

Circulation

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The Newsletter of the British Hydrological Society

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President's Perspective

In my final 'Perspective' as BHS President, I am focusing on concerns over sewage discharges, the need to increase flood resilience, a new review of carbon sequestration effectiveness and the return of in-person lectures in our universities.

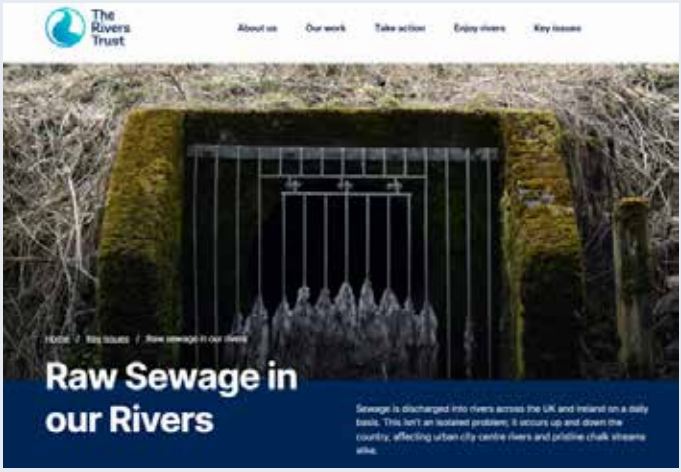
Sewage discharges to UK Rivers in the news

In recent months, the media have been highlighting the frequency of untreated discharges from UK sewage works outside times of flood overflows (BBC Panorama 17 April; Rivers Trust 2 July; *The Herald* 4 July; Riverside TV 14 July 2021). The imposition of a record £90 million fine for illegal discharges by Southern Water (Environment Agency 9 July 2021a) reinforced these concerns. Fears have also been raised about treated sewage and slurry applied to agricultural land entering watercourses (*Guardian* 12 Feb). The problem of micro-plastics in sewage discharges was the focus of an academic study by the University of Manchester (Woodward *et al*., 2021).

Clearly, these practices are negatively affecting both soil and aquatic fauna (National Biodiversity Network, 2019). As noted previously (*Circulation* 147), water companies have and continue to make huge investments in improved sewage treatment systems. Perhaps even greater investment is needed - with all of us paying for the true environmental costs of our loo flushes?

Concerns over pace of improvements to UK flood resilience

On 8 Feb 2021, the House of Commons Environment, Food and Rural Affairs Select Committee (EFRA) called for the Government to define clear targets to reduce the vulnerability of the 5.2 million properties at risk of flooding in England (EFRA, 2021). Scientists in the media (Reuters 17 July) have linked people-induced climate change to last month's life-claiming floods in Germany, Belgium and China. Given the likelihood of such events increasing over the next decades (Hanlon et al., 2021), even the most optimistic future limits on GHG emissions will not prevent us from needing major infrastructural investment to reduce current flood vulnerability



in the UK and elsewhere (NASA blog 2021).



The national and regional authorities with responsibility for flood mitigation in the UK (EA, NRW, SEPA, DfI and lead Local Flood Authorities) have built many very effective flood defences over recent decades and this work is continuing. Over the last few months groundworks have started on the £76 million scheme to reduce flood risk in Kendal (17 Feb) and the £45 million York scheme (10 May), while on 10 June 2021 the government approved the funding for the £500 million Thames flood scheme (BBC 10 Jun). In July the government announced record funding to better protect 336,000 properties by 2027 and so help avoid £32 billion in damage to the economy and reduce national flood risk by up to 11% (*Guardian,* 29 Jul).

Our flood authorities and their technical consultant partners are world-leading in the design and construction of flood defences, increasingly involving nature-based elements. Mitigating flood risk for all the 5.6 million at-risk properties across the UK (please note that here I am talking about the UK not England only) is going to require huge shifts in public expenditure towards these flood authorities at the expense of other demands on the public purse. If this is going to happen, politicians and the public need to understand that effective flood mitigation requires interventions on a huge scale. Approximately 100,000 m^3 of flood intervention is needed for a watercourse draining only 10 km^2 of upstream catchment and 1 million m^3 for a watercourse draining 100 km2 (see photo of 1.2 million m^3 Garstang Flood Basin). Blue-green infrastructure can be effective at mitigating floods, but only if undertaken as intensively as traditional engineering.

Local planners and politicians also have a critical role to play. The green areas around our urban settlements are often the only places major flood storage basins or other major NFM measures could be located. So, planners' first priority should be taking significant steps towards mitigating existing flood risk



with new blue-green or grey infrastructure before permitting new developments in our peri-urban areas.

Perhaps, COP26 will highlight the need to focus thought and substantial investment in Climate Change Adaption (Committee for Climate Change 16 Jun) to make our communities and businesses more resilient to flooding. Lessons that will come from Defra's new £170M Flood & Coast Resilience Innovation Programme (Circulation 148) – a novel 'learning by doing' research initiative – will hopefully show the practical ways of delivering such an investment.

Investment in blue-green infrastructure for ecological restoration and carbon sequestration

As highlighted in *Circulation* 147, the state of our terrestrial and aquatic habitats continues to decline. Ofwat's announcement that the UK water sector are to invest £2.8 billion in environmental projects to support the country's green economic recovery (Defra blog 17 May) is therefore most welcome. The Environment Agency's publication of a technical report showing which nature-based interventions can most reliably deliver carbon sequestration at landscape scales (Environment Agency 7 May 2021b) is a very useful new resource for those in the water sector investing in blue-green infrastructure.

Investing in our university students

The last seventeen months have been challenging for many, not least our university students. The loss of most in-person lectures and much in-person practical work due to Covid-19 has had many downsides, though students have undoubtedly benefited from innovations in digital learning that have arisen (*Circulation* 149).

There is now a greater appreciation of the skills and motivational benefits that come from hands-on practical work when teaching hydrology, though much less discussion of the value of in-person lectures.



In 2017, Sarah French and Gregor Kennedy wrote an excellent article reviewing the value of in-person lectures. They noted that '…students perceive that they learnt better, engaged more and even enjoyed themselves more when attending lectures in person…', and that students were more '…motivated to learn as a result of the group dynamic in the lecture setting and the presence of the lecturer…'. Further, they noted that a face-to-face lecture provides '… the capacity for lecturers to monitor students and determine their level of understanding…' and so '…adapt the lecture in real time to ensure that it is being taught at an appropriate level and is being understood by the group as a whole…' (French and Kennedy 2017). They raised many other excellent points that resonate with comments that I have received from our undergraduate and postgraduate students over the last academic year. I encourage academics to read this article (https://doi.org/10.1080/1

3562517.2016.1273213) and to encourage their universities to permit the return of in-person lectures from October. This should however, come with the proviso that the universities double efforts to mitigate the risk of large numbers of students missing large parts of teaching modules due to contracting Covid-19 from each other or because their course lecturer is on sick leave with Covid-19!

New perspectives

From our Annual General Meeting on 7 Sep 2021, you will have a new BHS President – Hayley Fowler, who is Professor of Climate Change Impacts in the Water Resource Systems Engineering Group of Newcastle University's School of Engineering. I look forward to working with Hayley on the 2021-2 BHS Main Committee and Executive as BHS Past President, and to reading her President's Perspectives from issue 151 onwards! A huge thank you to all UK hydrologists for maintaining our water supply, sewerage and hydrometric systems, delivering flood forecasts and flood schemes, persevering with your learning, adapting your teaching and sustaining world leading research, over the last 17 months in particular. I look forward to seeing many of you at our online members gathering on 7 Sep 2021 'Innovation in UK Hydrology' (details elsewhere in this issue of *Circulation*). I then hope to see many of you in-person at BHS2022 at Lancaster University, combined with fieldwork in the Lake District National Park, over the three days 12-14 Sep 2022.

Nick Chappell
BHS President
August 2021

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A warm welcome to Giuseppe our new Early Career Representative

Giuseppe comes from Calabria in the South of Italy, in the tip of the Italian boot. Calabria is a mountainous area located in the Pollino National Park, which stores Europe's most ancient tree and where Romans took wood for building their ships. It is a region frequently threatened by earthquakes and rainfall-induced landslides, that is why he has always been interested in civil engineering and worked with the University of Rome Tor Vergata for his MSc project to reduce the landslide risk in the area.

At Bristol University, he studies the reliability of bridge networks hit by water-related hazards to ensure communities' resilience and with Dr Maria Pregnolato and Dr Andre R. Barbosa considering climate change effects and infrastructure ageing, using descriptive and inferential statistics, and machine learning techniques.

Aside from work, he loves gardening, walking in the countryside – as a way to connect with nature – and playing with pets. He also practices cycling and swimming, because they challenge his limits, both mentally and physically. As an Early Career Representative, he will be really glad to promote Young Hydrologists' interests for their academic, personal, and professional development.

Welcome to the EA Flood Hydrology Improvements Programme team – your help needed!

In January 2021, as Storm '*Christoph*' was wending its way across north Wales and northern England, leading to over 200 flood warnings, the first steps were being taken at the Environment Agency to deliver aspects of the flood hydrology communities' 25-year Flood Hydrology Roadmap[1].

Whilst the Roadmap is the responsibility of the whole UK flood hydrology community to deliver, the Environment Agency is playing its part by developing a 6-Year £6.9M programme of improvements delivered as a series of projects within the Flood Hydrology Improvements Programme.

The team comprises experienced project managers and hydrologists with backgrounds in academia, consultancy, Environment Agency and NERC. We are led by Anita Asadullah, who led the delivery the Flood Hydrology Roadmap[1]. Anita will provide technical guidance and oversight for the whole programme. She is supported in the programme management by Craig Elliott, Team Leader Angela Barber and Project Managers Nigel Smith and Ruth Hughes.

The programme has been split into three main themes, which reflect the Flood Hydrology Roadmap actions. Each of the projects is scoped and led by experienced hydrologists within the team; Helen Harfoot and Esther Goodship are focusing on Ways of Working, which is about supporting the UK flood hydrology community and working in partnership to raise the profile, build skills and raise standards in flood hydrology; ensuring cutting edge scientific and technological developments translate more readily into operational improvements.

Chris Skinner and Jo Cullen (on p/t secondment from Welsh Water) are scoping projects on the Methods and Models theme which will develop improvements to current methods as well as start to scope the next generation of hydrological methods and models enabling us to better understand the impacts of climate and land use change and integrate flood risk between sources.

John Phillips is focusing on the Data theme which will review the types and quality of hydrometric data gathered for flood hydrology and deliver improvements to their collection, management and reliability, including improving how we quantify and communicate uncertainty in hydrological

[1] https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/flood-hydrology-roadmap

data. This theme also aims to deliver new and historical hydrometric datasets which are openly and freely available to support all flood hydrology studies, together with comprehensive information on all our data holdings to improve awareness and access to the user community.

We are funded through the Environment Agency, but are already working with our colleagues in SEPA, NRW and DfI NI to ensure we maximise reach and collaboration.

What we will deliver

Based on our current programme and projects, we aim to deliver the following over the next year ...and beyond.

The DATA theme will deliver in the next year...

- Make available for download all sub-daily flow, rainfall, groundwater and river level data for all active stations in our network.
- Review best practice of how data quality is defined, and identify and address priority data quality issues in Environment Agency archive.
- Review best practice of metadata standards and assess the changes required to meet user needs.
- Review how measurement uncertainty can be quantified, included within our hydrometric data sets and better communicated to the user community.
- Investigate the scale of the 'digital flow data gap' present in our electronic archive and develop a programme to extend sub-daily data time series.
- Data Register that makes users aware of all our flood hydrology related monitoring data, including issues relating to access, licensing and data quality

...and beyond

- Other improvements to data quality and access.

The WAYS OF WORKING theme will deliver in the next year…

- Create a list of user needs in flood hydrology compiled from the Flood Hydrology Roadmap and further interviews, which will be used to support and define future ways of working, data and methods.
- Investigate how we demonstrate the value of flood hydrology in England.
- Review of roles and responsibilities, skills, and quality assurance within flood hydrology in the EA.
- Review of hydrology skills across UK (looking to deliver in conjunction with BHS).
- Diversity baseline for UK hydrology (looking to deliver in conjunction with BHS)

...and beyond

- Improvements to skills, communications and quality assurance within the Environment Agency.

The METHODS theme will deliver in the next year…

- Comprehensive review of sources of uncertainty within hydrology and its role in the operational flood risk modelling chain.
- Review of current methods plus opportunities and barriers for improvements, considering a range of issues including integrated methods,

dealing with environmental change, decision-making processes, and methods that exclusively use free and publicly available data along with models and codes that are free to use, view, and adapt.

- Spatial mapping of links between flood risk, catchment descriptors, and modelling capabilities to prioritise future developments.
- Scoping an innovative new benchmarking framework to guide development of operational methods.

and beyond

- New open benchmarking framework of tests and datasets to assess new methods for operational use.
- Vision and scope for next generation hydrology.

Get Involved!

To ensure that we continue to capture the views and aspirations of the wider hydrological community we are seeking volunteers to act as 'FHIP Community Representatives' to feed into some of our projects, either simply by commenting on the scope of a project (a few hours), or by reviewing the outputs from them (half a day), or both. These FHIP Community Representatives will support the FHIP team in providing a wider perspective and could offer links to other relevant activities taking place within the wider community. We are seeking views from all parts of the flood hydrology community and would welcome a wide range of different voices and opinions, such as from early career hydrologists and others who are perhaps less often consulted in hydrology. There will be a rolling delivery of projects and we will send out details of projects we're seeking volunteers for along with a link to the short online application form via the BHS mailing list. In the meantime, if you would like to contact the Environment Agency Flood Hydrology Improvements Programme team with any queries, please email us at: (**FHIP@environment-agency.gov.uk**).

Please note that if there is a high level of interest from the hydrology community, we will not be able to accommodate all volunteers, and volunteers will be selected on the basis of providing a broad range of views.

Most of this work will be commissioned external to the Environment Agency and, to ensure fair spending of public money, any organisation on one of our frameworks and eligible to bid for work will automatically be sent a copy of the draft scope for review.

We look forward to working with you all.

Helen Harfoot
on behalf of the FHIP team
Chris, Jo, Esther, John, Anita, Angela, Ruth, Nigel and Craig



‘Innovation in UK Hydrology’

BHS National Meeting + AGM

7 September 2021

BHS Members Registration:
http://forms.ofoce.com/r/5RZZP4igcw

Programme

10:00-10:10	Welcome by current BHS President (Nick Chappell) and BHS Hon Secretary (Lucy Barker)
Session 1: Chair – **Peter Ede**	
10:10-10:30	Talk 1 (Geoff Darch, Anglian Water) Better incorporation of drought risk and climate change projections into water resources planning
10:30-10:50	Talk 2 (Chris Soulsby, University of Aberdeen: Integrating tracers in hydrological models: understanding the celerity-velocity paradox) 10:50-11:00
Break	
Session 2: Chair – **Kate Heppell**	
11:00-11:20	Talk 3 (Andrew Johnson, UKCEH: Why hydrology ‘rules’ when it comes to assessing the impacts of chemical contaminants in rivers)
11:20-11:40	Talk 4 (Chris Evans, UKCEH: The role of hydrology in sustainable peatland management)
11:40-12:10	AGM (BHS President, Hon Secretary and Hon Treasurer)
12:10-13:00	Lunch break
13:00-14:00	Panel discussion: Future of UK hydrology research (Keith Beven & BHS WG). Details for your consideration prior to meeting: www.lancaster.ac.uk/lec/sites/qnfm/bhs/bhs2021_future_discussion.pdf
14:00-15:00	Virtual poster exhibition with online Q&A, including afternoon break (also 1-hr on 8th): Details of how to submit submit a poster to Gather.Town will be sent by email to meeting registered members
Session 3: Chair – **Hayley Fowler**	
15:00-15:20	Talk 5 (Helena Soteriou, Catchment Initiatives Programme Manager, Thames Water: Value of embedding the public, landowners and environmental NGOs into whole catchment planning)
15:20-15:40	Talk 6 (Katie Muchan and Lucy Barker, UKCEH: Embracing the future of hydrometric data archiving and hydrological analysis)
15:40-15:50	Meeting close by new BHS President (Hayley Fowler)

Debris dams and walls of water

I find it curious that Barry Barton's letter in Circulation No 149 is right next to the contribution on the British Flash flood Chronology which I spent several years (inter alia) in preparing. Barry asserts that the three worst fluvial floods in terms of loss of life at Lynmouth, Louth and Carr Bridge where walls of water were described had been exacerbated by the collapse of debris dams. Like many hydraulic engineers before him he has elevated an assumption into circumstantial evidence. In none of these cases was a debris dam actually found and surely it should have on the small catchments where they occurred. In contrast, the flash flood chronology has identified 289 flash flood events in Britain over the last 300 years where a wall of water was described and in very few of these was there any evidence of an upstream blockage that caused the sudden rush of water.

There is now sufficient evidence from such events that they are generated solely by extreme short period rainfall in upland catchments and can be transmitted downstream for more than 50 km, as on the Tyne in July 2002 (Archer and Fowler, 2018). Bridges are demolished, not by the rapid build up of a static head but by the impulse of a pre-existing wave front. Such walls of water can be really extreme, which Barry notes, or they may not have extreme peak flows but are nevertheless a hazard to river users when the water level rises by more than a metre between the 15-minute measurement intervals.

I am currently looking at gauged rates of rise in Pennine catchments and have noticed an event in June 1983 on both the Wear and the Tees where the water rose simultaneously by more than a metre. It was not noted at the time either by the flood warning team at the then Northumbrian Water Authority (of which I was a member), nor by the local press (*The Teesdale Mercury*). This was presumably because the wall of water passed through at 02.00 and the water level by the morning was down to a normal level.

The event originated in the divide between the Wear and Tees and can't have been caused by simultaneous debris flows in tributaries on both sides. But yes, floods do occur following blockage by landslides and subsequent catastrophic breaking the most dramatic on the River Indus in 1841. The height of the dam was > 200 m. The dam broke in June 1841 and drained in 24 hours; it swept away complete villages and towns and a force of 500 Sikh soldiers encamped by the river instantly perished (Becher, 1859). As it emerged on the plains the river rose 25 m with an estimated discharge of over 50,000 cumecs.

And with respect to beavers. European beavers are less adept at dam building than their American cousins although they do build leaky dams usually not much more than a metre in height. Even if one broke in a flood the impounded volume is small and the consequences are likely to be much less serious than the events arising from intense rainfall.

David Archer

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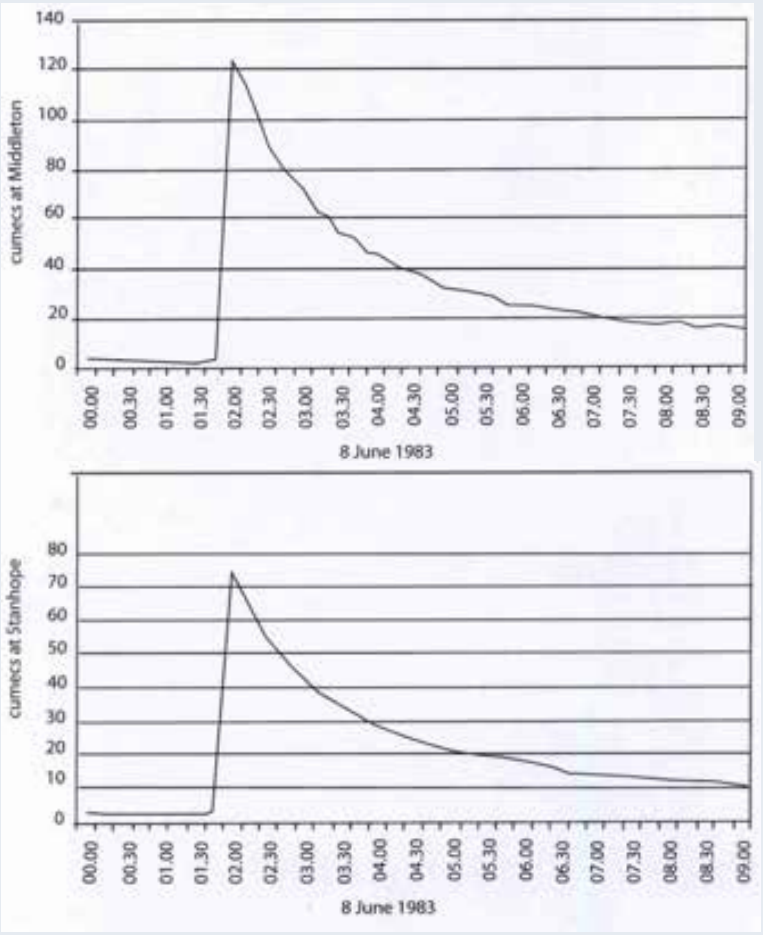


Fig. 1 a. Flow hydrograph for Tees at Middleton in Teesdale (Catchment Area 242 km^2, 15 minute rise in level and flow 1.53 m: 120 m^3/sec

b. Flow hydrograph for Wear at Stanhope (Catchment area 172 km^2, 15 minute rise in level and flow 1.44 m : 69 m^3/sec

New members

Marianne Piggott .....Mott MacDonald, Cambridge
Sarah Ashley.....Open University
Adam Sutcliffe.....Macclesfield
Kush Thakar.....Liverpool University
Mubasher Hussain.....Santec UK, Folkestone

Letter to the Editor

Dear Celia

The JBA Trust is to be congratulated for publishing online the British Flash Flood Chronology (*Circulation* 149, May 2021) and we shall be ever grateful to David Archer for the remarkable and painstaking archival research that forms the basis of the Chronology.

Having spent the best part of a lifetime concerned with desert flash floods, I applaud the focus on the dangers to life of rapidly rising water stage that can destabilise the unwary in minutes. Indeed, my own experience is that convective storms are often spatially so discrete that those in danger may be basking in sunshine unaware of an advancing flood bore. And, because most channels in drylands remain waterless for >99% of the time, there is a tendency for locals and visitors alike to be complacent about flood hazard. This explains the surprising number of fatalities from drowning in rivers that rarely run.

David's catalogue instructs us that, even in the temperate British Isles, we can expect flash floods and, importantly, that these typically arise in small catchments of, say, < 100 km^2, for which there is, usually, no prior documentation. We might postulate that the frequency and magnitude of such damaging events will increase for several reasons. Not least is that global warming appears to be shifting the nature of storms, increasing the intensity of rainfall, particularly in summer. But, as significant is that the intensity of arable farming, especially in eastern and central counties, has severely reduced soil structure and, hence, limited infiltration capacity, so inducing shorter catchment gathering time and producing flash floods.

As a community, we need to add our voice to those calling for changes in agriculture that ensure the re-establishment of 'good' soil. Our contribution is in highlighting the adverse consequences of failing to change and of continuing with seedbed preparation practices that encourage surface runoff. This is where the 'message' contained in the British Flash Flood Chronology is important as the nation debates the upshot of the Agriculture Act 2020 and any monetary benefits that might be expected by farmers in post-Brexit UK.

Best wishes.
Ian Reid



Peter Wolf Early Career Webinar 2021 & Symposium 2022

The next British Hydrological Society Peter Wolf Early Career Hydrologist's Symposium will be hosted by the Centre for Water, Environment, Sustainability & Public Health at the University of Strathclyde in Glasgow from 22nd – 23rd March 2022.

The theme of the 2022 Peter Wolf Symposium will be ***Hydrological Innovation for the Climate Emergency***. It will be an opportunity for early career hydrologists across the country to come together and share their recent work on all areas of hydrology and how it relates to the climate emergency.

Before then, the University of Strathclyde will also be hosting an online Peter Wolf Webinar with invited presenters and panellists on the 8th September 2021 following the BHS National Symposium the day before. Registration for the webinar will be free and open to everyone. The webinar will focus on hydrological innovation in the context of career development.

Details of both events, including the outline programme, key dates, and information on how to register are coming soon and will be available on the Peter Wolf Symposium website:

https://www.strath.ac.uk/research/subjects/civilenvironmentalengineering/environment/peterwolfsymposium/

University of Strathclyde Engineering

Organising committee:
Chris White,
Michael Cranston,
Scott McGrane
Lucy Barker

Farewell to Dave Rylands

At the end of May we said farewell to Dave Rylands, who after several decades of service retired from the Environment Agency. Dave had worked at the EA and its predecessor organisations for 44 years, joining the Southern Water Authority in 1976 as a Hydrometry Officer before moving on to a stint as a Waste Detection Officer in 1977. Dave then started a Hydrologist role with the Thames Water Authority in 1978, where he really began to cut his teeth in hydrology and learn more about the unique Thames River Basin. In 1986 he became a Senior Flood Hydrologist, with his work focusing on embryonic methods for flood estimation, including the FRQSIM unit hydrograph model. When he was elevated to Flood Modelling Manager in 1994, the National Rivers Authority had been formed and it was only a couple of years later that the Environment Agency was created. Dave joined the Environment Agency's Flood Forecasting team in 1999 as a Technical Specialist, where he worked on a number of novel projects, including the Flood Depth Estimation System (FDES) and converting hydraulic models for flood forecasting. Since 2014 Dave has been in the EA's Flood Hydrology team where he helped update the Flood Estimation Guidelines, NaFRA2 (National Flood Risk Assessment) and has supported our incident response work, both as a Modelling and Forecasting Duty Officer and a Thames River Control Duty Officer. Condensing Dave's career into a long paragraph is a massive understatement of his contribution to hydrology. The breadth, depth and wealth of experience he has will be sorely missed by the Environment Agency and wider hydrological community. What we'll miss even more is his positive, unflappable and laid-back personality, which makes Dave one of the most approachable people in the industry. We wish him every enjoyment in his retirement and implore him not to leave the world of hydrology entirely, although possibly someone who has worked for nearly half a century in the same discipline should be given some dispensation to walk away!



You know where we are Dave.

All the very best.

Trevor Bond
Senior Team Leader
Flood Hydrology at the Environment Agency

How equal, diverse and inclusive is Hydrology?

The 25-year Flood Hydrology Roadmap (see page 8) sets out a long-term vision for how we will address widely recognised limitations in current operational flood hyrology. This includes the science, methods, data, and ways of working. In its creation, the project team sought the experiences and opinions of the wider hydrological community, academic and practitioner, the voices of hydrologists that represent the full diverse spectrum of the UK population. However, if our hydrological community is not reflective of society then crucial voices may be missing as we seek to implement our long-term vision.

So how representative were those voices and do they fully represent the culture and experiences of the diverse UK population? We've looked at what data there are currently available to try and answer this question.

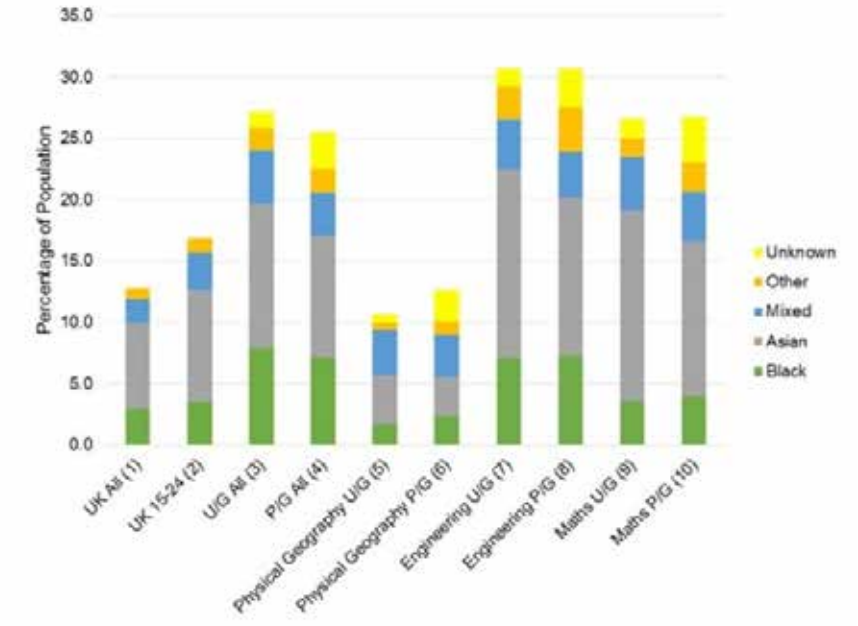
A study published in *Nature Geoscience* (Dowey *et al.*, 2021[1]) drove home the chronic lack of diversity amongst students studying physical science subjects in UK Higher Education (HE). By comparing the percentage of people identifying as either Black, Asian, Mixed, or other (collectively referred to by HESA as BAME*) amongst the whole population with those studying different subjects at University, the authors showed that subjects within the Geology, Environmental Science and Physical Geography classification had the lowest representation of BAME students.

Hydrology is often regarded as a 'geoscience', yet arguably the roots of hydrology extend beyond the geosciences to include the engineering and mathematical disciplines. Although inextricably linked in the physical processes, other geoscience disciplines, such as geology tend less to act as feeder subjects to hydrology. Consequently, whilst much of the learning in the study could be applied to hydrology it is not directly comparable and to understand better the picture in our discipline we need to look at different subject groupings.

We used a similar method to Dowey *et al.* (2021) to capture from the UK Census ethnicity by age[2] and HESA the proportion of students from different backgrounds studying Geography and Environmental Sciences (natural sciences), Engineering and Technology, and Mathematical Sciences[3]. However, diverging from the study we have elected to use the latest year of data available (2019–20). For 2019–20, HESA changed the subject classifications, with geology being separated from geography into a Physical Sciences classification, and not included in our analysis.

The outputs are presented in Figure 1 and there is a visible difference in the representation of BAME students within disciplines. We found the same pattern observed by Dowey *et al.* (2021) continued into the latest data, whereby only 10% of undergraduate (UG) and 10.1% of postgraduate (PG) physical

*We recognise that using the term 'BAME' to collectively refer to all ethnic groups is not helpful and does not reflect the diverse cultures or issues specific to different ethnic groups. However, this is how the Higher Education Statistical Agency (HESA) aggregate and present data within the higher education sector and is therefore the term used in the article below, we apologise if this causes any offence.



(1) 2011 Census for the United Kingdom
(2) 2011 Census for the United Kingdom, Table 1A: Usual resident population by 5 year age groups and sex
(3) & (4) HESA Student Enrolments 2019/20
(5) & (6) HESA Student Enrolments 2019/20: CAH12 – Geographical and Environmental Studies (natural sciences)
(7) & (8) HESA Student Enrolments 2019/20: CAH10 – Engineering and Technology
(9) & (10) HESA Student Enrolments 2019/20: CAH9 – Mathematical sciences

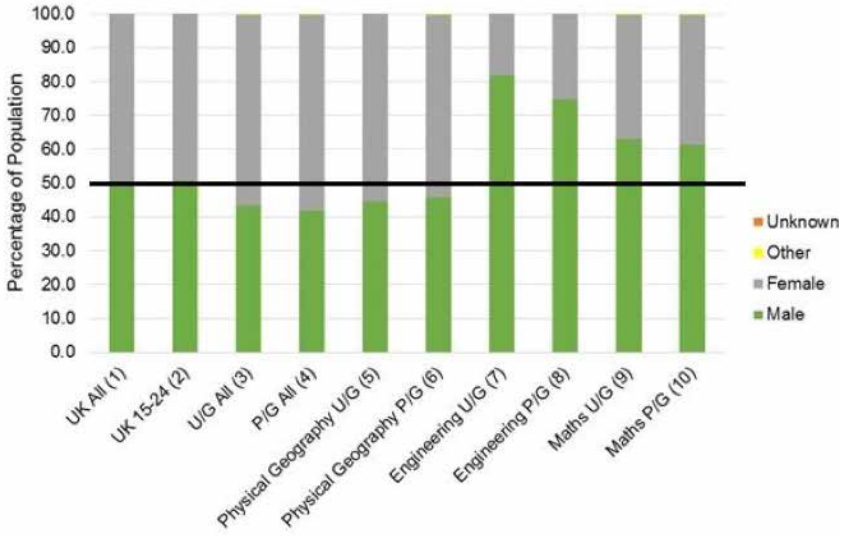
Fig. 1 Comparison of percentage of population reporting as BAME across the UK population (1), people within age groups most likely to enrol in HE (2), and those enrolling in HE and in subjects relevant to careers in hydrology (3-10).

geography students identified as BAME compared to the UK population (aged 15–24) of 15.7%. For engineering and maths the picture was different, whereby the proportion of BAME students at both UG and PG being higher than the UK population.

We should be careful not to look at some of the data in Figure 1 and come to a conclusion of false comfort. There is likely to be large disparities in enrolments across UK HE Institutions that are not visible in the high level data we are using. Even though the percentages of BAME enrolments are higher than the UK population across all institutions, we cannot say anything about the levels of opportunity afforded within the sector.

Race is not the only attribute people can be marginalised for though. Figure 2 shows the same population and subject break-downs by reported sex (both the 2011 census and HESA specifically report sex and not gender**). The overall picture shows more women than men entering HE, which is also reflected for physical geography, however engineering and maths have a higher proportion of men. Shockingly, as identified by

**Sex is bio logically defined, whereas gender is how one identifies.



(1) 2011 Census for the United Kingdom
(2) 2011 Census for the United Kingdom, Table 1A: Usual resident population by 5 year age groups and sex
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(9) & (10) HESA Student Enrolments 2019/20: CAH9 – Mathematical sciences

Fig. 2 Comparison of percentage of reported sex across the UK population (1), people within age groups most likely to enrol in HE (2), and those enrolling in HE and in subjects relevant to careers in hydrology (3-10).

Dowey *et al*. (2021), in two of the five years looked at in that study no black women at all took up postgraduate study in physical geography.

The Royal Geographical Society's report, *Geography of Geography*[4], highlighted that students progressing from a geography A-Level to study geography in HE were less disadvantaged, had lower ethnic diversity, and were more mobile than the national average. They also showed there was a lower uptake from students at a disadvantage (i.e., those eligible for free school meals) at GCSE and A-Level. For students who studied geography at A-Level, 21% from independent schools progressed to study geography at HE, whilst 17% from Further Education (FE) Colleges did so.

The data we have presented here are not perfect. For example, the subject classifications, especially for engineering and maths, are broad and will include subjects that have no relevance to hydrology. However, we do believe they are sufficient to illustrate the major challenges in HE from which the hydrological community is most probably not insulated. We are hoping this kick-starts a conversation about real, measurable actions we could take to tackle this.

There are many things we can do. For example, Wellcome[5] have developed an anti-racism plan and have published it, and a toolkit, open-sourced so organisations can adapt for their use. This could prove

a useful resource for a similar plan for the Society.

A programme inspired by *Geoscience for the Future*[6] could promote the value of hydrology to society in relatable ways and showcase a range of voices from professionals. This could be done in collaboration with other groups and societies, for example, the Royal Geographical Society, CIWEM and the British Society for Geomorphology, to create a *Rivers for the Future* that would work to address the issues in HE that impact us all.

Initially though, we need information on where to prioritise, to know where the inequities are, and to measure our progress against it. Currently we do not have such data for the hydrological community and the best we can do is to extrapolate from the broad scale HESA data. The priority, as a first step, must be to collect these data.

Helen Harfoot and Chris Skinner
Flood Hydrology Improvements Programme team, Environment Agency

Neither author of this paper identifies as from an ethnic minority and have never experienced racism or felt marginalised because of our race. We come from the perspective of providing equitable opportunities, recognising the importance of hearing voices that reflect the diverse UK population, and of hydrology being a welcoming and inclusive discipline.

References and resources

1 Dowey, N., Barclay, J., Fernando, B. et al. A UK perspective on tackling the geoscience racial diversity crisis in the Global North. *Nat. Geosci.* **14**, 256–259 (2021). https://doi.org/10.1038/s41561-021-00737-w
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3 HESA. What do HE students study: Personal characteristics. Found at https://www.hesa.ac.uk/data-and-analysis/students/what-study/characteristics#characteristics [last accessed 07/07/2021]
4 Brace, S., and Souch, C., 2020. . A report to better understand who is (and is not) studying geography at GCSE, A Level and university in England. A report by the Royal Geographical Society with IBG. Found at https://www.rgs.org/geography/key-information-about-geography/geographyofgeography/ [last access 07/07/2021]
5 Wellcome, 2021. Act boldly: Anti-racist principles, guidance and toolkit. Found at https://cms.wellcome.org/sites/default/files/2021-06/Wellcomes-Anti-racist-principles-and-toolkit-2021.pdf [last accessed 07/07/2021]
6 Geoscience for the Future, 2021. Website. Found at https://geoscienceforthefuture.com/ [last accessed 07/07/2021]

Some thoughts about weather forecasts and perception

Once again spring 2021 failed to live up to public(?) expectations, and at various times there was speculation about drought or cop failures due to cold. Last year (2020) it was hot and dry: this year was cold and dry. As a meteorologist friend put it, in both years the weather was dominated by high pressure: the difference was in the location of the anti-cyclone. In 2020, with the centre a little to the east of the British Isles, there was predominately southerly airflow which was warm. This year, with the high pressure doggedly stuck to the west of the British Isles, the airflow was from the north and east, and consequently cold weather persisted throughout April and into May. Mid-April saw the opening of pubs for outside service, and people wrapped up as if for a hike across the tundra, bravely sat and shivered in pub gardens. On some sunny days in mid-April, some east coast beaches reported crowds and even some swimmers: this when the sea- temperature was about 8degC. Still, it has not been as bad as June 5 1975, when a cricket match in Buxton was stopped for snow.

Advertising and media are mostly to blame for perceptions of spring (warm sun, blossoms and baby lambs), magnified this year by post-lockdown euphoria. The ubiquitous use of mobile devices has seemingly given everyone an instant weather report and forecast: but are people better informed? In one of the desultory discussions in a rain-break during 'Test Match Special', the topic arose of which of the many forcasts available was "best". Jonathan Agnew said that he went with the forecast that matched his hopes! I'm afraid the situation is an example of too many facts and not anywhere near enough knowledge. Just a fleeting mention of a high or low extreme anywhere in the country, glimpsed on a website or half heard from a broadcast, and the phenomena forecast is taken as a universal truth, whatever the recipients location!

Put simply, the current weather we experience is a matter of prevailing winds and air-masses: to me that is more relevant than speculation about changing climate! There has been an ongoing problem for many years with the dumbing down of media-presented forecasts. Isobars have largely disappeared, along with fronts, to be replaced by a few simple symbols. Even worse has been the recent tendency for a forecast to have "a message": this I have noticed as being biased to the "what a scorcher" or "the beast from the east" variety. As a friend of mine, who valiantly continues to listen to the BBC Radio 4 forecast at approximately 7.55am daily has pointed out, maximum temperatures get much more publicity than low temperatures. Radio 4 forecast are nominally allowed approximately 3 minutes. I use the word 'approximately', as the weather forecast time-slot is no longer sacrosanct, but can be eroded or even neglected, if a more interesting story is preoccupying the media presenters.

By contrast I find that web-based forecasts for locations in Canada and the USA have links that provided details of jet-stream behaviour, major weather systems, etc. Perhaps we receive the weather forecasts that we deserve. If the weather forecasts have become so vague and superficial, what hope

is there for the hydrological impacts of current weather to be explained? Only when there are possibilities of hose-pipe bans or flash-flooding do implications of weather get a mention on radio or TV forecasts. The availability of the monthly Hydrological Summary so thoroughly explained by Terry Marsh plus the on-line COSMOS reports give *Circulation* readers a clear picture as to impacts on soil conditions and water resources, thus avoiding hand-wringing and doom-saying. Figure 1 in Terry's last Summary (May 2021) is an excellent demonstration of the groundwater situation over the last 4 years, showing that levels were much lower prior to the last 2 years. Nobody remembers that far back – but I doubt that the general public is even remotely aware of the Hydrological situation. I really hope that BHS members can take the opportunity to speak up as appropriate and resist the dumbing down and ignorance that is so prevalent.

James Dent

BHS Funds to attend IAHS meetings: The Exeter Fund

Did you know BHS has funds for available for BHS and IAHS members to attend and participate in international meetings (outside of the UK) of the International Association of Hydrological Sciences (IAHS)?

The Exeter Fund is an endowment arising from surplus money generated by the first Scientific Assembly of the International Association of Hydrological Sciences (IAHS) held at Exeter University in 1982. This Fund provides grants to assist attendance at biennial IAHS Scientific Assemblies and International Union of Geodesy and Geophysics (IUGG) General Assemblies held outside the UK, and in particular to encourage early career scientists to become involved with IAHS as an Association.

Applicants must be working with or studying at a UK organisation or institution: further details at https://www.hydrology.org.uk/Travel_Grants.php

IAHS have a regular programme of meetings and you can find out more on the IAHS calendar: https://iahs.info/Calendar.do



The 11th Scientific Assembly of the International Association of Hydrological Sciences (IAHS 2022) will take place in Montpellier (France) from 29th of May to the 3rd of June 2022
The conference will include an assessment of the 2013 to 2022 Panta Rhei Change in Hydrology and Society scientific decade, progress of the Unsolved Problems in Hydrology initiative as well as IAHS's 100th anniversary year.
http://www.iahs2022.org/index.asp

BHS Hydro Profiles Questionnaires

*Many thanks **Steve Birkinshaw** for completing a Questionnaire*

How did you become interested in hydrology?



I have great memories of family holidays playing in rivers with my siblings. This included trying to dam the smaller ones and jumping from rock to rock in the big ones until one of us (usually me) fell in. It did get me wondering about how the water flowed into the river from the rainfall. Why was there so much water in the river when it had not rained for days.

However, I never thought of it as a career until after I finished my Maths degree. After a couple of years travelling I decided to do an MSc in hydrology at Newcastle University. Whilst doing this I took part in a night orienteering event during which I fell over, banged my head against a tree and concussed myself. I lost my short term memory and thought I was still doing my Maths degree and when told I was doing an MSc in hydrology at Newcastle, I said "Why the hell am I doing that?!"

What is your current job?

I am a research associate at Newcastle University, which I have been doing for over 20 years. My expertise is hydrological and hydrodynamic modelling. As part of my job I am in charge of the development and use of the Shetran hydrological model.

What is your dream job?

Probably my current job. I have quite a lot of freedom to do the research I enjoy and I spend my days working with numbers and maps which is great. I also have the pleasure of being able to work from home in the Lake District with, before Covid, a long day in Newcastle once a week. One part of my job which I used not to enjoy was writing journal papers but even this I now quite like. Also, I am only employed to do 4 days a week (previously 3 days) so I get to spend more time with my family.

What, or who, has helped you get to this point in your career?

I have chosen not to follow a normal career path with continually trying to get promoted. In the past this has meant lots of short term contracts, which was always a bit stressful, but I do get to do the research which I really enjoy. I do see some people who have progressed further in their careers and they spend the majority of their time doing administration, which they dislike, and not the research which they enjoy.

The people that have helped me are those that have received research funding and employed me to do the work, but also all the colleagues and students who I have worked with and helped me continually learn and try new approaches to solve problems.

Do you have any advice for your younger self?

Be more confident with talking to people, particularly at conferences. I still struggle a bit with this but when I was younger I used to find it really hard. There is of course no reason to worry as everyone is very friendly and keen to talk about their work.

What is your favourite river?

I do not think of rivers but of river catchments. My favourite river catchment would have to be the Derwent catchment in Cumbria. It covers a lot of the Lake District fells and the includes Derwent Water and Bassenthwaite Lake with the river Derwent flowing out to sea at Workington on the west coast of Cumbria. It is my favourite as it is a beautiful catchment but it also suffers from extremes of rainfall. I live in the upper part of the catchment close to where the record 48-hour UK rainfall record of 405 mm was measured in 2015. I watched the extreme events that caused massive flooding in Cumbria in both 2009 and 2015 happen. It was amazing seeing the amount of water around. On both occasions the river near me flooded so I was cut off for 2 days but worse than that I knew that downstream there was going to be a big flood but could do nothing about it.

Do you have a hydro-hero?

Not a hydro-hero but a group of hydro-heroes. These are the people that have collected and continue to collect all the data I use in my modelling work (rainfall, flow, temperature, OS MasterMap data, etc). In the UK we have some of the most accurate and longest time series of data and it makes my job so much easier compared to using data from other countries.

What keeps you busy apart from hydrology?

I am a fell runner and orienteer. I am probably best known for holding the record time (6 days 13 hours) for climbing the 214 Wainwright fells in the Lake District for a 5-year period between 2014 and 2019. As a family we all enjoy walking on the fells and most of the way through doing the Wainwrights at a much more leisurely pace.

What do you like about being a member of BHS?

It is a great group of like-minded people and they organise some great meetings. I really enjoy reading *Circulation*

UK Hydrological Bulletin: May – July 2021

Overall, the May-July period was warmer and wetter than average but with exaggerated spatial and temporal contrasts in both rainfall and runoff patterns. Western Scotland apart, runoff in May was notably high particularly across much of Wales. Aside from south-east Britain, June was generally a hot and arid month with steep river flow recessions, these coinciding with heavy agricultural demands for irrigation. Convective storms became more frequent in a very unsettled July causing major local transport disruption and underlining the vulnerability of urban drainage systems – London in particular – to intense downpours. Disruption was particularly widespread on the 25th when a monumental local rainfall event was recorded at Brettenham (Suffolk) – see below. Groundwater levels in the late summer reflect the contrasting responsiveness of different aquifers but are generally within the normal seasonal range; this is true of most reservoir stocks also but depleted stocks characterise some impoundments in Northern Ireland and western Scotland.

The track of the Jet Stream made for a generally very wet and seasonally cold May punctuated by some exceptional thundery downpours, many not captured in the raingauge network. Notwithstanding very dry conditions in north-west Scotland, where a few areas recorded less than 20% of the average monthly rainfall, the UK registered its 4th wettest May on record (in a series from 1862); Wales exceeded its previous maximum by a substantial margin. The contrast with April was stark; in Scotland, Leuchars had recorded 112 mm of rain by the 10th compared with less than 3 mm in all of April. With many index rivers, from the Conwy to the Cynon, registering new maxima May runoff totals, the overall outflow from Wales (see Fig. 1) also established a new monthly record.

Correspondingly, flood alerts were common and widespread

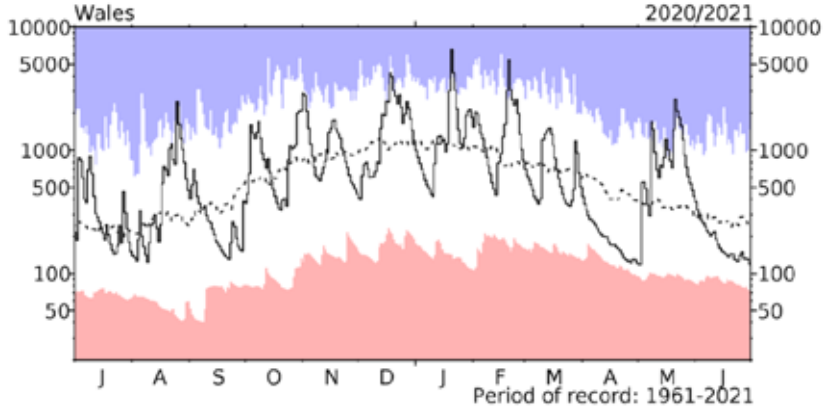


Fig. 1 Daily outflows (m^3s^{-1}) from Wales (black trace); the blue and pink envelopes show the long term daily max.and min.

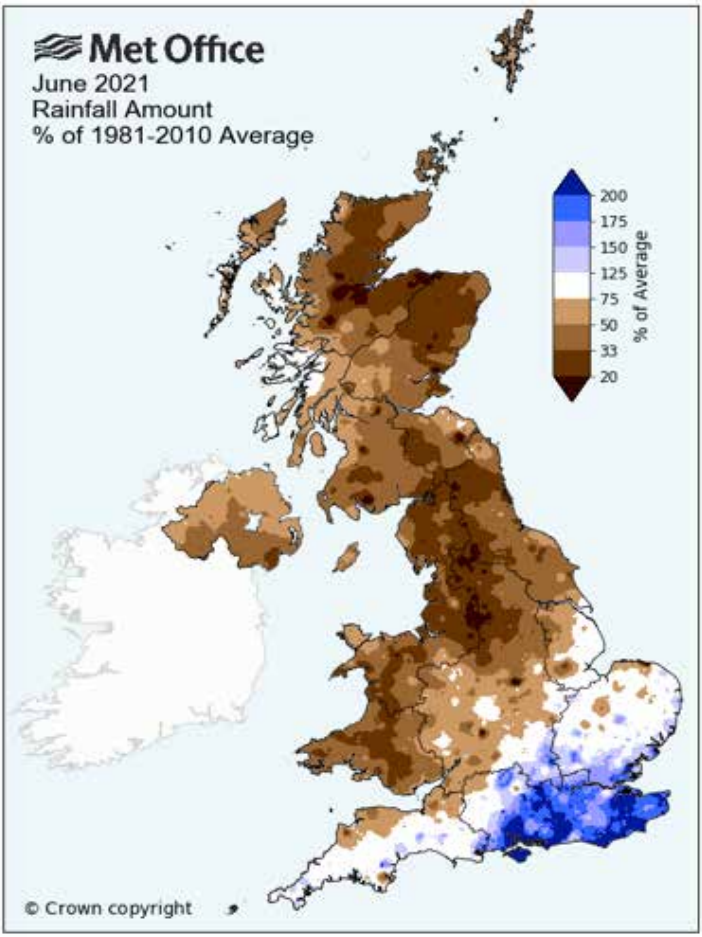


Fig. 1 UK rainfall pattern in June

particularly during the third week when most rivers draining the Pennines were also in spate. The seasonally wet conditions and loss of soluble nutrients in the soil were of some agricultural concern but, contrary to the normal seasonal trend, reservoir stocks generally increased through the month and stood above the national average at month-end.

June was a notably warm and, south-east England aside, a generally dry month; Scotland registered its second lowest June rainfall since 1941. In the west, a few residual snow patches on Ben More and the Ben Nevis range during the second week, heralded the end of the meltwater enhancement to runoff and river flows were notably depressed.

Steep recessions also characterised many rivers in England & Wales with notably low flows during the third week in, for example, the Lune, Severn and Yscir; outflows from Northern Ireland were also very modest.

By contrast, some catchments in south-east England registered more than twice the average monthly rainfall with intense downpours causing repeated episodes of flash flooding. This was particularly true of the third week when rainfall totals associated with slow-moving convective storms exceeded 50 mm in many localities. Flood warnings were common, particularly in and around London where disruption to road and rail transport was considerable. The sustained high

temperatures and increased evaporative demands across most of the country triggered increases in water demand (e.g. for agriculture and garden watering). Nonetheless, end-of-month reservoir stocks generally remained within the normal late-June range but with a few exceptions in western Scotland where stocks in Loch Thom were substantially depleted.

The UK rainfall total for July was close to the long-term average but regional and local variations in rainfall amounts were very substantial - in part due to the frequency of convective events. Northern Ireland recorded only around half of the monthly average and parts of western Scotland around a third. On the 12th a cluster of fronts and troughs moved across southern Britain; the associated downpours included a reported 70 mm deluge in 90 minutes in west London resulting in severe urban flooding. The weather system then moved into western Europe with disastrous consequences.

On the 24/25th many London streams were again at danger levels and a number of Underground Stations were inundated, a partial evacuation of Whipps Cross Hospital was required, and the temporary closure of the Blackwall Tunnel contributed to massive transport disruption.

On the same day, an exceptionally extreme, but very localised, downpour was captured in a standard raingauge (and noted by a very experienced observer) at Brettenham (Suffolk): 183 mm in one hour and forty minutes*). This is comparable with the record two-hour total of 193 mm total recorded at Walshaw Dean (West Yorkshire) on 19th May 1989 and the Hampstead storm of August 1975 (171mm in 2.5 hrs). In Northern Ireland, during the latter half of the month exceptionally depressed flows were recorded for the River Laggan but storms during the final week triggered further flood alerts, in Scotland particularly – with floodplain inundations in the Spey basin for example. At month end, reservoir stocks During the final week of July storms in Northern Ireland and Scotland triggered further flood alerts and floodplain inundations, in the Spey basin for example. At month-end, reservoir stocks in England were typical of the time of year but 15-30% below average in parts of western Scotland and Northern Ireland.

Terry Marsh
13/8/21

** Thanks to Colin Clark, James Dent and Dan Holley for ensuring this remarkable event entered the public domain*

PLEASE HELP...I've been dipping into the varous photo libraries rcently for our cover pictures, so far managing to find relevant subjects. However, it would be more satisfactory to have a stock of 'proper' hydrological photogrpahs to dip into so any contributions would be most welcome. As I like to wrap the image round both front and back covers, it is images in landscape format that are of particular interest. Copyright will always be acknowledged.

Celia Kirby



Photo: Environment Agency, Wessex H&T