in a 101-year series.

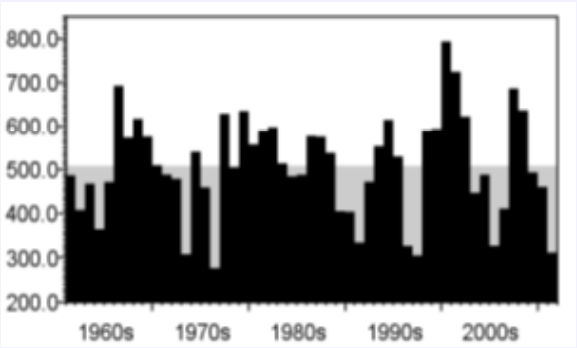


Fig 1 *Estimated annual runoff from the English Lowlands (in m^3s^{-1}); the grey infill indicates the long term average*

In much of southern Britain river flow recessions continued through the autumn. As a result rivers registering new minimum November mean flows showed a wide distribution across the English Lowlands and beyond. The Little Ouse (Norfolk) and Dove (Derbyshire) were among those index rivers reporting new Spring–Autumn runoff minima and, with declining baseflows in many southern catchments, the stream network had contracted substantially — with an associated temporary loss of aquatic habitat. Figure 1 confirms that the runoff from the English Lowlands

in 2011 was the third lowest in a 60-year series. By contrast, sustained high flows with widespread flood alerts were a feature of runoff patterns in northern Britain during the late autumn and early winter. In December, the mild conditions and associated rapid melting of snow accumulations in upland headwaters contributed to an increased flood risk, in Scotland particularly. Provisional runoff figures for 2011 suggest that outflows from Scotland established a new maximum (see Figure 2).

The December rainfall ensured that reservoir stocks were approaching capacity in most upland reservoirs in northern Britain, Wales and northern Ireland but elsewhere residual soil moisture deficits limited the improvement in water resources. The normal late-autumn decline in soil moisture deficits failed to materialise in much of eastern and central England, causing continuing problems for farmers and substantially delaying the seasonal recovery in river flows and groundwater levels over wide areas. Averaged across the Chalk outcrop, modelled soil moisture deficits for the end of November were the lowest since 1978 (see Figure 3) and the equivalent of around two months of effective winter rainfall.

In southern England, reservoir stocks were particularly depressed at Bewl and Ardingly (where stocks fell below 15% of capacity in December). Of wider concern was the continuing decline in groundwater levels across much of southern Britain. The very sustained recessions, together with below average recharge through the winter 2010/11 resulted in depressed water-tables throughout much of the Chalk outcrop, with natural base levels being approached in some areas (e.g. the south-western Chalk where the Tilshead borehole was dry for the first time since 1976 — see Figure 4. Based on an index incorporating levels from seven widely-distributed index wells and boreholes, total groundwater storage in the Chalk was the fourth lowest for December (in a 62-year series) — only during the sustained droughts of the 1970s and 1990s was storage lower for the early winter.

The sustained drought conditions and depressed

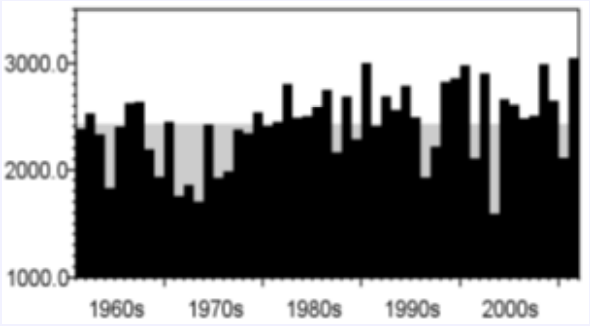


Fig 2 *Estimated annual runoff from Scotlanf (in m^3s^{-1}); the grey infill indicates the long term average*

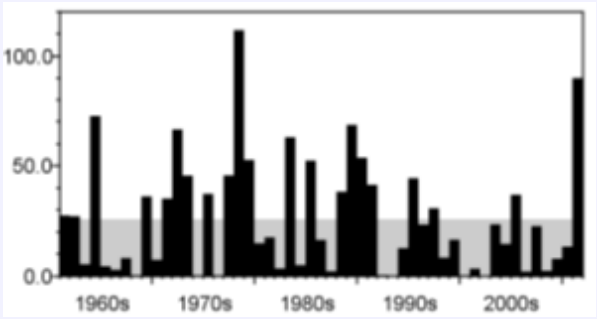


Fig 3 *Modelled end-of-November soil moisture deficits across the Chalk outcrop (in mm). Data source: MORECS*

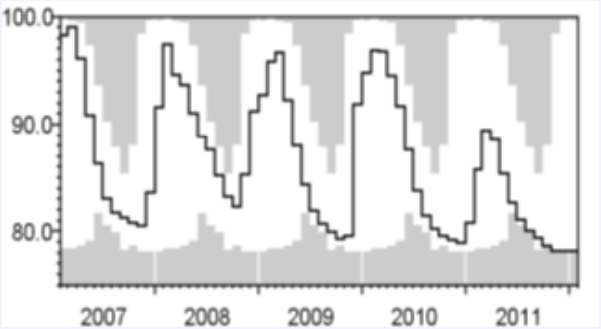


Fig 4 *Monthly groundwater level hydrograph for the Tilshead borehole in the Chalk; the shaded areas indicated the long term monthly maximum and minimum levels*

National Hydrological Monitoring Programme:
http://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html

stream flows (often accompanied by low oxygen levels) necessitated many fish rescues. Flow augmentation schemes, together with abstraction restrictions, were brought into operation to help maintain flow rates in drought-affected rivers and the need to protect the environment was also a factor in a number of appeals for water demand to be moderated. Early January was very unsettled, bringing welcome rainfall to many of the drought-affected areas, but thereafter a familiar synoptic pattern was re-established — low pressure systems again being deflected away from the South East. As a consequence, January rainfall totals were well below average over wide areas. With the window of opportunity narrowing for further substantial aquifer recharge and replenishment to gravity–fed reservoirs in the English Lowlands, it is now almost inevitable that some degree of drought stress will be experienced in 2012. The magnitude of that stress, and its spatial extent, will be heavily influenced by rainfall over the late winter and early spring, before evaporative demands rob the rainfall of much of its hydrological effectiveness.

Terry Marsh
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Note: unless otherwise stated the climatological data series referenced in the Hydrological Bulletins are those managed by the National Climate Information Centre at the Met Office.

12th International Conference on Urban Drainage 2011

Porto Alegre, Brazil
11-16 September

The International Conference on Urban Drainage (ICUD) is one of the most important scientific events, held every three years, in the field of urban drainage. It is jointly organised by the Joint Committee on Urban Drainage, operated by the International Water Association (IWA) and the International Association for Hydro-Environment Engineering and Research (IAHR). The main themes of ICUD 2011 were: (1) Urban hydrologic and hydraulic processes, (2) Technological issues and (3) Institutional, managerial and legal issues.

As around 350 papers were presented in the conference, a comprehensive overview of all topics covered is impossible: the three specific topics covered here - urban flood modelling, urban rainfall processing and integrated urban drainage modelling and management - reflect the background and research interests of the reviewers.

Urban Flood Modelling (Nuno Simões)

Nuno Simões presented three papers and was the co-author of four other papers presented at this conference. One of his papers was awarded the Poul Harremoës Award for 'Best Urban Drainage Paper by a Young Author'. This paper "Urban drainage models for flood forecasting: 1D/1D, 1D/2D and hybrid models"presented the hybrid model concept, a new type of physically-based drainage model in which the conventional 1D/1D and 1D/2D approaches are properly combined in order to take advantage of the benefits and overcome the drawbacks of each approach. The 1D overland network was deployed for

the majority of the catchment surface; while the 2D overland network was deployed in specific pre-indentified flood-prone areas of the catchment. This combination makes possible efficient and detailed urban flood modelling.

His paper "Urban flood forecast based on raingauge networks" presented a new methodology for spatial-temporal rainfall forecasting based on a network of raingauges. The methodology predicts rainfall at each raingauge location, based on the Support Vector Machine (SVM) technique improved with Singular Spectrum Analysis (SSA), which will be explained by Li-Pen in the following section. The prediction of the spatial distribution of rainfall is based on interpolation techniques. The forecast rainfall fields are then used as inputs for simulation of drainage systems to obtain a short-term flood prediction. The proposed methodology was tested using real data from a case study in Coimbra, Portugal, with the results showing that it is possible to predict the water level 30 minutes in advance..

Alma Schellart presented "Urban pluvial flood modelling with real time rainfall information – UK case studies", an overview of research by the Flood Risk Management Research Consortium Phase 2 (FRMRC2), a multidisciplinary UK research consortium, with a particular focus on urban flooding.

Susana Ochoa presented "Enhancement of urban pluvial flood risk management and resilience through collaborative modelling: a UK case study". This poster showed the main findings and lessons learned from the development and implementation of a new methodology for collaborative modelling, social learning and social acceptance of flood risk management technologies. These methodologies proved to be useful for promoting interaction between stakeholders, developing collaborative modelling and achieving social acceptance of new technologies for flood risk management.

Rui Pina's"Floodplain delineation with Free and Open Source Software" presented inp.PINS, an application developed to automatically link Geographical Information Systems (GIS) and the Storm Water Management Model (SWMM) for the delineation of flood risk maps.

Exeter University and Sheffield University research groups presented results of experimental and numerical investigation of interactions between surface flood flow in urban areas and the flow in below-ground drainage systems (sewer pipes and manholes).

Auguste Gires, from École des Ponts Paristech, quantified the uncertainty of sewer discharge associated with unmeasured rainfall variability at scales smaller than the usual C-band radar resolution.

Sarah Ward, from Exeter University, suggested that rainwater harvesting in the UK is on the brink of transition into the mainstream. However, it is limited by a confused top-down (policy) approach and greater support is required at the bottom-up (technical/stakeholder) level.

A group of German researchers from Aquafin and ifak e. V. described a cost-benefit analysis of solutions (RTC) to mitigate CSO impact and showed that RTC turned out to be the most cost efficient measure for CSO impact reduction.

Urban Rainfall Techniques (Li-Pen Wang)

Li-Pen Wang presented one paper in the "urban rainfall" session of the conference and was the co-author of four other papers presented in this conference. "An enhanced blend of SVM and Cascade methods for short-term rainfall forecasting".is a follow-up application of the improved SVM (Support Vector Machine) based rainfall time series prediction method, presented by Nuno Simoes in the same session ("A coupled SSA-SVM technique for stochastic short-term rainfall forecasting").

In these two papers, the predictability of conventional SVM-based time series prediction techniques was improved through coupling with the advanced SSA (Singular Spectrum Analysis) technique and the cascade-based downscaling. The former is a pre-processing technique with the capacity to capture more complex and nonlinear patterns of high-resolution rainfall time. An improved version of the SSA technique was developed through statistical analysis of over 80 historical short-term rainfall events. This improvement significantly strengthens the ability of SVM-based prediction techniques to capture the peaks of rainfall storms, which is very crucial for short-term urban flood forecasting. The latter is an application of the prior work in synergy with cascade-based downscaling techniques. The SVM was used to generate coarser resolution rainfall forecasts;

these forecasts were then disaggregated into finer resolution through the cascade theory. This combination increases the forecasting lead time and at the same time retains the necessary accuracy of the prediction.

In addition, the impact of climate change on urban rainfall structures was addressed in the paper "Revision of urban drainage design rules based on extrapolation of design rainfall statistics" by Dr. **Patrick Willems**. Through extrapolating design rainfall statistics (e.g. the IDF curves) according to current knowledge on future climate change trends, the hydrological design parameters, currently used in the guidelines for urban drainage design, were re-investigated. Rather than predicting future rainfall volumes by simply extrapolating current rainfall volumes, this research highlights the importance and necessity of carrying out further study on the evolution of rainfall structures induced by climate changes and consequently the impact on urban hydrology.

Advanced rainfall data processing techniques were also presented in two papers by Prof. **Daniel Schertzer** in the Urban Rainfall session, respectively "Multifractal study of three storms with different dynamics over the Paris region" and "High resolution rainfall for urban hydrology: X-band radar technology and multifractal insights". Prof. Schertzer has worked in the field of multifractals and its application to rainfall processes for over 20 years and in these two papers he addressed the topics of merging rainfall data from different sensors (radar and raingauge) and using high-resolution X-band radar in urban areas. In the former, a possibility to combine small-scale rainfall information obtained from a local gauge network coupled with radar network data through multifractal analysis was demonstrated. The results indicated that the general assumption of homogeneous distributions of rainfall was inappropriate for urban hydrology uses, particularly at scales smaller than 30 km. In the latter work, the general assumption of homogeneity approximations and/or factorization of the drop distribution in radar rainfall calibration were re-investigated. This assumption degrades the measurement resolution, the impact of which will increase when small-scale rainfall is studied, such as the calibration of X-band radar measurements. The results showed that it was possible to provide more reasonable information of rainfall drop distribution for X-band radar rainfall calibration through multifractal analysis.

Li-Pen also attended the annual meeting of International Group on Urban Rainfall (IGUR) during the conference period. IGUR is an International Working Group of the IWA/IAHR Joint Committee on Urban Drainage, focusing on disseminating knowledge, technology and existing procedures relating to rainfall measurement, analysis and modelling for urban hydrology uses. Dr. Patrick Willems is the current chairman of this group and Dr. Thomas Einfalt is the secretary. In the meeting, key activities in the previous year were reviewed and the coming important events were announced, e.g., the 9th Urban Drainage Modelling conference in September 2012 and the 10th International Workshop on Precipitation in Urban Areas in December 2012.

Integrated urban drainage modelling and management (Juan Pablo Rodríguez)

Juan presented two papers in the conference sessions: (a) Modelling and simulation of integrated urban water systems and (b) Performance assessment, indicators, benchmarking. The first was "A methodology to assess DWF pattern uncertainty for integrated urban drainage modelling" which described a stochastic time series generator to characterise sub-catchment dry weather outflows for use as inputs to simulations of the larger sewerage system. It demonstrated the potential for using semi- empirical models to characterise ungauged sub-catchment wastewater outflows, for both quantity and quality determinants, even when supported by low-mid time resolution data sets. This tool can provide useful data for a range of applications, particularly where data on DFWs are scarce, for example sewer infiltration uncertainty analysis, online screening and validation of quantity and quality automated monitoring systems, WWTP dynamic simulation-based design, control and operation and a better estimation of the dry weather contribution uncertainty to total storm event loads, allowing an improved understanding of storm water quality models.

Two other relevant papers were presented in the same conference session, one evaluating stormwater micropollutant (MP) control strategies by the application of an integrated urban drainage model (by

Dr. **Luca Vezzaro** from Technical University of Denmark) and other dealing with retention tank modelling using settling velocity distribution (by Prof. **Peter Vanrolleghem** from Universite Laval). Vezzaro illustrated the potential for the application of integrated dynamic models as tools to estimate MP fluxes across stormwater systems taking into account model uncertainties. Vanrolleghem presented the main outcomes from a research project to characterise the change of settling velocity distribution between the inlet and outlet of an off-line retention tank and to improve a dynamic retention tank model by implementing a re-suspension model due to pump activation during emptying. The improved model was successfully tested with full-scale data. A keynote lecture on modelling and scenario building of urban water and wastewater systems was given by Dr. **Manfred Shuetze** from ifak e.V. (Germany). His talk emphasised challenging tasks in urban areas under increasing pressures of climate change and population growth. It was shown how modelling can serve as an integral part of stakeholder involvement and participation and, thus, how it can contribute to informed discussions and participatory decision finding.

Juan also presented the paper "A serviceability model for supporting proactive maintenance in urban drainage systems" which summarised statistical analysis of sediment-related failure data which aims to support implementation of proactive maintenance strategies. For this, an exceptionally long and spatially detailed data set has been obtained from a customer complaints database in Bogotá (Colombia). The work builds on the fact that blockages are generally unpredictable in a deterministic sense. In this context, the best approach is to predict probability of failure in a given time period, or to prioritise different areas in terms of relative propensity for failure. The work showed that for most of the analysed areas the inter-arrival time between failures can be represented by probability distributions with stationary parameters. However, there is still a considerable fraction of areas for which non-stationarity exists.



Li-Pen Wang (left), Nuno Simões (centre) and Juan Rodríguez (right) during the gala dinner

In the same session, Prof. **Adrian Saul** from University of Sheffield presented results from a research project intended to implement a decision support system (DSS) for combined sewer overflow (COS) asset operation and management. The DSS comprises two models, one to predict the hydraulic response of the sewer flow depth in response to rainfall whilst the second model allows the analysis of the ways in which the operation and maintenance frequencies of individual CSO chambers may be better operated.

In another conference session, but in closely related to proactive sewer maintenance issues, **Ana Romanova** from University of Bradford introduced the use of non-intrusive methods to measure hydraulic roughness in partially filled pipes. Her presentation noted that non-intrusively monitoring of characteristics of in-sewer water waves, which can be linked to hydraulic roughness, could help sewer operators to identify progressive deterioration and so reduce the risk of drainage pipe failure and flooding.

We should like to thank BHS for the generous support for the trip.

Nuno Simões, Juan Pablo Rodríguez and Li-Pen Wang
Environmental Water Resource Engineering,
Imperial College London

Flood risk management and the Flood Risk Management Act

Scottish Hydrological Group
14th September 2011

The Floods Directive was written into Scottish legislation in 2009 as the Flood Risk Management (Scotland) Act. Since the enactment of the Act in June 2009, a number of key milestones have passed. Guidance on sustainable flood management was published in June 2011, advisory groups have been established by SEPA and SEPA is well on the way to producing an assessment of flood risks across Scotland leading to identification of areas most vulnerable to flooding by December 2011. With an eye to future milestones, SEPA and local authorities are working together to identify local plan areas by December 2011, establish local plan advisory groups and for local authorities to prepare a schedule of clearance and repair works. It was therefore timely for the SHG to hold a half-day event to hear about the experiences of local authorities and to consider gaps that still exist in our understanding of flood risk.

The event, organised by **Caroline Anderton** (SHG Honorary Secretary), was held at the Green House conference rooms in Inverness, with over 40 attendees from local authorities, SEPA, consultants, developers and others. The first speaker **Martin Boshoff** (Mott MacDonald) explained that his presentation was based on experience gained during his secondment to Highland Council as the head of their 'Flood Team'. The team was formed in March 2010 to lead the implementation of the Flood Risk Management (FRM) Act within the Council.

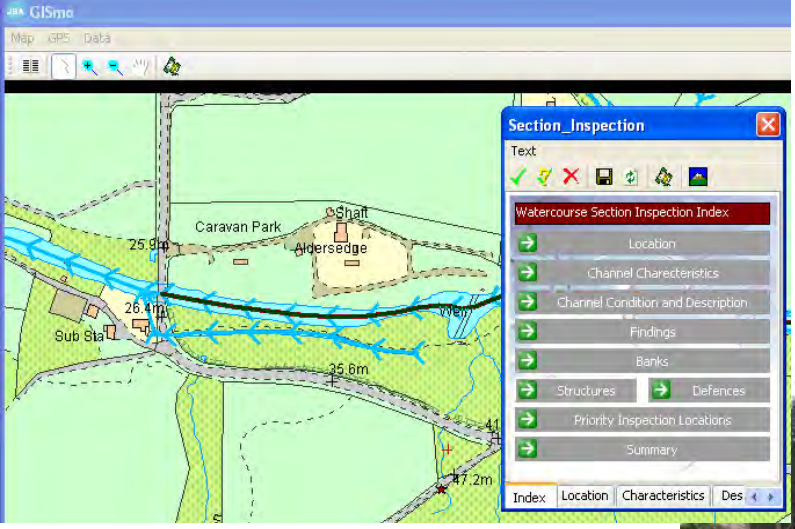
Highland Council, as Martin explained, has responsibility for a particularly challenging area with respect to flood management. It comprises some 33% of Scotland's land area, 49% of mainland Scotland's coastline and has some 2300 and 1200 properties located within the SEPA fluvial and coastal 200-year flood map. The size and variety of this region was the main driver for taking a risk-based approach to flood risk management. Martin illustrated how risk was based on the availability of historic flooding records, existing inspection priorities and developed pressures. High risk areas were then prioritised according to the number of properties at risk. Detailed baseline assessments were then carried out for each watercourse within priority areas.

Martin went on to present the four level prioritisation scheme developed for the Council. The scheme also included an assessment of maintenance frequency. For example, a priority 1 reach implies 'Immediate resolution required (Council to intervene with Emergency Powers or Monthly Inspection)' while a priority 4 reach implies 'Solutions to be developed when resources permit and/or yearly inspections'. Information on the existing state of each reach had been developed by the Council using hand-held tablets, GPS and GIS.

Notwithstanding all the technical and organisational developments with the Council, public relations still play a key role in data gathering and dissemination. Martin concluded by giving the audience a flavour of the Council's website and leaflets developed by the Flood Team.

The second speaker, **David Bassett** (JBA Consulting), gave a presentation entitled 'Watercourse asset and maintenance inventory — meeting the requirements of the Flood Act' This presentation was co-authored by **Angus Pettit** (JBA Consulting) and **Stuart Cullen** (Clackmannanshire Council).

This presentation linked nicely with the previous one as it too presented a risk-based approach to inspection. David explained the history of watercourse maintenance in Clackmannanshire Council and discussed the new responsibilities implied by the FRM Act. Specifically,





An example of the draft results from the National Pluvial Flood Hazard Map. Note: This is a preliminary map and has been published with the permission of CEH, SEPA and Halcrow.

the Act places a duty on every local authority to assess watercourses to ascertain whether their condition gives rise to a risk of flooding and to identify where clearance and repair works would substantially reduce that risk. David went on to illustrate the Project's approach which involved proactive and regular inspection to determine the probability and consequence of flooding. As with Highland Council, Clackmannanshire Council have developed a data capture system using GIS, GPS, a hand-held device (based on the J|Gismo system) and a web-based systems. An example of the site assessment screen and accompanying photograph are shown in the figure above.

David concluded by summarising the value of this approach to asset management. It allows the integration into local and river basin management planning, the potential integration into a future national database, it feeds into local plans to prioritise works, allows multi-criteria analysis of work and enables the integration with Scottish Water, Network Rail and Forestry Commission systems.

The next presentation took us away from channel maintenance and asset management and focused our attention on an aspect of SEPA's national flood risk assessment: Pluvial flood mapping.

Pascal Lardet (Halcrow) gave the presentation 'National pluvial flood mapping for Scotland' on behalf of co-authors **Jon Wicks** and **Kashif Shaad** also of Halcrow. The work had been commissioned by SEPA in September 2010. Pascal gave a brief background to the mapping of pluvial flooding in Scotland and reminded us of the definition of pluvial flooding proposed in the 2009 Scoping Study carried out by Jacobs, HRW and the Met Office for SEPA: "*Flooding as a result of rainfall when water ponds or flows over the ground before it enters a natural or man-made drainage system or watercourse, or when it cannot enter because the system is already full to capacity*".

The first phase of the project focused on a pilot area encompassing Glasgow, the Clyde and Loch Lomond (3900 km^2) to establish and refine a viable method, to balance the data, data processing, method and computational demands, to identify the best available national datasets and therefore to establish a nationally consistent method. Pascal discussed the issues concerning data sources including the NextMap SAR (synthetic aperture radar) DTM and the 5 km grid of depth-duration-

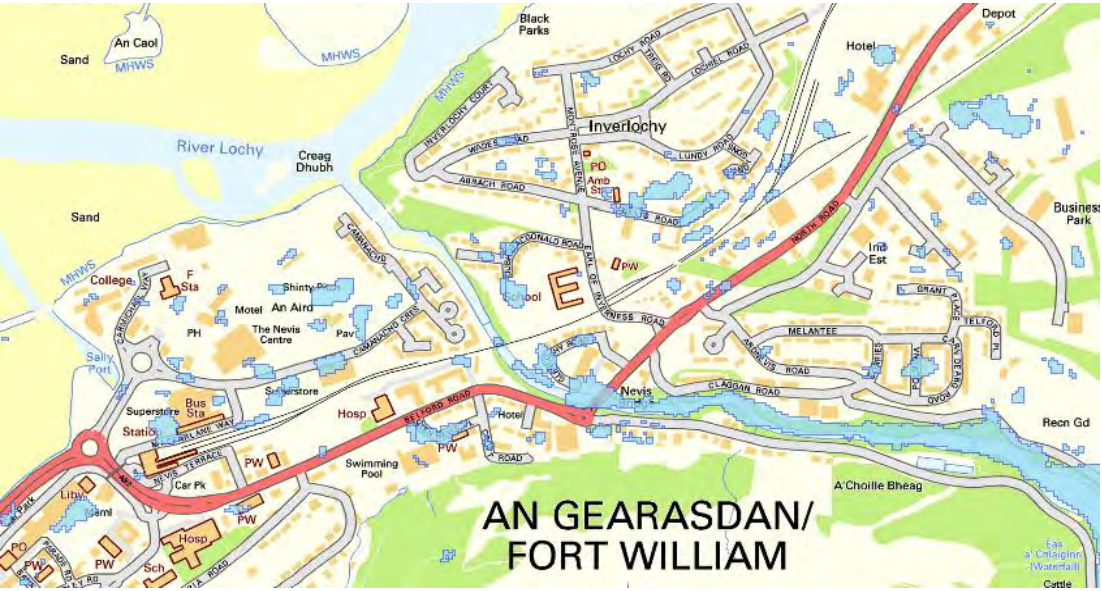
frequency (DDF) parameters derived using FEH. ISIS FAST was used to spread the effective rainfall over the DTM.

ISIS FAST was selected as it uses simplified hydraulics and has been designed to link networks of depressions typically generated when assessing pluvial flooding. In addition, its fast run times and stable nature made it ideal for national mapping. Pascal reported that it took less than 48 hrs to run for the whole of Scotland for a single rainfall scenario. The method included a process to remove small ponded areas and produced aggregate results comprising polygon shape files for the nation at 0.1 m and 0.3 m thresholds (30 yr, 200 yr and 200 yr+20%) and raster grids at 5 m × 5 m of flood depths. The results were then compared to historic data, where available, such as the Glasgow East End flooding of 30 July 2002. Pascal concluded by giving us an overview of the results with focus on locations around Scotland including the Green House and surrounds (see below).

The method proved to be flexible, making best use of national available data. This is the first time that a national pluvial map has been produced for Scotland. Validation proved to be difficult but it did suggest that the map is satisfactory for the identification of areas susceptible to pluvial flooding.

The fourth talk: 'The invisible hazards of pluvial flooding in urban areas — the impacts of climate change of pluvial flood risk' was presented by **Donald Houston** (St Andrews University) and covered a study carried out by St Andrew's University, Dundee University and JBA Consulting on behalf of the Joseph Rowntree Trust.

Donald followed from where Pascal's talk had concluded by considering the influences of hydrological and climate change and the influences of demographic and social change on pluvial flood risk. While much effort has gone into improving our methods for assessing flood hazard, Donald suggested that relatively little effort has gone into assessing the change in vulnerability and exposure of receptors. He considered the SEPA flood hazard map and suggested that social deprivation is a good measure of flood vulnerability. Donald went



An Example of the draft results from the National Pluvial Flood Hazard Map

Note: This is a preliminary map and has been published with the permission of CEH, SEPA and Halcrow.

on to look at pluvial flood risk and similarly concluded that while climate change impact studies have given us a measure of uncertainty, there is still substantial uncertainty in the change in exposure and vulnerability (caused by demographic change): population growth frequently has a more significant impact on pluvial flood risk than climate change. Moreover, population growth when combined with factors such as population ageing, insurance withdrawal/higher premiums, blighted areas and the distribution of social housing has a significant, but poorly understood, impact on vulnerability. Donald concluded by emphasising the need for research into the impacts of population growth and demographic change on flood risk with specific focus on flood risk areas.

The final talk of the day developed the concepts of exposure and vulnerability, further reminding the audience of the impact of flooding on people and communities. **Paul Hendy** of the Scottish Flood Forum gave us a sense of the impact on people of flooding through relaying the typical experiences of people that the Scottish Flood Forum has assisted. He went on to look at the typical measures that property owners can take to protect their properties from flooding such as various easy to fit devices to seal air bricks, vents and door openings. Paul touched on the associated health issues that can arise as a result of flooding, including stress and anxiety. It can typically take 12 months or more for properties to be fit for habitation and although this provides a roof over people's head, items of personal value such as photographs, personal documents and memorabilia are lost for ever.

Caroline closed the meeting by leading the audience in thanking the speakers and reminded all that forthcoming SHG events can be found at the SHG web site (http://www.scottishhydrologicalgroup.org/programme.html).

Tim Jolley
SHG

Keep up to date with the latest Environment Agency weekly and monthly water situation reports for England Wales at

http://www.environment-agency.gov.uk/research/library/publications

The monthly reports are published on the 10th of each month, providing information for the previous month: the weekly water situation reports for the previous week are available every Thursday.

Editorial

Bob has referred to our proposed response to the ICE's calls for input to their 'State of the Nation' report. What struck me about the responses within the Committee discussion and in the feedback from members that has come in via email, is how strong is the concern over lack of 'hands-on' experience we are now able to offer new entrants to what is essentially a field-based profession. Seems to me that if you've never been out on upland catchment in a driving westerly gale trying to read some instruments, can you ever fully appreciate the imperfections of some model parameters.

Celia Kirby



European Freshwater Sciences

Girona, Spain
June 27th to July 1st 2011

The 7th meeting of the European Federation of Freshwater Sciences, SEFS7, was convened beneath the hot Spanish sun in the historic and picturesque town of Girona in north eastern Spain. The conference theme was "Freshwater ecosystems — Challenges between conservation and management under global change." It brought together freshwater scientists from across Europe and beyond to consider these issues throughout the spectrum of freshwater environments, from rivers and streams to reservoirs, lakes, ponds and wetlands.

Three key themes and their interconnections emerged from the plenary and parallel sessions held during the week. These were the importance of thoughtful restoration and management of freshwater systems, the need for greater consideration of the interfaces between different environments, and the impact that a range of stressors and their interactions has on the freshwater environment across its physical, chemical and biological components.

Restoration and management

Margaret Palmer from the University of Maryland emphasised the need for a prioritisation of action in the management of our freshwaters, from conservation of pristine systems to ecological design practices, on impacted reaches to limit the further loss of these ecosystems and their services. River restoration approaches were needed that promote functionality and resilience of these environments, particularly in relation to the impact of ecosystem stressors. She argued for a more effective partnership between restoration practitioners, scientists and natural resource managers, where effective pre- and post-restoration monitoring is essential to identify the measures likely to succeed.

An example of partnership working was provided by **Paul Leonard** in the community action being carried out on the urban River Crane in London, where the local community were assisting in the restoration and monitoring of the health of the river. An assessment of the use of agri-environment schemes for the restoration of freshwaters was presented by **John Murphy**, where the success of the different levels of the scheme was mixed over a short monitoring period, and depended on the previous conditions of the site and the level of the scheme adopted.

Interfaces between environments

Andrew Boulton from the University of New England, Australia, developed the restoration theme by illustrating that although the linkages between ground and surface waters have been known for decades, the uptake and use of this knowledge in management and conservation strategies has been slow. He argued that too frequently surface and groundwaters have been managed as separate entities and that conservation and restoration in streams are rarely focused on zones where these linkages are active. The potential benefit of restoration of these linkages to both water bodies and their ecology was illustrated, with the help of some woody debris, and he highlighted that there are further opportunities for research into the mechanisms by which groundwater–surface water interactions affect rivers and aquifers.

Interactions between the freshwater and terrestrial environments also featured in a number of talks where new catchment scale observatories are being developed in Germany (**Sonja Jaehnig**) and ecological subsidies between ecosystems are being quantified such as the emergence of midges in Iceland presented by **Mireia Bartrons**.

Ecosystem stressors

The final theme which persisted throughout many of the talks and plenaries during the week was the impact of ecosystem stressors and particularly the effect of multiple stressors on all levels of the freshwater ecosystem. **Guy Woodward** from Queen Mary, University of London, provided a review of a range of work looking at climate change impacts from molecules to ecosystems. A number of talks by **Alex Elliott**, **Michelle Jackson**, **Peter Smyntek** and **Annika Wagenhoff** during the week re-emphasised his point that stressors such as changes to environmental temperature, nutrients, sediments, the invasion of new species or hydrological change can act individually or synergistically.

Hydrological changes were also the subject of **Arturo Elosegi**'s (University of the Basque Country, Spain) plenary. He emphasised that healthy river ecosystem functioning is dependent on the hydromorphological integrity of the river channel. Human alterations to the channel form and water flow causes shifts in biological community composition with knock-on effects on the functioning of the ecosystem. He stressed that a better understanding of these linkages is needed when planning the management of our rivers.

Coherence in the temperature signals provided by freshwater bodies was the subject of **David Livingstone**'s (Swiss Federal Institute of Environmental Science and Technology (EAWAG), Swtizerland) talk in relation to climatic forcing. Using long-term data sets from across Europe, he showed that water temperature and ice phenology changes over time could be detected at spatial scales from several hundred to several thousand kilometres. The take-home message was that in the face of these widespread thermal changes to our freshwaters, conservation and management practices based on past experience and knowledge may not be able to predict potential outcomes in the future.

Eleanor Mackay
Lancaster University / Centre for Ecology and Hydrology

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).*

American Geophysical Union Fall Meeting

San Francisco, California
5-9th December 2011

Given that over 20 000 scientists gathered for the American Geophysical Union (AGU) Fall Meeting, it is hard to believe that it was not even the largest convention in San Francisco that week, with Santacon seemingly far exceeding this number of participants! Nevertheless, I put aside my Santa costume and delved into a packed schedule of excellent scientific presentations on offer at AGU.

Lance Bosart (State University of New York) gave an interesting presentation on the causes of the unusually cold winters of 2009–10 and 2010–11 in North America and northern Europe. In 2009–10, cyclonic activity in the Pacific Ocean triggered a storm that tracked across the US and helped establish an extraordinarily negative Arctic Oscillation. Airline timetables were severely affected, extreme snowstorms were reported in Chicago, Boston and northern Europe, and the Hudson River experienced its latest freeze-up on record.

F Martin Ralph (ESRL, NOAA) introduced atmospheric rivers (ARs) and underlined their importance for mid-latitude precipitation. ARs are 400 km-wide, 2000 km-long conveyor belts of moisture that are responsible for 90% of mid-latitude precipitation. Predominantly affecting coastal areas, their impact is also felt further inland; there are clusters of gauging stations in neighbouring states such as Colorado, Arizona and Idaho in which 70–90% of high flow events occur during the winter half-year.



Continuing on this theme, Michael Dettinger (USGS) presented a study from California into the changing characteristics of AR events. Decision-makers were interested in how characteristics of ARs may change under future climate change, and preliminary findings suggest it is likely that there will be both a lengthening of the AR season and a 15–25% increase in intensity of AR events. Further work is required to determine the corresponding impact these increases will have on flood characteristics.

Fresh from being relentlessly hounded by the New Scientist paparazzi (see opposite), **David Lavers** (Walker Institute, University of Reading) linked the most severe winter flood events of the last 40 years in the UK to the occurrence of ARs. Each of the top ten largest floods in the Eden catchment over this period were associated with ARs, whilst the Ewe and Teifi catchments also show similar correspondence. Dr Lavers also showed how a persistent AR remained stationary over the Eden catchment for 24–36 hours during the record-breaking storm of November 2009.

Luis Samaniego (UFZ Leipzig) applied a soil moisture drought index in Germany, clustering drought occurrence in space and time to allow identification of the characteristics of major agricultural drought episodes and their seasonal variability. It was concluded that those areas in which drought is most persistent are also those which are the most important agricultural areas in Germany. **Michael Roderick** (Australian National University) stated the need to be realistic and not alarmist when

discussing the sensitive topic of climate change impacts. The Murray-Darling Basin has recently emerged from a severe decade-long drought during which time water resource infrastructure was stretched to breaking point. However, the recent drought was shown to be within the bounds of natural variability, despite climate change causes receiving much attention in the media.

Sharon Nicholson (Florida State University) provided a fascinating account of her 40-year career gathering hydrometric and documentary evidence of drought in Africa since 1800. Using a variety of methods, Dr Nicholson presented indices of drought over the last 200 years for 90 homogeneous regions across the continent. The occurrence of a 40-year drought between 1801 and 1840, more prolonged and severe than anything witnessed since, prompted a chilling conclusion that much worse could be yet to come for the vulnerable Sahel and Horn of Africa.

Yves Tourre (Columbia University) presented the use of harvest dates of Pinot Noir grapes in the Burgundy region of France since the 14th century as a proxy for European climate. In correlating sea surface temperatures and grape harvest dates, Dr Tourre was able to predict the harvest date of Pinot Noir grapes in late August 2011 by reviewing SSTs in April 2011. This information was of significant utility to decision-makers in the wine industry in France in preparing for harvest.

Stacey Archfield (USGS) utilised threshold-based methods to investigate hydrological similarity across the United States. After grouping gauging stations into homogeneous regions, Dr Archfield applied a number of indicators of climatic and hydrological similarity to explore the extent to which regions are coherent in their hydrological response. The conclusion that even



neighbouring catchments show significant dissimilarity may help inform network review studies.

Jamie Hannaford (Centre for Ecology & Hydrology) presented a summary of trend studies in the UK and Europe, underlining the importance of reference hydrological networks (RHNs) for detecting hydrological change. Recent studies of streamflow trends in Europe emphasise the sensitivity to the period of analysis, and there remain questions relating to the representativeness of the period of records and the spatial distribution of gauging stations in RHNs. The use of trend analysis to validate global hydrological models was also presented, corroborating modelled trends against those observed in RHNs.

Keen not to cede any ground to our American counterparts ahead of the London Olympiad, an elite team of British hydrologists were amongst the 400 scientists that entered the AGU 5k Fun Run. Given that the race began at 6:30 am following questionable pre-race carb-loading (nachos and popcorn for some), BHS members held their own in the face of stiff opposition. **David Hannah** put in a particularly strong performance, and after conquering the Sierra Nevada, CEH also finished respectably (results below):

69th	David Hannah	Birmingham University	20:35
174th	Jamie Hannaford	CEH	24:05
203rd	Simon Parry	CEH	25:20

I am very grateful to the British Hydrological Society for providing a BHS Travel Grant that allowed me to present a poster and attend the AGU Fall Meeting. It was highly valuable both as a dissemination exercise and as a learning experience. As one of the many prophetic fortune cookies in Chinatown suggested, “There are lessons to be learned by listening to others”.

Simon Parry
Centre for Ecology & Hydrology, Wallingford



Hydrology Research: an International Journal Reviewers 2010

The contribution made by Reviewers of manuscripts submitted to HR is crucially important but can go largely un-noticed and poorly acknowledged beyond the boundaries of the confidential editorial system. The following kindly reviewed manuscripts for HR in 2010 (see also http://www.iwaponline.com/nh/reviewers.htm). If you are interested in reviewing for HR and have not done so yet, please do contact me. Manuscripts from BHS members are welcome!

Ian Littlewood

Abesser, C.
Abida, H.
Abrahart, R.
Achberger, C.
Adeloye, A.
Agnew, C.
Aherne, J.
Andersson, L.
Apsite, E.
Archfield, S.
Arnbjerg-Nielsen, K.
Aronica, G.
Asghar, M.N.
Ashkar, F.
Assani, A.

Bacchi, B.
Bain, M.
Ball, J.
Barry, A.
Bartlett , P.
Bauer-Gottwein, P.
Beldring, S.
Bellot, J.
Bengtsson, L.
Berndtsson, R.
Beven, K.
Bielsa, J.
Binning, P.
Blenkinsop, S.
Bloschl, G.
Borga, M.
Bradley, C.
Breuer, L.
Briant, B.
Bronstert, A.
Bruen, M.
Burn, D.
Butler, J.
Buttle, J.
Buytaert, W.

Cancelliere, A.
Characklis, G.
Chelmicki, W.
Christensen, S.
Cimen, M.
Clarke, R.
Cloke, H.
Comas, X.
Conway, D.
Cooper, D.
Criss, R.
Croke, B.

da Silva, V.
Dawson, C.
de Jong, C.
Denoth, A.
Deswal, S.
Draveniece, A.
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Xu, C.-Y.u

Yildirim, G.
Yuan, P.-C.

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Stop press

The second edition of **Rainfall-Runoff Modelling -The Primer** has now been published. It includes a number of new 'Beyond the Primer' chapters including regionalisation, residence time distributions, the next generation of hydrological models, and hypotheses, measurements and models of everywhere ("and the cover is much much nicer than the 1st edition", says author Keith Beven). Further details at:

http://eu.wiley.com/WileyCDA/WileyTitle/productCd-047071459X.html

also available on Amazon

Forthcoming Events

The first CONVEX* workshop will take place at Reading University on 17th and 18th April 2012

Further details at:

http://research.ncl.ac.uk/convex

* Using Observational Evidence and Process Understanding to Improve Predictions of Extreme Rainfall Change

Fifth International Scientific Conference on Water, Climate and Environment

28 May to 02 June 2012
Ohrid, Macedonia

Further information at
www.balwois.com/2012

6th International Congress on Environmental Modelling and Software (iEMSs 2012)

Managing Resources of a Limited Planet: Pathways and Visions under Uncertainty

July 1–5, 2012
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Abstracts are welcome for oral presentations (no posters). Technical instructions on how to prepare abstracts and further conference information:

http://www.iemss.org/iemss2012

Copy deadline for Circulation No. 113 23rd April 2012

Diary

6-7th March 2012
Water Futures - groundwater interactions in the environment
Conference organised by the Geological Society, Burlington House, London W1J 0BG
Contact: Steve Whalley (Tel: 020 7434 9944)

21st March 2012
Applied Flood Hydrology
BHS National Meeting
organised by: BHS South East Section
Institution of Civil Engineers, London SW1P 3AA
Contact: Thomas Kjeldsen (Tel: 01491 692404)

3rd-4th April 2012
Peter Wolf Early Career Hydrologist's Event 2012
Location: University of Birmingham
Contact: Phillip Blaen (Tel: 0121 414 5682)

17th-18th April 2012
CONVEX workshop on extreme rainfall
Location: Reading University
Time: 11.00
Contact: Dr Stephen Blenkinsop (Tel: 0191 222 7933)

22nd–27th April 2012
EGU meeting
Vienna

BHS 2012

The 11th BHS National Symposium will be held in Dundee, from 9–11 July 2012

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