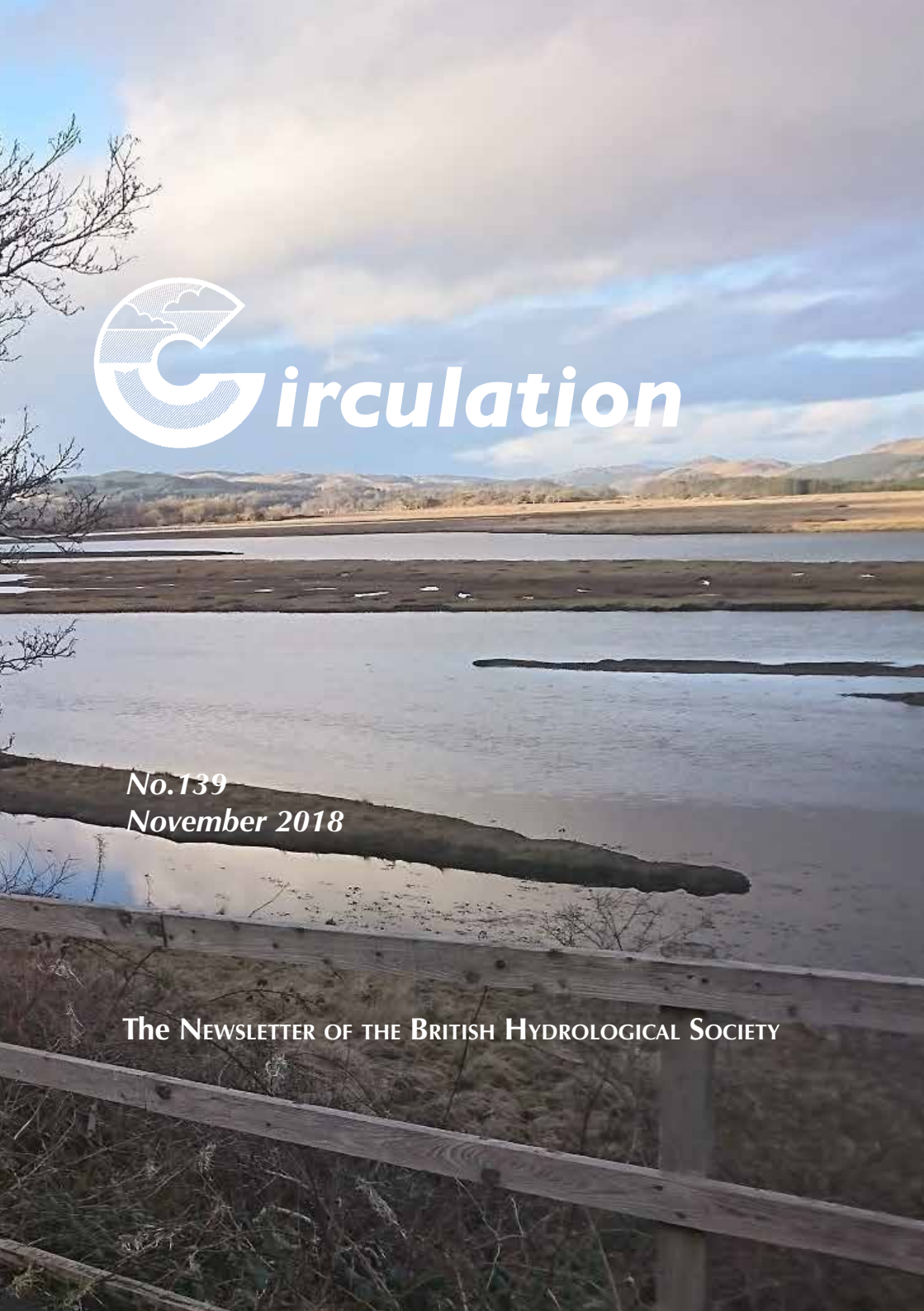


# Circulation

*No.139*
*November 2018*

The Newsletter of the British Hydrological Society

# Contents


Geoff Petts

36th BHS AGM

2018 Student Prize

New Committee Members

Travel costs for IUGG 2109

NRFA peak flow data

Travel Grant reports

History of Hydrology update

BHS 2018: report

President's Address

Do other countries need UK hydrologists?

Forthcoming meetings

UK Hydrological Bulletin


**Copy deadline for Circulation No. 140 24th January 2019**

## Congratulations to the winners of the BHS Photographic Competition

**We had three categories of entry:**

*Hydrological landscapes*
**Winner Michael O Flatharta**

*Hydrological extremes*
**Winner: Tom Beskeen**

*Hydrologists in action*
**Winner: Daryl Hughes**

**Thank you to all those who entered**


*Circulation* **is published quarterly. It is free to members of the British Hydrological Society and costs £25 to nonmembers on annual subscription.**

- **Membership enquiries: Moira Doherty, BHS Secretary, Institution of Civil Engineers, 1-7 Great George Street, London SW1P 3AA. Tel: 0207 665 2234 Email: bhs@ice.org.uk**
- **Editor: Celia Kirby Tel: 01544 230053 Email celia.kirby@btinternet.com**
- **Web pages: http://www.hydrology.org.uk/**

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

# President's Piece

Not long after I last wrote came the news that my predecessor as President, Professor Geoff Petts, had died. Even though I knew that he was very ill, and had feared the worst, this was a shattering blow. Besides his time as President he served the Society as Honorary Secretary at an important early stage of the development of BHS, and he did the early planning for our recent Symposium held at the University of Westminster where he was Vice-Chancellor. In early October I attended Geoff's memorial service at St Marylebone parish church in London, along with several other BHS members including one former President. We heard accounts of a remarkably busy life, and I was left wondering how he found time for BHS amongst all his other commitments.

The circumstances of the Symposium were certainly unusual, and hopefully never to be repeated. The opening session included a fulsome tribute to Geoff from Professor Paul Wood. Elements of that tribute are reproduced elsewhere in this issue of Circulation, together with a wider review of the Symposium. The event was a great success (we even had to turn away prospective last-minute attendees as we were at least at the limit of room capacity), and a worthy part of our tribute to Geoff, with the keynote presenters (invited by Geoff) topping and tailing eight sessions of presentations covering the breadth of UK hydrology plus some interesting elements from overseas. If there is a regret it is of the presentations that one could not attend because the sessions were being held in parallel, but I am delighted that so many members (and a few non-members) were able to present their work. A large number of posters and the Conference Dinner also contributed to an event that was widely enjoyed and sets the standard for the organisers of BHS 2020 which will be held at Lancaster University.

At the Conference Dinner I spoke of the importance of people stepping forward to join the committee in order to help to take the Society forward, because if we do not look to develop and grow we run the risk of losing significance at a time when an understanding of hydrology will surely be growing in importance for the country and the world. I am delighted to welcome Nick Chappell as President-elect and Michael Cranston as Honorary Secretary, together with Anita Asadullah, Mason Durant and Michael Pollock as ordinary committee members. Please think about whether you could follow in their footsteps in a future year.

Whilst the Society seems healthy, with a good programme of National meetings planned for 2019, it is a little disappointing that previously active regional sections in the South West and the Midlands are currently dormant. If you live in one of those areas perhaps you would like to join with others and re-establish a local meetings ; the Main Committee is very keen to offer support (including financial) for regional activities. And if you live in an area not covered by any of our regional sections please talk to us about establishing local activity.

*Peter Ede*
*President*

# Professor Geoffrey Petts (1953–2018)



It is with great sadness that we inform members of the recent death of Professor Geoffrey Petts, former BHS president (2015 - 2017) and secretary (1988 - 1990). Over an academic career spanning 40-years, Geoff Petts made an outstanding contribution to hydrological sciences and advancing our understanding of river science. Even after his career move into university senior management, he continued to edit a major international journal, supervise research students, actively engage with learned societies and play an active part in research projects. His enthusiasm, energy and encouragement of other researchers explains why he will be missed by so many.

Geoff was born in Kent, growing up in the small town of Tenterden, and maintained a lifelong association with the county, supporting Gillingham Football Club and retaining contact with the local cricket club and his former school. His sporting interests, spanning cricket, hockey and fishing, provided a welcome distraction from his academic activities. Despite his immensely busy schedule he still found time to meet friends and colleagues for important events whether it be a day at Cheltenham races or an occasional round of golf.

Geoff obtained a joint honours degree in Geography and Geology from the University of Liverpool in 1974, followed by PhD research under the supervision of Ken Gregory: his PhD in 1978 was for ''The adjustment of river channel capacity downstream of reservoirs in Great Britain". This research provided the foundations for the interdisciplinary research for which he became internationally known and allowed his academic career to flourish.

As a very gifted lecturer who actively encouraged and engaged with undergraduate and postgraduate students he had a near constant stream of people seeking his advice. He was a prolific researcher and published widely throughout his career. Research on river impoundment and fluvial geomorphology resulted in the publication of the landmark monograph 'Impounded Rivers' in 1984. This book provided an interdisciplinary perspective on the effects of river impoundment which brought into focus the hydrological, geomorphological and ecological ramifications of river regulation. He authored and edited over 20 books and wrote over 120 papers and almost 50 book chapters spanning his interests in fluvial geomorphology, flow regulation, sediment dynamics and deposition, hyporheic flows and thermal profiles, wood in rivers and interactions between fluvial processes and instream ecology. Much of this research was published collaboratively and often included one or more of the 22 research students he supervised during his career.

Geoff was the founding editor of the international journal 'River Research and Applications (formerly Regulated Rivers) and was editor in chief from 1985-2016, overseeing the publication of 32 volumes. His standing in the academic community resulted in appointments to several important positions related to river management nationally and internationally.

Geoff had friends and collaborators globally and through his participation at national and international workshops and conferences helped advance understanding in hydrological sciences and river management. Even during the advanced stages of his illness, he continued to work: collating abstracts and preparing the programme for the 13th BHS National Symposium (2018) at the University of Westminster.

*Paul Wood*

**Geoff Petts – teacher, supervisor, colleague, mentor, professor and friend – will be greatly missed by us all.**

# 36th Annual General Meeting
## 12th September 2018
## Westminster University

**This year's AGM was held at the University of Westminster during the 13th BHS National Hydrology symposium .**

The President, Peter Ede, thanked the 29 members who attended during the Symposium's lunch break.

### Report of the 35th AGM

The report of the 35th AGM held on the 13th September 2017 was published in *Circulation* 135 (pages 4–7). The report was approved by Ian Littlewood.

### President's Report

Activities during the year were overshadowed by the death of our previous President, Professor Geoff Petts, on 11th August 2018. He had been unwell at the time of the previous AGM in Loughborough in September 2017 (and only able to attend for part of the day's events), but the seriousness of his condition was not known to others at that time. He had expected to attend committee meetings in his role as immediate past President, but was unable to do so because of his illness and treatment. His funeral was private, but the University of Westminster expects to arrange a memorial service and I hope that BHS will be well-represented at that. Throughout his illness Geoff remained committed to the National Symposium here at the University of Westminster which he wanted to be part of his swansong following his time as Vice-Chancellor. Before his death he was delighted with the extent of the draft programme which others then took forward to the events taking place today and tomorrow. Until very late he was determined to attend the Symposium, but sadly that was not to be.

There have again been fewer National and regional meetings than was the norm in earlier years (see the Hon Secretary's report), but there are more promising signs for the year ahead. The Peter Wolf Symposium held at the Canal and River Trust in Leeds was a great success, showcasing some of the work being undertaken by early career hydrologists as well as providing a valuable forum for the interchange of ideas. The National Symposium was reduced from three days to two following review of the previous event in 2016; all the signs are that it will be a very successful event.

The Society's Statutes were revised during the year. The trustees are now the elected members of the National committee, rather than all committee members, as it was felt inappropriate for members nominated by other organisations (eg CIWEM) to be expected to take on the responsibility of being trustees of the charity.

During the year we have established a sub-committee structure to help to drive forward the Society's activities. These three sub-committees cover Finance, Meetings and Communications, and generally liaise between committee meetings through email and conference calls.

The Society retains its 'special' relationship with its founding partners the Centre for Ecology & Hydrology (CEH) and the Institution of Civil Engineers

(ICE). BHS is now a 'Specialist Knowledge Society' of the ICE. The ICE has revised the way that it charges such societies for administrative support; whilst this does mean an increase in our costs, ICE has stressed its willingness to help the societies to develop the "knowledge" aspects of their work, something that they in principle expect to do without increasing charges. I would like to thank all members of the committee for their support, particularly those who are stepping down, including Ian Pattison who completes four years as Honorary Secretary.

**Honorary Secretary's Report**

Ian Pattison reported on the Society's activities over the last 12 months. He started by outlining the range of technical meeting and symposia convened over the last 12 months as these continue to represent a key area of activity for the Society. Over the last year BHS had held one main National meeting, as well as supporting events by other organisations e.g. DEFRA, EA. The meeting, on Seasonal Forecasting, held at Loughborough University and organised by Dr Louise Slater, took a new format, over two days. In addition to these National meetings, there had been a several regional meetings, mainly organised within the Pennines and SE regions covering topics such as Storm Desmond: Lessons Learnt, Hydrogeology and SUDS, and Low flows and abstraction.

The Peter Wolf Symposium was held on the 7th-8th June by the Canal and Rivers Trust at Leeds. Thanks to Adam Comerford, Sarah Edwards and Sarah Richards for organising. This again was a great success and shows the future of our discipline is bright.

On behalf of the Society, Ian thanked all of those involved in organising, convening, presenting at, chairing, administering and reporting on meetings. The success of the programme is down to BHS members so their involvement is much appreciated. However, it has been increasingly difficult to put together a BHS national meeting programme, so suggestions and volunteers are needed. However, there are some National meetings in the pipeline, with a meeting on UK Reservoir Spillway Flood Hydrology in March 2019, and discussions for meetings on the new UKCP18 climate projections and with the Meteorological Society.

In relation to communication, the Society continues to seek ways to improve the ways it keeps in touch with Members. We have made improvements and developments to our website and we welcome any feedback or suggestions on its usefulness and appeal. Furthermore, we have developed our presence on social media, with 1629 (+80) members on LinkedIn and 1564 (+413) followers on Twitter, led by Lucy Barker.

Ian extended special thanks to Moira Doherty, who as the ICE BHS Secretariat support, has provided invaluable assistance in liaising with ICE. Web support from Celia Kirby and John Griffin is greatly appreciated, along with Celia's editorial work on *Circulation*.

Ian concluded by noting the good health of the BHS with Membership of the Society pretty constant and the ability of the BHS to attract new Members from across the hydrology sector (increasing student membership). The success of the BHS is down to its members and we welcome any thoughts, feedback or ideas. As this is my final report, I would just like to thank everyone who I've sat on committee with over the past 4 years for their support and assistance, it has been a really fulfilling role to contribute to the society.

**Honorary Treasurer' Report**

The draft summary of BHS accounts for FYE 30th June 2018 distributed today is for information to the AGM. A definitive statement of these accounts will form part of the annual Trustees' Report, which is currently being prepared and will be inspected externally before being filed with the Charity Commission.

Compared with the previous FY, Income for 2017/18 was down by about £9K, largely because we did not stage a biennial or international Symposium. Surpluses from the National meetings that were held remained healthy. Membership subscription income was down slightly – we should keep an eye on that. Expenditure was down by about £8.8K (again, because of no BHS Symposium in 2017/18). MSc Student awards (£1,500 per student) increased: the number of awards increased from 6 to 9. BHS Travel Awards decreased by about 10% on the previous FY – we should keep an eye on that too. The accumulated general fund at 30/6/18 stood at £70,155. There was no spend from the Exeter Fund in 2017/18. At FYE, the EF stood at £64,085. The BHS Total Funds at FYE stood at £134,240, an increase of about £11.4K on the previous FY.

Over the years, the Exeter Fund administered by BHS (providing financial assistance to individuals attending IAHS and IUGG events specifically) has been excessively drawn upon in some years but not at all in others. Discussion is ongoing concerning how BHS might better manage the EF towards a more even annual expenditure from the EF endowment income. In recent years the EF has not been used as much as perhaps it should (see also page 12).

A paper to Committee by the Honorary Treasurer in April 2018 identified substantial, arguably unnecessary, costs (these can not be seen in the summary of BHS accounts presented earlier). Currently BHS is paying for the production and distribution of exactly the same information to Members in hardcopy and digital formats. Distribution via the digital medium is zero cost to BHS and renders redundant the costly printing and physical postal distribution of hardcopy. Hon Treasurer has recommended cessation of hardcopy of the *Circulation* newsletter, which would of course continue in digital form. Cessation of the hardcopy could be immediate – *Circulation* need not change at all. Over the next year or so, part of the savings could be used to develop the digital version of *Circulation*, e.g. for additional consumption via mobile phones. Committee continues to consider this issue.

**Changes to the Membership of the Main Committee**

The Hon. Secretary Ian Pattison reported that a call for nomination to the Main Committee had been circulated to all Members.
Under the Statutes of the Society the following elected officers and members of the Main Committee were due to retire at this year's Annual General Meeting:
Ian Pattison (Hon. Sec.), Victoria Coates, Cedric Laize and Emma Wren. Three nominations were received for Main Committee members and Anita Asadullah, Mason Durant and Michael Pollock were duly welcomed on to the Committee.

The President Peter Ede then warmly welcomed President Elect, Nick Chappell, Lancaster University. Unfortunately, no nomination was received for the post of Honorary Secretary by the time of the meeting but this post has subsequently been filled by Michael Cranston – see page 10

# Congratulations to the winners of our 2018 Student Prize

First place goes to **Sophie Gordon** of the University of Bristol for her dissertation "A tide of plastic: the spatial distribution of microplastic contamination in the hyper-tidal River Avon (Bristol) and Severn Estuary, UK"

Our two runners up are:
**Maria Tsaptsinos,** University of Nottingham, for "Assessing and comparing disruption of longitudinal connectivity on macroinvertebrate communities in four UK rivers" and **Charlotte Hudson,** University of Cambridge, for "Modelling the impacts of climate change on river flows in the Lena River Basin, Siberia, and potential implications for the Atlantic Meridional Overturning Circulation"

**Sophie's Abstract:**

All the world's oceans are contaminated with microplastic particles, but there is a lack of research into freshwaters and estuaries, which are substantial sources of plastic to the ocean.

An existing fluorescent dye method was developed to identify microplastic particles in sediment and surface water samples from the hyper-tidal Bristol Avon and Severn Estuary in the south-west of the UK. Microplastic particles and fibres were found in all samples. The estuary sediments had the highest plastic concentrations of any area studied so far, with an average of 19,500 particles $kg^{-1}$ dry sediment and a maximum of 71,000 particles $kg^{-1}$. The water samples from the Avon contained an average of 0.56 particles $m^{-3}$ water. The tidal influx into the river carried with it a large quantity of microplastic particles, temporarily increasing the fluvial plastic concentration by around 300 times from 0.14 - 41.0 particles $m^{-3}$ at high tide. Based on cycles of deposition and resuspension of sediment in the estuary, it appears likely that plastic will accumulate there rather than being immediately exported to the sea. This could cause microplastic concentrations to increase even further in the future, compromising the water quality and endangering biota.

# New members to Main Committee




### *Michael Cranston – Honorary Secretary*

Michael is Technical Director at RAB and manages the resilience and flood risk management team in Scotland. He is the RAB lead for flood forecasting and early warning and has recently worked on projects in Nepal, Northern Ireland and Spain.

He is an Honorary Research Fellow at the University of Dundee contributing to research activities and successfully won a Horizon 2020 Research and Innovation award contributing to the development of a multi-hazard early warning platform across Europe.

Following an early career as a hydrologist with the Environment Agency and Centre for Ecology & Hydrology, Michael worked with SEPA in the development of their flood forecasting and warning capabilities which included the development of the Scottish Flood Forecasting Service – a strategic partnership with the Met Office.

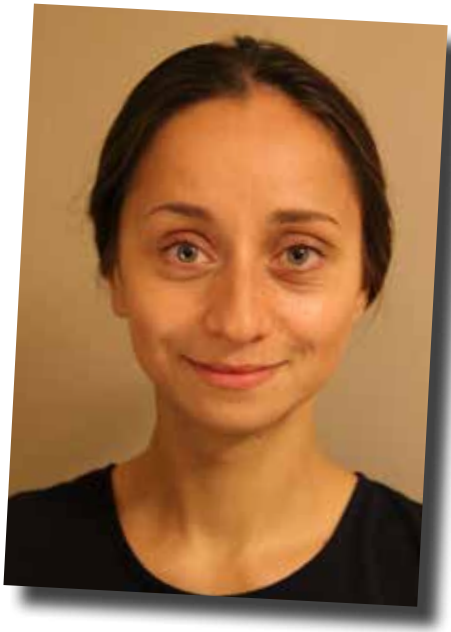
Michael was previously Honorary Secretary of the ICE Scottish Hydrological Group between 2000 and 2007 and Chair of the UK Inter Agency Committee for the Hydrological Use of Weather Radar.



**Mason Durant** is a Scientist in the Water Management group at HR Wallingford, working on a variety of research and consultancy projects across flood risk, urban drainage, water resources, and water, sanitation and hygiene work areas. My current work focuses on how statistical approaches to water resource modeling could be used to determine impacts on customers. I hope to encourage the increased sharing of information within the hydrological community, and am looking forward to contributing to the running of the Society.

**Michael Pollock** studied Civil Engineering at Newcastle University and quickly developed an interest in hydrology, which led to an MSc and latterly to a PhD in quantifying and mitigating the impact of wind-induced undercatch in rainfall measurements. This industry-based research project introduced Michael to his current company, EML, where he has been exposed to a wide range of hydro-meteorological applications, in the context of field measurements and modelling.





**Anita Asadullah** is a hydrologist from Imperial College masters' programme with 10 years consultancy experience with Halcrow in UK and Buenos Aires and DHI in Denmark. I currently lead the National Flood Hydrology team at the Environment Agency with the responsibility for operational hydrological methods, skills, and national guidance. I joined the agency 2 years ago. In the past I've specialised in satellite-based rainfall estimation and joint water resources management and flood forecasting models in various countries around the world. I've also had experience in hydropower analysis and PMF estimation, particularly in Peru. Current interests lie in bringing together various aspects of flood hydrology to improve our technical approach operationally. I'm leading the Flood Hydrology Road Map work which will develop a national vision and action plan for flood hydrology.

# Help with travel costs for IUGG2019

**Applications will be invited in February 2019 for the Exeter Travel Fund to help with the costs of participation in the 27th Assembly of the International Union of Geodesy and Geophysics (IUGG) in Montreal, Canada, 8-18 July 2019. The IUGG Assembly includes a programme of 29 hydrological symposia organised by the International Association of Hydrological Sciences (IAHS) covering all aspects of hydrology: http://iugg2019montreal.com/h.html**

BHS administers the Exeter Travel Fund which arises from the income of the invested profits of the 1st Scientific Assembly of IAHS held at Exeter University in 1982 and organised by Des Walling and colleagues. IAHS is a non-profit making non-governmental scientific organisation with global reach, run by hydrologists for hydrologists. Individual membership of IAHS is free and there are currently more than 8000 members in almost 200 countries.

The Exeter Travel Fund is open to applications from hydrologists resident in the UK, and applications are particularly encouraged from early career hydrologists. Applicants should be presenting a paper or poster at IUGG2019. Applications should be made on the Travel Fund application form available on the BHS webpages from 1 February 2019 at: **http://www.hydrology.org.uk/Travel_Grants.php** and emailed to the current Chair of the UK Committee for IAHS - Kate Heal, School of GeoSciences, University of Edinburgh k.heal@ed.ac.uk. The deadline for applications is 5 pm on Friday 1 March 2019.

For any queries about IAHS or how to get involved in IAHS-related activities feel free to contact Kate Heal.

## Current membership of the UKIAHS Committee

| *IAHS Commission represented/Role* | *Name* | *Affiliation* |
|---|---|---|
| UK National Representative for IAHS (Committee Chair, Past President ICWQ) | Prof. Kate Heal | University of Edinburgh |
| ICCE, Continental Erosion (President ICCE) | Prof. Adie Collins | Rothamsted Research, North Wyke |
| ICCE, Continental Erosion (UK National Correspondent for ICCE) | Prof. Des Walling | University of Exeter |
| ICCLAS, Coupled Land-Atmosphere Systems | Dr Alberto Martinez-de la Torre | Centre for Ecology & Hydrology |
| ICGW, Groundwater (Vice-President ICGW) | Dr Corinna Abesser | British Geological Survey |
| ICRS, Remote Sensing | Prof. Dawei Han | University of Bristol |
| ICSIH, Snow & Ice Hydrology (Vice-President ICSIH) | Dr Melody Sandells | CORES Science and Engineering Ltd |
| ICSH, Statistical Hydrology | Dr Wlodzimierz Tych | Lancaster University |
| ICSW, Surface Water (Vice-President ICSW) | Prof. David Hannah | University of Birmingham |
| ICT, Tracers | Dr Josie Geris | University of Aberdeen |
| ICWQ, Water Quality (President ICWQ) | Dr Wouter Buytaert | Imperial College London |
| ICWRS, Water Resources System | Dr Mike Simpson | HR Wallingford |
| BHS President | Mr Peter Ede | Mott MacDonald Group |

# 8th European Pond Conservation Network Workshop

## *Torroella de Montgri, Girona, Spain*
## *21–25 May 2018*

The European Pond Conservation Network (EPCN) Workshops have occurred biennially since 2004. This year's meeting was highly interdisciplinary, with aquatic and terrestrial scientists from a broad range of disciplines and provided an opportunity for anyone with an interest in hydroecology to gain new insight regarding research developments in aquatic science.

The workshop featured 4 plenaries and 35 oral presentations over 5 sessions, focusing on metacommunity functioning, biodiversity in shallow lakes and ponds, carbon fluxes in temporary waters, and the management and restoration of lentic ecosystems. The workshop provided a relaxed and supportive atmosphere for the presentation and discussion of freshwater research, and for the development of international and interdisciplinary collaboration. After the welcome address by **Xavier Quintana** (University of Girona, Spain), the first plenary speaker, **Zsófia Horváth** (WasserCluster Lunz, Austria) outlined her current research on the structure and functioning of aquatic communities in soda pans, the need to develop a link between space and time to better understand metacommunity functioning, and highlighted the internationally collaborative research examining spatial and temporal turnover in metacommunities (sTURN working group) currently being undertaken.

The first session followed, focusing on the 'structure and function of metacommunities'. **Mesquita-Joanes** *et al*. (University of Valencia, Spain) and **Tornero** *et al*. (University of Girona, Spain) both identified local environmental variables to typically be a more important driver of community structure in ponds than spatial variables. My own paper 'Examining local contributions to beta-diversity in urban pond communities: implications for urban biodiversity management and conservation' was accepted in this session. I discussed my preliminary findings, highlighted the contribution of individual pond sites to overall beta-diversity and how identifying the environmental and spatial drivers of ecological uniqueness could provide critical information for the effective landscape-scale management and conservation of pond biodiversity.

Within the same session, **Cunillera-Montcusi** *et al*. (University of Girona, Spain) provided an interesting talk on the response of macroinvertebrate metacommunities to wildfires. Connected ponds were found to be highly resilient to wildfires, with recovery only significantly affected in the most isolated ponds.

**Federico Marrone** (Università di Palermo, Italy) presented the second plenary, outlining research on gene-flow in ponds and the conservation importance of temporary ponds. One stand-out presentation from this session was by **Blaustein** *et al*. (University of Haifa, Israel) on the effects of the fire salamander larvae on aquatic community structure, and the negative effects of fire retardant (FR CROS 134) on the survival of juvenile

fire salamanders.

The following two sessions were on carbon fluxes in ponds and pond biodiversity. The third plenary was delivered by **Biel Obrador** (University of Barcelona, Spain) on the role of temporary ponds in the carbon cycle. **Greaves** *et al*. (UCL, UK) presented her research on the importance of understanding the perceptions of farmers and other stakeholders in farmland pond restoration, educating farmers on the value of ponds and developing community pond restoration projects that re-connect landowners with local farmland ponds.

**Lemmens** *et al*. (KU Leuven, Belgium) presented interesting research which suggested that integrating commercial fish farming and nature conservation can be economically beneficial, reduces the cost of biodiversity management in ponds, and enables effective biodiversity conservation at large spatial scales. **Lewis-Phillips** *et al*. (UCL, UK) presented research highlighting the importance of pond management in agricultural landscapes for avian biodiversity and **Sayer** *et al*. (UCL, UK) provided a very interesting talk on the recovery and conservation of the Crucian Carp in the UK.

The final session of the workshop focused on the management and restoration of lentic ecosystems. **Francisco Comín** (Instituto Pirenaico de Ecología, Spain) presented the fourth plenary on current management and restoration strategies for small waterbodies, and the opportunities and challenges for pond restoration/management in the future.

Within this session, **Cañedo-Argüelles** *et al*. (University of Barcelona) presented research which found the expansion of Barcelona airport had significant effects on the hydrology of surrounding lagoons, resulting in poor water renewal, eutrophication and a reduction in aquatic biodiversity.

Alongside the oral presentations, the conference provided a broad range of high quality poster presentations. In total, there were 28 poster presentation covering a wide range of topics. Those of particular interest included: 'Experimental study on the effect of water regime on plant life history in Mediterranean Temporary Ponds' (**Bagella, S**. University of Sassari, Italy), 'Long-term plant community patterns in temporary freshwater rockpools' (**Lanfranco, S**. University of Malta, Malta), 'Very high resolution aerial images from unmanned aerial vehicles to monitor environmental conditions in a karstic Mediterranean pond' (**Moreno, J. L.** University of Castilla-La Mancha, Spain) and 'How do zooplankton respond to a coastal lagoon deurbanization and restoration process? The case of newly created salt marsh lagoons in La Pletera (NE Catalonia)' (**Quintana, X**).

The conference excursion was to La Pletera salt marshes, where there has been significant de-urbanisation (removal of the coastal promenade) and restoration of the hydrological and ecological functioning of the coastal lagoons. We hiked around the lagoons, making numerous stops to discuss and visualise their hydrological and ecological recovery. La Pletera was a hydroecologist's paradise with multiple stops being made to observe and identify bird, flora and aquatic species. The EPCN 2018 workshop was a fantastic experience; I met lots of great researchers and returned with a number of collaborative ideas for future research projects. I am very grateful to BHS for providing me with a travel grant to be able to attend this fantastic workshop.

*Matthew Hill*
*University of Huddersfield*

# Hydrology: Advances in Theory and Practice

## University of Westminster

### *12–13 September 2018*

The 13th BHS National Hydrology Symposium – 'BHS 2018' – had a traumatic gestation for the reasons we know too well. For those of us on the inside, it seemed ever more unlikely that the event would happen. That it did – so successfully – is a great tribute to David Boorman and his *ad hoc* team.

Many delegates who were there were likely as amazed as I was that such a full and interesting programme had been packed into two days. There were consequences of this of course, the inevitale repetition of Chairmen saying 'We must now move on to our next speaker...etc." and much interesting discussion stopped short in mid-flow. Mind you, when we moved to the coffee breaks it was obvious that all inhibitions about tackling contentious issues were entirely absent.

A big issue for future such meetings must surely be that parallel sessions are a real pain and best avoided. Even – dare I say it – deliberatly planning for a longer meeting despite the cost. Of course part of the problem is our subject: what **doesn't** come within the remit of 'hydrology'? Indeed, part of the attraction of such events is the opportunity to widen horizons, to follow the more intricate relations between theory and experiment and practical implementation.

Individual presentations are now simply amazing: the (awfully embarrasing at the time) business of that walking to the podium wondering if your notes are going to carry you through have been banished through the creative use of electronic presentations. In the same way that everyone is now an ace photographer, so we are all polished presenters.

The highlights of the meeting were the Keynote presentations; Keith Beven's 'President's Address' at the start, a shortened version of which is elsewhere in this issue (page 22), which had everyone talking, not only during the meeting but also in the follow-up messages received long afterwards, closely followed by David Boorman's and Rob Wilby's 'wind-up' contributions.

Many of the technical presentations from the meeting are now loaded on the BHS web site: see **www.hydrology.org/publications.php.***

An invitation to submit full papers for publications in a Special Issue of *Hydrology Research* has been sent to all the speakers.

*Celia Kirby*

# BHS




I thought the Westminster symposium was great if a little on the warm side at times! I'm certain Geoff would have enjoyed the two days.....





..... need to learn that model rejection is a Good Thing; ..... need to improve our representation of hydrological processes so that we get the right results for the right reasons.






.....valued the networking sessions to speak with a wide variety of academic researchers and other practitioners



# 2018




.....some of
e previous BHS
nferences have
ed a bit "flat" but
e was a real buzz
out BHS2018

..... difficulty of swapping between parallel sessions



.....enthusiasm and general high quality of all the presentations.





noticeable that there were much higher numbers of practitioners at this event.....

.....we need
"Journal of
ydrological
ures" where we
publish null
ts and rejected
ideas

*AGU Chapman Conference*

# Hydrologic Research in the Congo Basin

***Washington DC, 25–27 September 2018***

When I first heard about the proposed AGU Chapman Conference on Hydrologic Research in the Congo Basin, I knew it would be a very important conference for my PhD, and so it proved – many thanks to BHS for part-funding my attendance! My PhD is on the hydraulics and bathymetry of the Congo River's main stem, specifically the middle reach where the main stem is a highly complex, multichannel system that interacts with the Cuvette Centrale Wetland. The middle reach is also heavily relied on for river navigation by both domestic and commercial users, but the morphology is dangerous and challenging to navigate at times. My PhD is also affiliated with the Congo River users Hydraulics and Morphology (CRuHM) project, which has facilitated field trips and workshops with other Congo River researchers.

AGU defines its Chapman conferences as small, topical meetings designed to permit in-depth exploration of specialized subjects in a manner not possible at large meetings. In this Chapman conference, the topics were diverse but the geographical context was focused on the Congo Basin. I found this diversity of topics one of the most enjoyable aspects of the conference: having a prior understanding of the geographical context made it easier to get to grips with unfamiliar topics and improve my awareness of how these different areas could potentially interact with my research. One of these topics was climatology, and in particular some of the challenges associated with retrieving rainfall data by remote sensing in the Congo Basin. Another session on carbon & hydrology drew my attention to the importance of flood inundation dynamics to carbon cycling in the Congo Basin.

My conference poster presented the results of a reach-scale high resolution digital elevation model (DEM) of the main stem's bathymetry. The bathymetric DEM partly comprises river bathymetry measurements I collected with a sonar device on a CRuHM project field trip in 2017, but this data only covered a small part of the channel – it is very difficult and time consuming to survey a 10km wide channel separated by numerous islands! I therefore developed a bespoke method which interpolates the sparse sonar data collected, and combines it with estimates of bathymetry in the un-surveyed locations. The results I obtained are promising, and going forward I hope to scale the method up and use the bathymetric DEM to undertake hydrodynamic model simulations of the Congo's annual flood pulse.

One of the aims of the conference was to remove economic and language barriers between researchers active in the Congo Basin. This was certainly achieved – the excellent translation service enabled me to understand numerous presentations given in French; by both European and Congolese researchers. Of most interest to me was some of the work presented by researchers at Institut de Recherche pour le Développement (IRD), around

using satellite altimetry data to derive river channel bathymetry and measure discharge.

Thanks again to BHS for helping me to attend, and thanks also to Professor Doug Alsdorf and others involved in making the conference happen.

*Andrew Carr*
*University of Leeds*

# Stream Gauging Course and River Flow 2018 Conference

I am currently completing my first year of my PhD focusing on 'the evaluation of UAVs for river flow monitoring', therefore the River Flow 2018 conference and the Stream Gauging course presented a timely opportunity for me to gain a better understanding of various types and applications of river flow monitoring. I was excited to attend the Stream Gauging course in particular to enhance my knowledge of the various techniques for monitoring river flow, and to create new connections within the community.

The Stream Gauging course was organized by IAHR/WMO and IAHS, and the program was packed with lots of interesting seminars and fieldwork. The seminars focused on different stream gauging techniques such as Velocity Area, ADCP, dilution, imagery (LSPIV/STIV), stage-discharge rating curves as well as methods for verification, calibration and comparison of such techniques. Furthermore, a lot of emphasis were given on uncertainty analysis; this gave me a great insight into the different techniques that I will be able to implement within my own studies for calculating uncertainty. Furthermore, I met with two of the creators of the software that I will be using throughout my PhD (Fudaa-LSPIV), they gave me some invaluable advice and training for




Different techniques demonstrated during the Stream gauging course fieldwork day. A – Surface Velocity Radar, B – Current Meter deployed from incidence van, C – ADCP, D – Transparent Velocity Head Rod (TVHR), E – Dilution gauging, F – Image velocimetry (LSPIV).

the use of the software for which I am very grateful, without attending this course, that may not have been possible.

The River Flow 2018 conference was the first international conference that I have attended, therefore it was very interesting for me to experience such an event. I was excited to listen to internationally recognized scientists present their research and learn a lot from the community. In particular, I attended sessions focusing on: experimental hydrodynamics, management of hydrological extremes, innovative in-situ measurements (discharge) and computational methods and code calibration. The research presented throughout these sessions were very insightful and have enhanced my knowledge as well as raised questions that I could implement within my own study. I hope to attend the River Flow 2020 Conference to present the findings of my PhD. I would like to thank the British Hydrological Society for awarding me with a Travel Grant which helped me to attend the Stream Gauging Course and River Flow 2018 Conference.

*Sophie Pearce*
*University of Worcester*

# History of Hydrology Update

More material has been added to the History of Hydrology wiki site (www.history-of-hydrology.net). There are now nearly 120 biographies, a few histories of experimental catchments and institutions, and more articles and textbooks. An "anecdote" heading has been added, so if you have any important anecdotes that ought to be recorded then please add them to an existing entry or let me know.

Some personal anecdotes have also been recorded in a new series of video interviews that were started during the EGU meeting in Vienna this year. These can be found at **https://www.youtube.com/channel/UCJvhzZ9wjcEJEnnnHyLoSZQ**. They include interviews at EGU with Siva Sivapalan, Eric Wood, Mike Kirkby, Gia Destouni and myself. I also did three additional interviews this summer with John Sutcliffe, John Rodda and Christine McCulloch, that particularly relate to the early days of the Institute of Hydrology.

Suggestions for other entries and other interviews are always welcome, but please remember that since this is a wiki site anyone can also register to add or edit entries. Templates for each type of entry are provided.

*Keith Beven*





# NRFA peak flow dataset Version 7 released

The National River Flow Archive has released an update to its peak flow dataset including the files for use in the WINFAP software for flood estimation.

The dataset includes AMAX and POT data for 956 gauging stations, updated with an additional water year of data (October 2016 to September 2017) in England, Northern Ireland, Wales and for those stations that took part in the Data Review in Scotland (released in v6).

It also includes a period-of-record review of data and metadata for 20% of stations across the UK.

As well as the core peak flow data, there are now a number of metadata updates including FEH Indicative Suitabilities, ratings, datums, missing and rejected data and station descriptions. This additional information about the gauging stations will allow users to make informed judgements regarding application of the data.

The NRFA's peak flow dataset provides flood data for 956 river flow gauging stations around the UK. The data can be used with the flood estimation methods set out in the Flood Estimation Handbook (FEH), which is the industry standard for current flood estimation in the UK.

The peak flow data provided through this service originate from gauging stations operated by a range of UK hydrometric measuring authorities as is the case with other NRFA data. Version 7 of the WINFAP files is the fourth version released since stewardship of the national peak flows dataset was passed to the NRFA. Updated peak flow time series and metadata are now available to view on the NRFA website and can be found using the NRFA's gauging station search tool.



**BHS Symposium President's Address**

# How to make advances in hydrological modelling

*Keith Beven, Lancaster University*

In his invited President's Address, Keith gave a quick summary of his history in hydrological modeling from his first attempt as an undergraduate student in 1970 (modeling the Lynmouth Flood with a program in Algol that existed on punched cards), through his PhD Finite Element Model of the East Twin catchment in 1975, and his involvement in the development of Topmodel, the SHE model, the IHDM4, Dynamic Topmodel and MIPs models, and for the last 25 years or so, trying to understand uncertainty in hydrological modeling. He noted that we have a real plethora of different hydrological models (from ABC to Xinanjiang, but suggestions are still needed for Y and Z?). Most of those models are conceptual in nature, variants on the stores and storage-flux relationships of the Stanford Watershed Model of the 1960s. Some are based on (incomplete) process theories; some derived directly from the available data (ANN, DBM). Some are distributed and highly integrated into geographical information systems (SHE, Hydrogeosphere, Dynamic Topmodel). Some are modeling systems that allow the user to try out many different structural configurations (Superflex, SUMMA). Some come with databases of parameter values so that they can be applied without calibration (SWAT), although it is usually calibration that allows us to declare some sort of success.

Success after calibration is often illusory, however. Performance often degrades in even the simplest of split-record validation test, and there is no guarantee that a calibrated model will match multiple observables, all parts of the calibration series, or be fit-for-purpose when used to predict the changed conditions often required to provide evidence for decision making. Part of the problem is certainly that the data available for modeling are often not adequate; they can even be hydrologically inconsistent and feed disinformation into the modeling process. But part of the problem is also the lack of rigorous testing and invalidation of models which should best be viewed as multiple working hypotheses about how a catchment or water body functions.

Keith outlined three major issues in trying to make advances in hydrological modeling. The first is deciding when a model is not fit-for-purpose and he suggested that what is needed is an appropriate form of Turing Test for models. The second is a better way of representing hydrological processes that, because of the differences in velocities and celerities in the system, has some scale dependence in modeling both flow and transport within a consistent framework. The third is how to manage the 'models of everywhere' that are becoming available, with visualisations of model outputs that can be evaluated by local stakeholders.

For the evaluation of models for fitness-for-purpose a Turing

Test in the form: "Can a group of experts tell the difference between a sequence of observations in space and/or time and a model simulation?" could be considered. Keith noted that we all do this type of evaluation, whether that be in model development and testing, in reviewing papers by other modellers, as clients and consultants in reviewing the results produced by contractors. The question is whether we are sufficiently rigorous in doing so, while recognising the inherent uncertainties in the forcing and evaluation data when some of that data may not be informative in telling us whether a model is fit-for-purpose. A particular point here was the idea of satisfying some statistical criteria 95% (or less) of the time – that still does not necessarily mean that a model will be fit-for-purpose if what we are really interested in (usually flow peaks or low flows) falls within the other 5%. He illustrated the Turing Test concept by an application of the SWAT model to the Morland DTC catchment when it was concluded that SWAT was not fit-for-purpose in that case. He noted, however, that such model failures are actually a good thing – because it means we have to do better.

Fitness-for-purpose is especially important when we wish to predict the impacts of future change. A relevant current example is the need to predict the impacts of Natural Flood Management measures to make some assessment of effectiveness when making decisions about investments. Until now, many schemes are being implemented with a belief that there will be adequate benefit, but without such assessments and without any form of monitoring. Predicting the future, however, is subject to important epistemic uncertainties that may be difficult to assess properly, even when that is only how model parameter changes should be implemented.

What an appropriate Turing Test should look like is not yet clear. It will certainly depend on the purpose; it might well depend on what evaluation data are available and assessments of data uncertainties; it might involve decisions about critical experiments or observations that could help in the assessment. Keith used the example of the Blind Validation methodology of Ewen and Parkin (*J.Hydrol.*, 1996), which was applied to the SHE model in applications to two small catchments as one of the few examples of trying to set criteria for model acceptance before running the model. In both cases the model failed some of the tests: even the passes were not all that rigorous, but that has not stopped the model being used widely since. This concept is also at the heart of the GLUE Limits of Acceptability methodology that has been used in a number of studies, some of which have rejected even the best models found.

So the next question is whether we can improve our models further. Here Keith suggested that a good way of looking at process representations is closure schemes for the mass and energy balance equations applied at whatever scale of landscape discretisation was appropriate. There is then, however, an implication that process representations should be both hysteretic and scale dependent. Much more needs to be done in understanding what such closure schemes might look like, and he gave the example of using the MIPs particle tracking model – where all the water in the system is tracked as particles that move with different velocities– to investigate changes in hysteresis of the storage-flow relationship at different scales and different antecedent conditions.

Another way in which model improvements might be instigated is by the wider availability of visualisations of model outputs. This provides the means for local stakeholders to relate to what is being predicted in their locality. In the future this will mean much more feedback about where models are wrong, such that modeling will become less the application of models to places and much more a learning process about those places. This raises a variety of research questions, not the least of which is to how to get better data in learning about places (and, again, how to actually do model evaluations both now, and in the future as the system evolves if past simulations can be stored for later access). A final suggestion was that the hydrological community could be much more pro-active in commissioning new measurement techniques.

Keith finished by suggesting that he was finishing his career with much more uncertainty than when he started, but that was a good thing because it meant that there was still so much more to do, especially in reducing epistemic uncertainties particularly through better measurement techniques; in developing better hydrological science as better process representations; and in finding better ways of testing models and being allowed to accept that they might not always be fit-for-purpose.

A written version of the Address will be included in the special issue of *Hydrological Research* arising from the BHS Symposium. The slides of the Address may be found by searching links on www.hydrology.org.uk/publications/php .

## New members

Cordula Wittekind.....Leeds University
Dr Emma Shuttleworth.....Manchester University
James Bishop.....Dundee University
Katherine Ashworth.....Southport
Alex Garratt.....Cardiff
Maarten Wynants.....Plymouth University
Charlotte Hudson.....York
Philip Hook.....Edinburgh
Jamal Zaherpour .....Nottingham
Romain Sarremejane.....Nottingham
Helen Rossall.....Environment Agency, Newton Abbot
Vicky Crichton Environment Agency, Newcastle upon Tyne
John Harwood.....Environment Agency, Petersfield
Mike Summers.....Environment Agency, Bristol
Emily Trill.....Centre for Ecology & Hydrology, Wallingford
Harry West.....University of Western England, Bristol
Adam Griffin.Centre for Ecology & Hydrology, Wallingford
Isabelle Costaz.....Dundee University

# Do people in other countries really need UK hydrologists?

**One of the messages that I took from presentations and the BHS National Symposium was a suggestion that we hydrologists have a duty to help people in other parts of the world, usually poorer countries, with our hydrology skills. I've seen this idea raised elsewhere too, and I think it deserves more discussion about what it really means in practice.**

When I was working on an international project in East Africa, a colleague told me a joke. It goes like this…"What did they use in the Democratic Republic of Congo for lighting their homes before they had candles…?"

The answer? "Hydropower". It's not a classic or even a cracker filler, but the point of this (partly true) anecdote is that people's quality of life does not progress in step with better hydrological understanding. It is not science but political, economic and social factors that determine how people live.

Furthermore, in my experience (working on World Bank-funded hydrology projects for six years in several different regions), it is very easy to end up extracting more than you give, despite a genuine desire to help.

Numerous countries have seen hydrological studies carried out by foreign institutions repeatedly over the years, with very little impact in country. This isn't because the hydrological estimates were wrong. Perhaps it is because the need to push studies forward into action requires sustained expertise in the country. Perhaps it is because some countries never asked for these projects in the first place. Or maybe it is because hydrologists don't always understand the local context in which our work has to be applied. In reality, it must be a combination of many reasons.

There are some places where UK expertise can be usefully procured by other countries. I have seen cases where it has worked well when there is both some local expertise and strong institutions which have defined the scope of the work and can take the work forward. In other cases, I have found that working as a hydrologist in other poorer countries can mean:

- We can extract money – by being paid to do a job with money meant to reduce poverty in the country of need (for example if funded by World Bank or UK aid). We take most of that money back and spend it in our local economies at home.
- We can extract knowledge - by studying local datasets we develop knowledge of the region's hydrology. As a result, that knowledge is lost to the country when we leave and can only be bought back at expensive rates when they hire us to do the next job. That knowledge could otherwise have stayed in the country if it had gained by someone locally.
- We can extract experience and networks – by working with institutions in the country. We put this experience on our CVs and it enhances our careers. These relationships could have

usefully led to future collaboration in the country had they been made locally and the experience furthered the careers of local hydrologists (who would also spend their money locally!).

I think international work is incredibly interesting, but we have to be clear that we are not always the solution and at times we may be getting more from it than we put in. In fact our presence may even contribute to a long-term system of dependence on international expertise, preventing development of local hydrologists who may be better placed to effect real change.

**Who are these people that need UK hydrologists?**
It is worth noting that hydrological problems are very different in different places. If we're not careful, we risk perpetuating an outdated representation of the world which depicts knowledgeable scientists in the West, and 'other' poor powerless people who need us everywhere else. This does not give due respect to both established and potential hydrologists in other countries, nor the huge variety in economic and technological development around the world. We need to be clearer – which countries we are talking about, what assistance are we suggesting we offer?

**If knowledge is power, perhaps we can help there?**
Perhaps some of the success stories where foreign scientists have made real improvements to people's lives is in making data and information available. This includes global satellite-based datasets provided by NASA and others, and remotely managed early warning systems. Research which develops (and shares) knowledge of large-scale hydrological processes can also help. For example, understanding of El Niño Southern Oscillation has led to successful preparedness measures in Latin America.

**Can we help by collecting data for local evidence?**
At the BHS symposium, Olivia Cooke won a prize for her engaging presentation about her work monitoring water quality in an informal settlement in South Africa. It doesn't take a scientist to realise that the living conditions there were unacceptable: The photographs of rubbish-filled watercourses between homes said it all. And it's not a lack of scientific understanding that created that situation in the first place. For me, the real power in her work is generating a specific local evidence base with which to lobby government. By reporting concentrations of toxins against WHO standards rather than using SI units, the work carries the implicit statement that people living there should be afforded international living standards.

**So do people in other (poorer) countries really need UK hydrologists?**
We have things to offer. UK hydrologists have privileged access to research funds and information that can help to build an evidence base. Perhaps, for lasting change, we can also support hydrologists in other countries, by helping them build skills and access funding, or by supplying access to online information and tools.
However, I would argue that until we've actually asked people in these other countries what they really need, we can't know if we hold any part of the answer.

*Anita Asadullah*

These views are my own and do not reflect the views of my employer.

## Forthcoming Meetings




This one-day conference will look at the regulatory and policy backdrop enabling better flood risk management, including the latest climate projections and changes to FCERM and surface water management, and provide practical strategies to manage the impact of flooding on infrastructure and housing development.

Fully researched and written in discussion with Lead Local Flood Authorities and environmental and flood risk consultants, the programme will provide a mix of presentations, including case studies and new approaches; Q&A discussion; and networking opportunities to enable you to get the most out of your day. You will leave with the information you need to better manage the likely risks from changing weather patterns and achieve a more proactive and integrated approach to flood resilience at a local level.

This informative event will discuss:

- How the Surface Water Management Action Plan 2018 will better address the risks from surface water flooding and how local authorities are managing this threat
- Infrastructure Resilience: detailing how and where investment is being targeted to improve flood risk management and sustainable drainage
- The Impact of Weather Extremes on the Growth Agenda: examining how changes to flood risk management under the new National Planning Policy Framework will impact on local planning and development
- Considering Flood Risk as part of Planning and Design: the benefits of early engagement and collaborative development
- Innovations in Building Design, including Retrofit measures to adapt to changing climates and mitigate flood risk

Visit: https://environment-analyst.com/flood18'

To book your place, call +44 (0)203 637 2191
or email sales@environment-analyst.com.

British Hydrological Society

CIWEM

**Joint CIWEM-BHS National Meeting**

# Celebrating hydrometry

## Tuesday 22 January 2019

***Institution of Civil Engineers,***
***One Great George Street, London***

**T**his joint CIWEM-BHS national meeting (part of an ongoing series of meetings designed to link researchers, policy makers and practitioners) will provide an excellent opportunity to learn more about the value that hydrometry provides for society, the environment and the economy. It will feature presentations and debate from those responsible for the collection and management of hydrometric data, through to those who use it in studies or in planning, managing and regulating the water environment.

Who should should attend? The meeting will bring together academics, researchers, consultants, hydrologists, environmental managers, policy-makers, regulators and other stakeholders.

What will you learn? The meeting will be of interest to all who rely on good quality, long-term hydrometric data records to make informed, robust decisions on water resources management and flood risk, whether that is planning a new reservoir or flood alleviation scheme, managing abstractions and discharges or providing flood warnings. Good quality, continuous hydrometric data underpins almost every aspect of the way society interfaces with the hydrological cycle, yet can be undervalued, overlooked or misunderstood by many decision makers. This meeting seeks to promote the value of the ordinary – the seemingly routine observations of our rivers and streams, the groundwater beneath our feet, and the rainfall and other parameters that are measured – and recognise its importance and wider benefits for consultants and practitioners, as well as wider society, the environment and the economy, across the whole spectrum of water management. It will also cover new challenges, including increasing demand and reduced funding, signpost emerging developments in the field, and explain how concepts such as open data, big data and citizen science, alongside technical standards, quality assurance and expert judgement can help take hydrometry forward.

Meeting organiser:
Adam Comerford
Canal & River Trust and CIWEM Water Resource Panel
*Adam.Comerford@canalrivertrust.org.uk*

*Advance notice of a Workshop being planned by hydrologists at Bristol University:*

# Quality through equality – tackling gender issues in hydrology

Unfortunately, gender issues are still common and compromise both the potential of research groups and the well-being of individuals.

This one-day event includes several talks given by speakers from different career stages. There will be a training session focused on unconscious bias, group discussions as well as discussions with the speakers. The workshop will help the attendees to understand and to identify problems present in the hydrologic community and discuss potential solutions.

The event will take place in February, 2019 (exact date to be announced). There is no registration fee for this event. Lunch and refreshments will be provided. To reserve your place please complete the online registration form.

A link to the registration form as well as further information can be found at:

**https://tinyurl.com/qualitythroughequality**

# UK Hydrological Bulletin: August – October 2018

**The August-October period in 2018 served to underline how rainfall patterns, geology and soil moisture conditions across the UK can interplay to make for large regional and more local contrasts in runoff rates. Record low minimum summer (June–August) runoff totals for some rivers in eastern Scotland and depressed late-September reservoir stocks in parts of northern and south-west England contrasted with extreme flood events during October, in Wales particularly, and abundant runoff in western Scotland. In much of eastern, central and southern England a more general contrast could be identified between continuing low flows in many impermeable catchments but healthier runoff rates where groundwater levels — which generally remained with the normal early autumn range — ensured substantial low flow support. Under such circumstances generalisations carry little conviction but, in most areas, the drought conditions of the late summer have abated, reservoirs stocks are recovering and, in much of the country, mid-October saw the focus of hydrological concern switch to the risk of flooding.**

After the warmest and third driest May–July for the UK in a series from 1910, soil moisture deficits entering August were the highest, for the time of year, since late July 1989. Correspondingly, the drought's impact on agriculture — the wine harvest aside — was a major concern and in many rivers draining impermeable catchments a combination of low flows, depleted oxygen levels and high water temperatures caused considerable ecological stress with local fish fatalities (e.g. in

the Mole) and salmon waiting in estuaries for spates to trigger movement upstream.

Above average August rainfall in south-east Britain was particularly welcome and, generally, rainfall totals were in the normal range. Nonetheless, the May–August rainfall for the UK was the second lowest since 1984 and drought conditions remained extensive (Fig. 1). In many western catchments, (e.g. the Conwy in Wales and Mourne in Northern Ireland) runoff rates recovered considerably through August but, by contrast, flows continued to decline in eastern Scotland. The rivers Deveron and Whiteadder registered their lowest June–August runoff in records of thirty-seven and thirty-nine years respectively. Overall reservoir stocks for England & Wales continued to decline and were the lowest for late August since 1996 with stocks in the Derwent Valley group down to 40% of capacity.

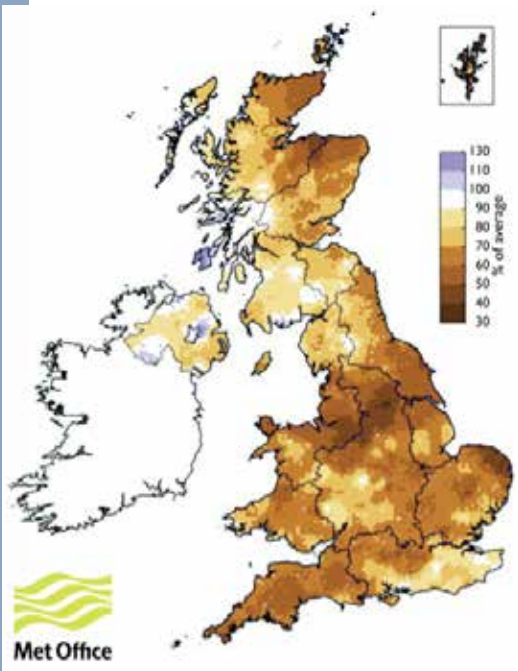



**Fig 1** May-August 2018 rainfall as a % of the 1981–2010 average

Temperatures generally remained above average during September but regional contrasts in rainfall were substantial — north-west Scotland was wet whilst rainfall deficiencies increased in Northern Ireland and much of southern and eastern England. In other areas runoff rates increased substantially after the first week, with high spate conditions particularly in parts of Wales and northern Scotland on the 20/21st. These contributed to the highest September runoff in a 35-year series for the river Nevis. In the headwaters of the Derbyshire Derwent levels in the Howden Reservoir increased by 5.5 metres on the 20th following 50 mm of rainfall in 24 hours. By contrast, depressed flows were recorded in Northern Ireland, in the Annacloy particularly, and in a number of rivers draining to the North Sea. By contrast, flows in many groundwater-fed streams in the English Lowlands (e.g. the Lambourn and Coln) continued to benefit from relatively healthy groundwater support (see Fig. 2) a consequence of the abundant recharge in March and April. Notwithstanding some local recoveries, overall reservoir stocks for England & Wales remained at their lowest since late-2003 around month-end (Fig. 3); Clatworthy and Roadford reservoirs (south-west England) and Washburn (Yorkshire) remained over 20% below average for the time of year.

After a dry start, cyclonic weather patterns became dominant from the second week of October, initially across northern and western Britain. Sustained rainfall in northern

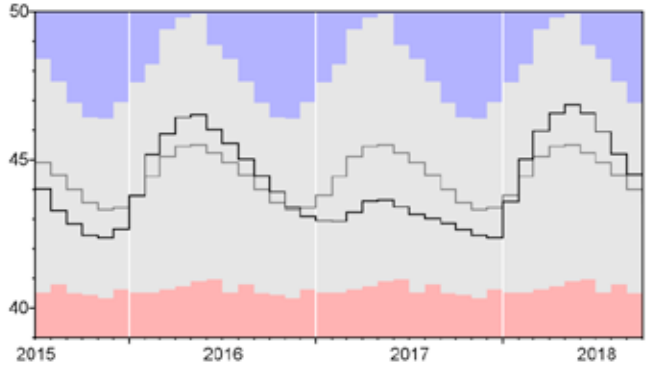



**Fig 2**

Monthly groundwater levels in the Chalk at Washpit Farm (Norfolk). The blue and pink envelopes are the period-of-record max. and min. Levels and the grey trace represents the long term monthly averages.

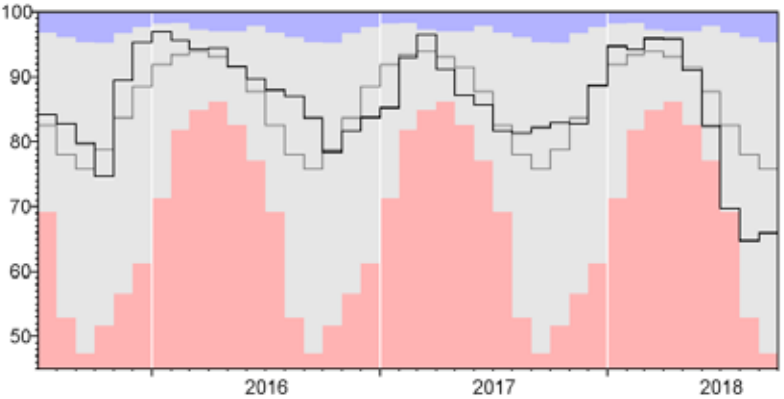



**Fig. 3** Month-end reservoir stocks for England & Wales as a percentage of capacity. The blue and pink envelopes are the period-of-record max. and min. Levels and the grey trace represents the long term monthly averages.

Scotland — Achnagart recorded 117 mm in 24 hrs on the 8/9th — triggered widespread spate conditions but this wet episode was clearly eclipsed during the subsequent slow passage of storm Callum. Rainfall accumulations were exceptional: in the Brecon Beacons a 218mm 48-hour total was recorded at Libanus and totals in excess of 100 mm were reported from north Wales and the Lake District. Correspondingly, flood alerts were common, flooding was extensive and transport disruption — locally exacerbated by landslides — was severe; in South Wales, the rail track near Mountain Ash was submerged necessitating the evacuation of 30 passengers. Callum's impact across the English Lowlands was substantially more muted, generally limited to moderate spates on responsive and/or urban streams but recessions continued in most spring-fed rivers where the seasonal recovery in most aquifers has yet to commence. The water resources outlook is very dependent on late autumn and early winter rainfall.

*Terry Marsh*
*25/10/18*



*Photo: Michael O Flatharta*