Circulation

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The Newsletter of the British Hydrological Society

Contents

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Stop press

The Environment Agency are setting up a mailing list to better communicate with practitioners involved in operational flood hydrology in the UK. The intended use for this is to enable occasional timely and targeted communications from the EA regarding flood hydrology to practitioners; who use our guidance and proformas, as well as enabling communication of project updates and technical issues. If you would like to be added to the mailing list, please contact our team at FloodHydrology@environment-agency.gov.uk who will send you a form to complete.

THANK YOU

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President's Perspective

As I write this, I am reflecting on the fact that it is only 6 months before I hand the Presidential reins over to Duncan Faulkner. The time seems to have gone so fast, especially, I think, because it started in the Pandemic. Since Christmas, life seems to be pretty much back to normal, if not for the number of extreme weather events we are seeing around the globe.

When I started as President in September 2021, I wanted to try to modernise the society (only a little as I really like the general ethos of the BHS, the friendliness, the informality), but one thing I wanted to do was to formalise some of the procedures and governance; we are still hoping to achieve this by September 2023 (see AGM minutes). The second was to update the website; we want to launch the new website for the 40th anniversary in November. The third, and final, objective was to try to hold joint meetings with other societies more often – Covid has made this difficult, but we are in talks with the Royal Met Soc (among other societies) about hosting joint events. I am hopeful that this will come to fruition. This transdisciplinary working, I am convinced, is something we should all be working towards as we grapple with our rapidly changing world.

In the last few months, I have been involved in a number of activities. As BHS President, I am a member of the Governance Board of the Flood Hydrology Roadmap and was involved in the recent appointment of the STAG (Scientific and Technical Advisory Group) which will take the roadmap forward with greater pace. I am looking forward to working more closely with them over the coming months and more details can be found on our FHRM page on the BHS website.

I would like to encourage everyone to get involved as a community in initiatives such as the FHRM. Other things that are ongoing at the moment are a consultation around UKCP18 user requirements (to build the next UKCP – so please do get involved if you can!) and workshops led by UKCEH on adapting and enhancing the UK monitoring programme for terrestrial and freshwater science; this asks the community to help to design the next UK monitoring and modelling programme. Alongside, the Floods and Droughts Research Infrastructure (FDRI) Programme, there is a huge amount of interest and investment in this area at the moment; please get involved and have your say.

Finally, there are several upcoming meetings. Newcastle University will be hosting this year's Peter Wolf Symposium for ECRs (June 2023 TBC), our ever-popular webinars will be continuing, and we have some in-person meetings in both the summer and autumn, culminating in the BHS 40th anniversary event in November 2023, which is in planning. We look forward to celebrating this milestone for the BHS with you all in November!

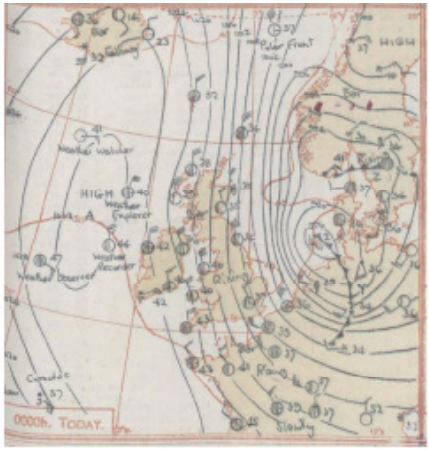
Hayley Fowler
BHS President

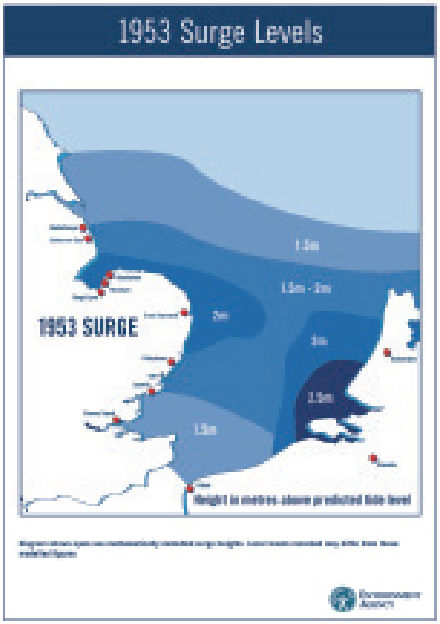
Remembering the east coast floods of 1953

Closely following on the 70th anniversary of the Lynmouth Flood, we must also recall the extensive sea flooding of 31 January to 1 February of 1953 which caused the death of 307 people along the east coat of England and 19 in eastern Scotland, and more than 2,000 fatalities in the Netherlands and north-west Belgium. The same depression caused the sinking of the Princess Victoria rail ferry on its crossing between Stranraer and Larne, which claimed 133 deaths, and there were several other ship-sinkings which caused fatalities. It was by far the worst natural disaster to have affected the UK in the 20th century, and had a fundamental effect on flood forecasting and coastal flooding protection for a whole generation.

The event can be briefly described as the result of a vigorous Atlantic depression moving rapidly across the north of Scotland and onward into northwest Europe, intensifying and causing prolonged northerly winds to blow down the North Sea. The figure on the right shows the meteorological chart at 0000hrs on 1 February 1953. The passage of the deep depression caused a rise in sea-level in the North Sea basin, and the persistent northerly winds forced a tidal surge to move southwards. This surge level increased to reach a maximum of 2.0m to 2.5m above normal high-tide level along the coast from Lincolnshire to the Thames Estuary, as shown in Figure 2. The build-up of water continued over two tidal cycles, and the persistence of strong winds produced devastating waves and erosion of the low-lying coastline made up of marshes and unconsolidated sedimentary rocks. It was thus, in what has become a cliche, "a perfect storm". The effects of the surge and high sea was greatest along the Dutch coast, where even worse damage to the sea defences, farming land and loss of life (estimated at over 2,000) was much greater.

I have vivid memories of the night of the storm and the aftermath of flooding in parts of East Anglia. With my bedroom being on the second floor of the flat above the Pharmacy in east Ipswich managed by my father, I was kept awake all night by the ferocious wind. On the morning of the 1st February, Dad came





on the north Norfolk coast, and I saw the amazing impact of the North Sea floods earlier in the year. We stayed in the annex of the Victoria Hotel, which was adjacent to the coast road. The high-water mark left by the flood was still clearly visible up to the level of the first-floor windows.

We went down the access road to the beach, and found that the embankment carrying the railway line from Wells to Hunstanton had been completely washed away, with twisted rails and sleepers scattered about as if an angry child had thrown aside it's train set. The railway was never re-instated. Two years later we visited Heacham Beach near Hunstanton, and great slabs of concrete from the sea-wall were still lying where they had been broken up by the waves and tidal surge. We stayed at King's Lynn for that holiday, and considerable areas of the town were still recovering form the floods 2-years previously.

There was an almost total absence of information during the event on the movement of the flood down the east coast of England. Although the Met Office had forecast the meteorological severity of the storm well in advance,

back up from the shop to report that the lower parts of Ipswich had been flooded. Later on we learned of the extensive damage and drownings in Felixstowe and Harwich.

In the summer of 1953, we took a family holiday to Holkham

and issued the necessary warnings, there was little to co-ordinate the combined areal effect of flooding. This problem of communication was exacerbated by wind damage to telephone lines, so in effect there was little opportunity of tracking the progress of the surge from Bridlington southward to the Wash, the Norfolk coast and eventually the Thames Estuary. The prototype of a Storm Tide Warning Service was quickly put in place in the months after the event, and this was the fore-runner of what has become the present day Surge Tide Warning System. Longer term responses to local and large-scale flood defence arrangements such as the Thames Barrage and smaller scale surge protection schemes along the east coast from Hull to Barking have been constructed. Since the 1953 flood there have been a number of storm surges, in particular when similar areas in eastern England and the Netherlands suffered on 8-9 November 2007. The ports of Felixstowe and Rotterdam were temporarily closed, but no major overtopping or failure of defences happened. In January 1978, on the 25th anniversary of the Great Flood, maximum tide levels at Wells-next-the-Sea, Norfolk, came within a few millimetres of the 1953 levels, but since then, flood walls and a flood gate had been put in place, and the town was protected. A plaque is placed on theharbour wall, adjacent to the flood gates.Rescue and recovery after the 1953 event provide some remarkable stories of heroism in what were clearly awful conditions of wind and flood. Amongst the main facets of successful coping with a natural disaster, the hydrological community tends to concentrate on resilience, forecasting and warning, but the recovery aspects to a major flood is firmly in the hands of the emergency services. In general we think of the police and fire services, and in extreme cases, the military. In 1953, the latter group played a highly significant role, and because of the proximity of World War 2 and the ongoing Cold War situation, there were large numbers of UK and American Service personnel at bases in Lincolnshire and East Anglia who could be called out at very short notice. It was not just specialist equipment and transport that they provided, but also sheer manpower. It is a very glib answer that "the Army" can provide back-up in a wide variety of difficult conditions, including hospitals and transport, but as was seen during the Covid situation, their deployment was less easy to provide in practice.

Historically major flood surges have occurred quite frequently in the North Sea basin, as recorded by John Kington in his excellent book 'Weather and Climate'. He cites notable flood events from 1099, with four major surge and flood events recorded in the 20th century In some cases, huge fatalities were concurrently reported in the Netherlands, and such an event caused major destruction of Dunwich on the Suffolk coast (1362). Doubtless tidal surges will continue to pose risks in the future, and the price of security will be continuing vigilance and careful design of protection for major infrastructure such as the Sizewell nuclear power complex, worryingly close to Dunwich. With such a clearly identified chronology of storm surges and floods in the southern North Sea, it would be fatuous to attribute similar events in the future to climate change, just as it would be foolish to assume that present day facilities and capacities will ensure continued safety. A very thorough summary of storm surges is contained in the Met Office Fact Sheet, Floods and Flooding.

James Dent

40th Annual General Meeting
13th September 2022
held at Lancaster University

The 40th Annual General Meeting of BHS was held at the University of Lancaster during the 14th National BHS Symposium on Tuesday 13th September 2022, with an option to join online via MS Teams. There were no apologies for and no corrections were needed for the report of the 39th BHS AGM published in Circulation 151.

Presidents Report

Hayley Fowler opened the session by thanking all BHS members for maintaining out water supply, sewerage and hydrometric systems, delivering flood forecasts and flood schemes, sustaining world leading research, adapting teaching, as well as their continuing participation in and contributions to BHS activities over the last water year .

During 2022, Chris Skinner undertook a governance review of BHS following the good practice guidelines published by the Charity Commission. As a result of this review, which was carried out with input from BHS Committee members, Chris made 13 recommendations (outlined in *Circulation 154*). The top two recommendations were presented at the AGM to elicit feedback and input from members which seemed unanimously positive. Adopting these changes will require changes to the Statutes of the Society and approval from the membership. We are aiming to implement these changes by September 2023:

1 – Change the charitable status of the Society to a Charitable Incorporated Organisation (CIO). The CIO status is relatively new, designed for charities like ours. It would create the charity as a legal entity and provide us more flexibility. It would also reduce the personal risk to those who volunteer to be trustees.
2 – Restructure Society committees to create greater separation between governance and management. The current structure unnecessarily places the majority of the voluntary burden on members of the Main Committee. A new structure would create new opportunities for members to get involved and help us achieve more.

November 2023 marks the 40th Anniversary of the first BHS meeting held at the Royal Society in 1983. The BHS Committee have started planning an event to mark the occasion and are preparing an application for a Royal Society Scientific Meeting. If successful, the Royal Society would fund the hosting of the event and travel for invited speakers. More to follow on this and other celebratory events throughout 2023.

Circulation continues to be one of the main ways we as a Society have to communicate with our members, Hayley thanked BHS Technical Secretary Celia Kirby for all her efforts in putting together *Circulation* each quarter, as well as all those who have contributed to Circulation over 2021/2022.

The BHS social media accounts continue to be active with members of the Communications sub-committee (Lucy Barker, Michael Pollock and Chris Skinner) running the *LinkedIn* page and group, and the BHS Twitter account (@britishhydrosoc), as well as managing the YouTube channel. We now have almost 3000 followers on

Twitter, and our official *Linked*In page set up in 2019 has 860 (has almost doubled from last year's report). The BHS YouTube channel (run by Lucy Barker) has 37 videos available, totalling over 750 hours of content with 6,700 views; the channel has 240 subscribers.

Formal partnerships with ICE and UKCEH continue. The Institute of Civil Engineers (ICE) provide support with financial and membership management, committee and meetings support. UKCEH continue to contribute to Society activities and meetings as well as to the running of the Society. David Boorman stepped down from formally representing UKCEH on the committee on his retirement and was replaced as UKCEH representative by Lucy Barker. BHS is also represented on the UK Committee for International Hydrology (chaired by UKCEH) and UKCEH continue to provide strong contributions to BHS meetings.

In January 2020 *Hydrology Research*, the official journal for BHS, was made open access and all papers are now freely available on-line. Some universities are able to submit to *Hydrology Research* for free due to institutional agreements ***(https://iwaponline.com/open_access/pages/institutional_agreements)***. BHS has again been able to secure four open access fee waivers for 2022: please contact Editor-in-Chief Nevil Quinn for more information (*Nevil.Quinn@uwe.ac.uk*). There is strong BHS membership in Editors and the Editorial Board, with the number of Editors expanding this year. BHS members were reminded that they are eligible to apply to the Exeter Fund to support travel to overseas IAHS meetings. After several years without travel, the Exeter Fund is healthy so members are encouraged to apply. Find out more about the assembly here: *www.hydrology.org.uk/Travel_Grants.php*

Thanks were given to Prof. Keith Bevan for chairing the BHS Working Group on the Future of Hydrological Research. The group published two papers during its term:

- Developing observational methods to drive future hydrological science: Can we make a start as a community? Bevan et al., 2020, Hydrological Processes, https://doi.org/10.1002/hyp.13622
- Knowledge gaps in our perceptual model of Great Britain's hydrology, Wagener et al., 2021 Hydrological Processes, https://doi.org/10.1002/hyp.14288

BHS has given out a number of awards this year. Supported by the Environment Agency and the JBA Trust, BHS awarded 11 MSc Studentships of £1500 each for the 2022 academic year, **see more information in the Treasurers Report below**. The BHS Undergraduate Dissertation Prize judging panel chaired by Liz Lewis had 11 excellent projects to consider this year; thank you to all the university staff for submitting entries. First prize was awarded to ***Chenyuan Wang*** from University College London for an outstanding piece of work in the field of hydrological modelling: "Assessing the Impacts of Climate Change Using Hydrological Modelling for the River Dee Catchment, Northeast Scotland". A runner-up prize was awarded for an excellent piece of work by ***Rosie McGahan*** from the University of Bristol, also in the field of hydrological modelling: "Projected Impacts to the Climate and Hydrological Regime of a Scottish Highland Catchment with Snowmelt Contribution under Climate Change".

Honorary Secretary's Report
Lucy Barker summarised society activities over the past year. We were pleased that despite being reorganised multiple times, the 2022 Peter Wolf Symposium for early career hydrologists held at the University of Strathclyde (in the week following BHS2022) sold out with xx registered participants.

BHS2022 and ***Peter Wolf 2022*** marked the first in-person BHS events since the pandemic, however we continued to host BHS webinars throughout 2022. In June 2022 Hayley Fowler (BHS, Newcastle University), Mark Franklin (SEPA) and Helen Harfoot (EA) hosted the '***UK Flood Hydrology Roadmap – Next Steps***' – providing an update to the well-attended 2021 webinar. In July Duncan Faulkner (JBA Consulting) and Clare Waller (EA) presented on 'Flood frequency estimation in groundwater-dominated catchments. Liz Lewis hosted our second BHS Hydrology Careers Q&A session in November 2021, with panellists Chris Skinner (Environment Agency) and Adam Comerford (Canal and River Trust). The Pennines group were particularly active and hosted nine webinars and the Scottish Hydrological Group two, covering a range of topics. Recordings of webinars can be found on the BHS YouTube channel.

Two future events were advertised: the 2022 Hydrology Careers Q&A session and a webinar "From CAMELS to Caravan: Community datasets for catchment hydrology over regional to global domains" given by Gemma Coxon (University of Bristol) and Nans Addor (Fathom) – now available on the BHS YouTube channel.

Other meetings, both online and in-person, will be arranged for the coming year so please watch out for more information in *Circulation*, via Mailbase, Twitter and *LinkedIn*. Opportunities to get involved with BHS events were highlighted, including Peter Wolf 2023, webinars, BHS 10th Anniversary, in-person meetings, 15th National Symposium and the Sixth International Sympoisum. Get in touch with the new Honorary Secretary ***Victoria Coates*** to discuss your idea and plans. You can find out more about organising BHS meetings on the website: https://www.hydrology.org.uk/Organisation_of_BHS_Meetings.php Thanks to Michael Pollock and Emily Fowler for all their time and support in the BHS Meetings sub-committee!

Honorary Treasurer Report
As of the AGM, the finances of the society continue to look healthy and are supporting a wide range of members and students across different activities in hydrology. While the overall funds are down on the same period as this time last year, this reflects a growth in spending on activities as the world continues to recover from the Covid-19 pandemic.

Our membership remains strong and we continue to attract new members commencing their postgraduate studies or professional careers. While this is naturally offset by a loss of some older members, we have a vibrant community of UK hydrologists and I'm grateful to each of you for your ongoing support.

As conferences slowly pivot back to being in-person, I am pleased to say that we have been able to support many of our members in attending these through both our travel grant scheme and the Exeter Fund for IAHS events. Providing these funds to members is a hugely important element of ensuring UK hydrological science continues to have a strong representation at major conference events around the world, including AGU in Chicago most recently where I was pleased to provide support to several members.

Another major element of our annual expenditure is the ongoing commitment to the BHS-JBA Trust-Environment Agency MSc Studentship Scheme. This year, recognising the growing effects of the current Cost of Living crisis, we collectively took a decision with JBA and the Environment Agency to increase the amount of funding attached to these packages to £2250 after years of the amount remaining at £1500. In total, we supported ten students embarking on their MSc studies at Universities across the UK in 2022.

We experienced many benefits from the return of both the National Symposium and Peter Wolf Symposium in Lancaster and Glasgow respectively last year. Both events were hugely successful in bringing together the hydrology community at various career stages, with some excellent presentations, site visits and professional connections for life being honed. These events resulted in modest financial income to the society, but more importantly, provided a long-overdue and welcome opportunity to reunite with colleagues and peers, and forge new connections. Once again, due to the cost of living crisis, I took the decision to open up our travel grants for a UK event for the first time, to help members attend these events and benefit from all they had to offer. I hope those who did benefit from this funding had a fulfilling experience at the event they attended.

Finally, I'd like to remind members that funding is always available to apply for through the society – be this for travel grants, to establish workshops or events, or to support any incoming students that may be joining your MSc programmes in September 2023. In my final year as treasurer, I hope I can continue to provide the UK hydrological community with the financial means to bring people together and exchange knowledge and business cards alike!

Committee Membership

BHS would not run without its committee of volunteers who keep the Society going alongside their day jobs. Thank you to everyone for working together for another productive year of BHS! We are particularly grateful for those completing their terms of office on the main committee and in the regional sections, including:

- Nick Chappell who ended his term as Past President after four years on the committee, and in particular for the organisation of BHS 2022
- Lucy Barker who ended her term as Honorary Secretary but will remain on the committee as the UKCEH representative (replacing David Boorman)
- Liz Lewis who has stepped down from her position of Ordinary Member having made significant contributions to the BHS Education and Careers sub-committee
- Michael Vaughan who has stepped down from his position of Ordinary Member, having made invaluable contributions to the Finance sub-committee
- We also say goodbye to the following co-opted committee members and thank them for their valuable contributions to the Society: Anita Asadullah (EDI sub-committee), Michael Pollock (Meetings and Communications sub-committees) and David Boorman (UKCEH representative)

We are pleased to welcome three new Ordinary Members to the committee: Katy Peat (Defra), Gemma Coxon (University of Bristol) and Will Rust (Atkins). Victoria Coates (Mott Macdonald) re-joins the committee as Honorary Secretary and Duncan Faulkner (JBA Consulting) as the new BHS President-Elect.

Lucy Barker
Outgoing BHS Honorary Secretary

On 'What is hydrology?'

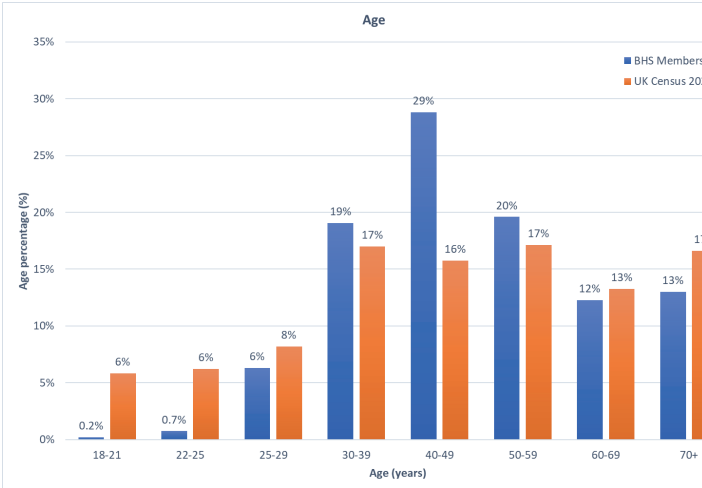
Anthony Hammond introduced an interesting discussion on the scope of hydrology in *Circulation* No. 155, starting with a concern that purely empirical approaches to flood forecasting might be neglecting useful hydrological knowledge and concluding by asking whether there are other subjects that suffer such an identity crisis. I see the problem in a somewhat different way. Hydrology is a difficult and inexact science [1] but one which has great significance for society. The latter importance demands answers about hydrological futures for policy and decision making; the former difficulty means that we do not necessarily have the knowledge and understanding to fully support those answers. This tension is one of the things that makes hydrological research so interesting, and hydrological practice at times frustrating (not enough data, necessity of assuming stationarity for analyses etc.). That is why we sometimes resort to institutionalised recipes for ways of doing things, such as the Flood Estimation Handbook. They give some confidence in providing answers by defining current best practice, and can be revised as more data become available. In some cases, we might be able to bring understanding to bear in useful ways — for example, one reason why we might resort to data-based approaches to flood warning is exactly because we do not expect the data in flood events to be consistent with mass balance because of errors in estimating inputs and potential for rating curve errors in estimating discharges. This means that forecasting water levels directly, with data assimilation, and no mass balance constraints using machine learning or transfer functions techniques with updating might be the best strategy (e.g.[2]). In other cases, we would choose to use a more process-based approach because the data do not exist (just what effect is all that tree planting in your catchment going to have on future flood and drought responses?). But I see no identity crisis there. Borrowing an aphorism traditionally associated with geographers (which whom we have much in common), hydrology is what hydrologists do!

Keith Beven

[1] Beven, K. J., 2019, Towards a methodology for testing models as hypotheses in the inexact sciences, *Proc. Roy. Soc, **A***, 475 (2224), 20180862, doi: 10.1098/rspa.2018.0862

[2] Smith, P. J., K.J. Beven, D. Leedal, A.H. Weerts, and P. C. Young, 2014, Testing probabilistic adaptive real-time flood forecasting models, *J. Flood Risk Manage*, **7**(3), 265-279, DOI: 10.1111/jfr3.12055

BHS EDI



What Next? Develop BHS EDI strategy which will include:

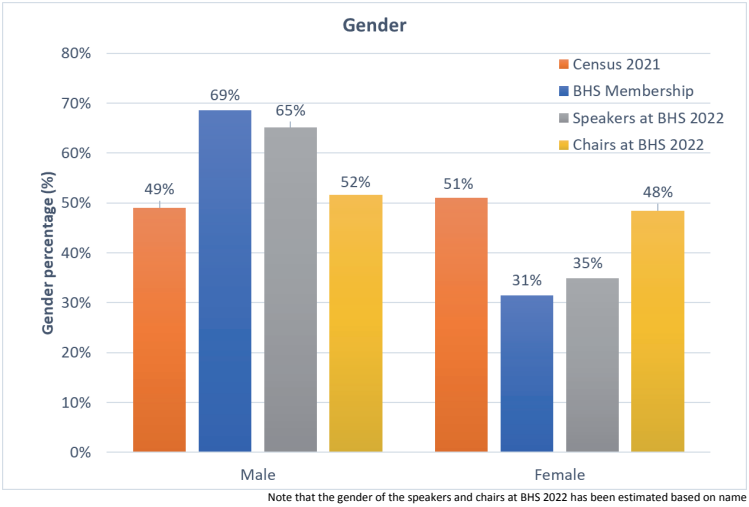
Improved data collection of the BHS community

A survey was carried out in July 2022, however results indicate that the responses received are questions could also be improved. We plan to:

- Design a New Member data collection form
- Keep a record on dissertation prizes, travel grants, MSc studentships and presenters at
- Continue to improve data collection on EDI
- Communication on EDI through Circulation
- Support UK Hydrology skills and satisfaction survey due to launch on 6th February 2023

Interventions may include:

- Consideration of meeting times/dates to improve accessibility (i.e., over lunchtimes, re
- Recording all meetings to increase accessibility
- Guidance for meeting organisers
- Continue to monitor and report on EDI within BHS to track our progress



Note that the gender of the speakers and chairs at BHS 2022 has been estimated based on name

e not a true reflection of the BHS. The breadth of

all BHS events

duce weekend travel, outside of school holidays)

We welcome any feedback, ideas or comments to improve the EDI within BHS. You can speak to members of the BHS Committee or contact: bhs@ice.org.uk

Urban flash flooding in England
– an exciting new project

There have been many severe surface water flooding events in recent years, which those affected have found shocking and traumatic. These include events in Market Rasen, Lincolnshire, in 2022; Dorridge, West Midlands, in 2021; and Barnstaple, Devon, in 2020. Some have badly disrupted transport systems, damaged schools and hospitals, and even posed a danger to life.

However, often few outside the local area are aware of these events. Given the localised nature of surface water flooding, often hitting a handful of streets in an unsung provincial town, the issue received relatively little national media attention until London was affected in 2021.

There is also a lack of comprehensive and easily accessible historic data. If this were available it would be much easier to convey the extent of the problem accurately, as well providing a valuable input for model validation and planning decisions.

Local newspaper reports often have very detailed street-by-street accounts of surface water flood events, illustrated with photos and videos. While these descriptions are clearly often not geographically exhaustive, and can provide only sparse, often visual or qualitative information on depths and velocities, they can at least provide an understanding of what occurred with some degree of spatial detail. However, this information is distributed amongst thousands of different documents on hundreds of websites.

Nevertheless, attempting to use these account to fill in some of the gaps in the historical record has been the key motivation for the Urban Flash Flooding in England Project, which I have worked on for the past few months. The project is funded by Subak, an organisation which supports not-for-profits working with climate-related data, and has analysed approximately 2,400 articles relating to summertime urban flash flood events in England over the past decade or so from 260 newspaper websites.

The project uses two distinct techniques from Natural Language Processing (NLP), the branch of artificial intelligence concerned with giving computers the ability to understand human language, to analyse the articles. The first of these (text classification) is used to distinguish articles about urban flash flooding from those about other flood-related topics (winter storms, flood alerts, etc.). The other (named entity recognition) is used to identify the names of towns, buildings, streets and other geographical features within sentences.

These locations can then be displayed on a map by using geocoding to automatically derive coordinates for them. Brief, standardised 'nuggets' of descriptive information on what can be understand to have occurred in each place (e.g. whether there was internal flooding) are added for each location. This latter process has relied on human interpretation and quality control, which is also used to verify event dates.

The resulting main project output will be a set of downloadable detailed interactive maps of many of the key summertime urban flash flood events over the past decade or so, one for each date on which significant flooding occurred. These include the

Great Tyneside Flood of June 2012 and the two major London flood events of July 2021, but also many much less well-known events in smaller towns and cities. A geospatial dataset with all dates, locations, descriptive information and links to source articles will also be available to download.

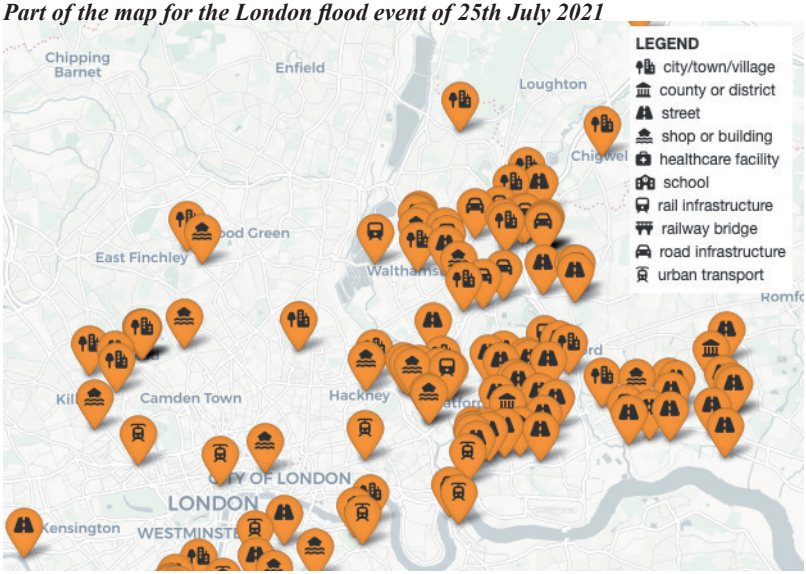
The project title refers to 'urban flash flooding' because obviously river flooding does occur in combination with surface water flooding, and it may not always be reliably clear from a newspaper report which was responsible for described impacts in a given location. In addition, painstaking delineations of which flooding impacts are and aren't within scope ('is it urban or a large village?') could cut out information of potential interest to users. For these reasons, the maps retain information relating to other flood impacts occurring on the same date as the urban surface water flood events which are the primary focus.

I am grateful for the feedback and encouragement I have received from hydrologists, meteorologists and other regarding the project, and hope they will find this a useful reference resource for these events, and a complement to resources which have compiled event information from newspaper reports over a longer historic timeframe, such as the Chronology of British Hydrological Events and the British Flash Flood Chronology.

For more information please see the project webpage: ***https://www.climatenode.org/maps/about_UFF_maps.html***. The project outputs will be freely and publicly available from this page and the Subak Data Catalogue (***https://data.subak.org/***) around the end of February. Anyone who would like to be notified is very welcome to contact me at helen@climatenode.org or join ClimateNode's mailing list: https://www.climatenode.org/register.html. I'd also be very interested to hear how the data is used.

Helen Jackson
Director, ClimateNode

Part of the map for the London flood event of 25th July 2021



Improved grassland catchments and NFM

If there is one factor common to hydrologists it is, we all need more time to study a catchment. We rarely have time to evaluate the landscape changes from historical land use and yet, Natural Flood Management is often an attempt to reverse flood-promoting adverse land use changes.

We, my wife and I, have had the good fortune to live in, and observe, the same small(7.8 km2), improved grassland, hilly North Wales catchment for nearly 40 years. In the past 10 years we have mapped the catchment more intensively, in all weathers, discovering the ephemeral flow routes, springs, land drains, dams, filled ponds, ditching and historical land uses. In total there are more than 65km of flow routes operational in heavy rain leading to a high drainage density of over 8km/km2.

Once mapped it is clear that the headwaters have been extended in many places close to or even through the catchment boundary. Many of these changes appear to be pre-1840 and hand-made land-drain pipes attest to this. However, with the rise of modern machinery some of the headwaters have been continually deepened and scraped clean. Coupled with the modern change over to pasture, compacted by higher stocking densities of cattle and sheep, most ephemeral flow routes are now in short, and often sparse, grassland. Compare this with records from the 1840s showing less than one-third pasture, with low stock numbers and the rest arable, with some evidence that wetlands and ponds were more extensive and common.

Over time the field soils have also been smoothed and made uniform by being picked clean of larger stones and boulders, with the largest having been pushed into stream channels, resulting in abnormally high densities in the streams, or in the case of a 20-tonne glacial erratic, blown-up!

The synthesis is that the flow routes through the soil(the slow path) has been progressively short-circuited to the channels(the fast path). In addition, in recent decades there has been a profound loss of soil insects and worms that probably ameliorated soil compaction from high stocking densities. Wetlands with legacy sediments from arable farming(which substantially ended by the 1950s) thrived until pre-2000, after which deep ditching short-circuited their flows with the loss of biodiversity too.

Many of us have seen models and some field studies of NFM leaky dams in permanent streams that result in only small flood-peak reductions, perhaps from the physical reality that flow resistances and storage are minimal with leaky dams. Blocking extended headwaters with leaky dams will also fail as the requirement to return to the original slow, soil flow path regime is to excavate the legacy sediments and completely fill in the channel.

In ephemeral streams through grassland (Strahler zero order hollows or Saturation Excess Overland Flow(SEOF) zones), it appears that the leaky dam does little, unless combined with massive storage. To return it to the original land use, may be more effective by removing any land drains and re-creating linear wetlands. Either method though, is certainly not popular with landowners and farmers.

Another NFM go-to, hedging across the flow path appears in this catchment to fail to intercept flows. In the 1960s much hedging was removed, although progressive changes

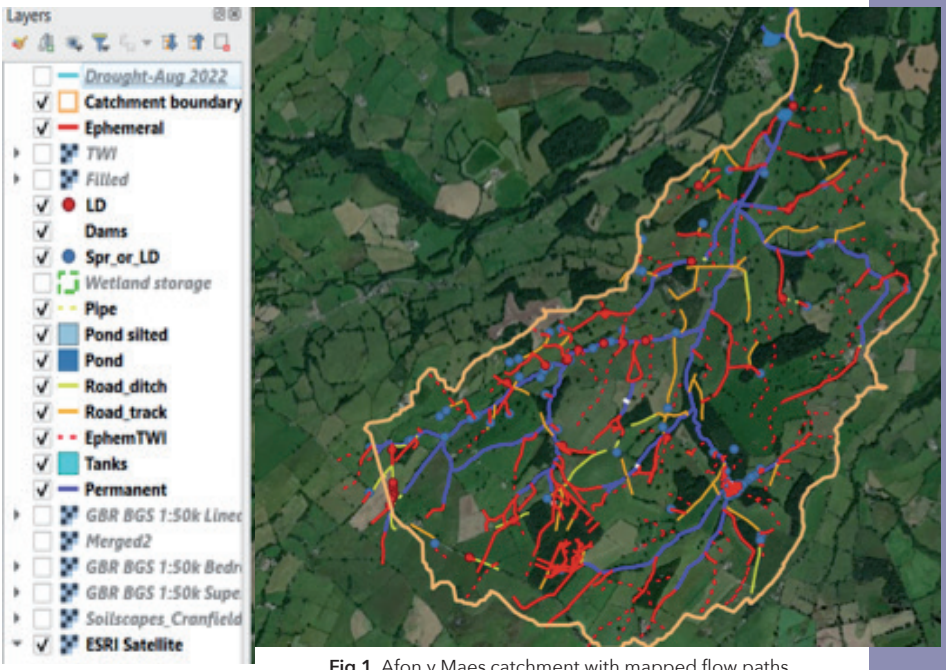


Fig.1. Afon y Maes catchment with mapped flow paths

are seen from 1840s, where field sizes were often 5-10 times smaller than present. Observations in storms with heavy rain suggest that the deep brown earths over mudstone allow flows to pass under mature hedging, leaving the only advantage of new hedging as improved biodiversity.

In conclusion, there may be only a few NFM interventions that are effective in hilly improved grasslands; either massive storage, and in such terrain sites are rare, or a significant effort and expense in disconnecting the flow path linkages by reinstating slow soil flow paths and SEOF zone wetlands.

Steve Conway

Message from the Pennines Group

Since the pandemic we have started hosting all our technical meetings on Zoom, in part because it is easier to organise, but also because it makes them accessible and available to all BHS members who may be interested, regardless of their location. Whilst we try to organise talks which cover hydrological issues seen in the Pennines region, many of the topics are common to all geographical areas so hopefully they are of interest to the wider society. We make all our talks available on this playlist on the BHS YouTube channel.

BHS Pennines Section - YouTube - https://www.youtube.com/playlist?list=PLfzIFXtpS_JBR_NMlir2SybxColfeeJF6

Chris Allman
BHS Pennines Chair

The Coalburn 2020 Experiment

In a 2016 edition of Circulation we proposed the Coalburn 2020 experiment to address the question:
Can we predict the hydrological impacts of changes in land use and management?
Given the current focus on the potential of natural solutions to reduce flood hazard and given concerns about future water availability for potable supply, this is an important question. The Coalburn Experiment is a chance to assess how good hydrological models are at predicting these impacts.
Using hydrological models predictions will be made on the impacts of a land use change on streamflow. Significantly, this is without having seeing the post land use streamflow data. Then we can assess how good these predictions are and provide some insight in whether we can trust hydrological model predictions.

Coalburn Catchment
Coalburn is the UK's longest running forest research catchment, with monitoring commencing in 1967. It is also important as it is one of the few catchments where the land use change has produced a clear response in outlet discharge, with the change from small trees to mature trees producing an increase in evapotranspiration and a reduction in annual discharge (Figure 1) . The upland catchment (1.5km2) is located in the north of England, close to the Scottish border. In 1972/73 the upland grassland within the catchment was ploughed and planted with a conifer forest. The trees are now mature, with around 30% of the catchment felled in June 2016 and Sept 2018 (Figure 2).
The following quality controlled data is available on the Coalburn2020 website (http://research.ncl.ac.uk/coalburn2020):

- Hourly meteorological data for the period 1993 to 2022.
- Hourly discharge data for the period 1993 to 2015.
- Daily meteorological data and hourly streamflow data from 1967 to 1992, although there are some gaps.
- GIS datasets including DEM data and land use maps.

Experimental Design
For the experiment the plan is to make predictions of the impacts of the forestry felling within the Coalburn catchment on (a) monthly water yield and (b) flood peaks. It is proposed that simulations be performed for the period 1993 to 2015 (or back to 1967 if the modeller wishes), using parameters representative of the historic land cover, with the models calibrated to produce the best fit between the measured and modelled discharge. The modellers will decide which parameters to change and assign new values (or lower and upper bounds) to these parameters to take into account the changed land use in the felled part of the catchment. Once this has been carried out then the discharge data for the four years from 2019-2022 will be made available and the modellers can assess how good their models are at predicting the effect of the felling on streamflow.
There are two things to note:
1)At Newcastle we have already run the model for the period 1993-2015 using the Shetran hydrological model and defined values for the parameters we are going to change due to the felling. These predictions were made in 2016 and can be seen on the Coalburn2020 website.
2)In order to check there is a

different response in streamflow as a consequence of the felling, we have provisionally compared the annual discharge against the annual precipitation. For 2019-2021 this shows an increase in discharge compared to the pre-felling years of 2003-2015 (Figure 1). This suggests the felling has had an impact of the annual discharge.

Please do contact us if you are interested in taking part in this experiment. We intend to run an online workshop about the data and experimental design and then a second workshop that considers the modelling results. We will report back to Circulation on the outcomes of the hydrological predictions, and with participants produce a journal paper.

Steve Birkinshaw
(s.j.birkinshaw@ncl.ac.uk)
Greg O'Donnell

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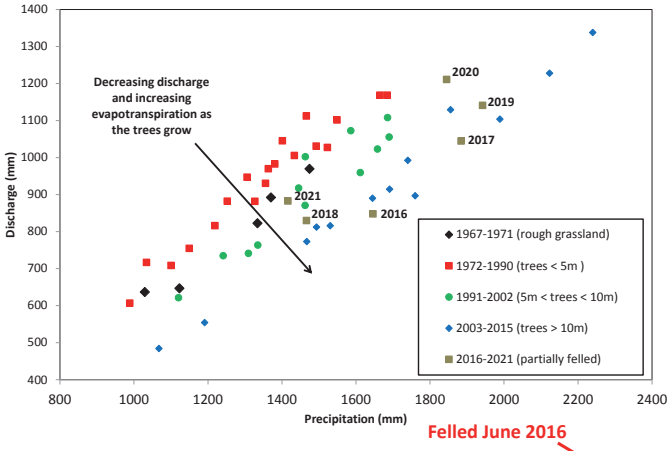

Fig. 1. Comparison of discharge and precipitation over a 55 year period for the Coalburn catchment. Data points since 2016 are labelled and suggest an increase in discharge in 2019-2021 as a consequence of the recent felling

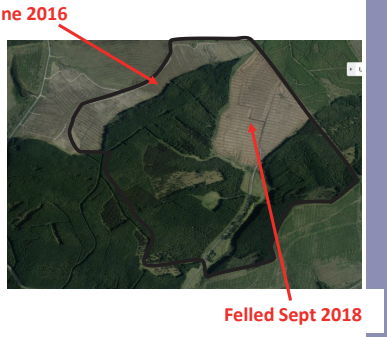

Fig. 2. Recently felled trees within the Coalburn catchment

Obituary

Peter Adamson (1946-2020)

compiled by Peter von Lany, Tim Turner, Malcolm Wallace and Tony Green

Peter graduated in 1969 with a BSc in Earth Sciences from the University of Newcastle. This was followed by an MSc in Water Resources and a PhD in Hydrological Modelling from the University of Stellenbosch (South Africa) in1984.

From 1973 until 1989 Peter worked for the South African Department of Water Affairs and in the Civil Engineering Department at the University of Natal, Durban. He made significant contributions to regional water resources studies, including methodological advances in the fields of applied hydrology, reservoir planning and operational simulation and the statistical estimation of flood and drought risk. From 1989 to 2003 Peter worked for Halcrow. He quickly earned a reputation as an innovative hydrologist with a sharp intellect and a keen interest in travelling. Acquaintances at his local pub in Pewsey, Wiltshire (where Peter had a flat) used to refer to him as the Marco Polo of Pewsey!

Peter recognised that well analysed data is crucial to good water resources planning and engineering design. As a Fellow of the Royal Society of Statistics, he was keen to apply innovative statistical techniques. He developed a suite of hydrological analysis and modelling methods; which, he used to say, could be used to "interrogate the data until it confesses"

During his time at Halcrow, Peter worked in at least 14 countries on a range of water projects, introducing new ideas on many, including water resource strategies for England and Wales. He was always ready to share insight with colleagues, mentor junior staff and supervise students. He contributed papers to international scientific journals and was a joint author of the 3rd edition (1995) of "Floods and Reservoir Safety - the ICE Guide". Peter was an Honorary Visiting Research Fellow at the Department of Applied Mathematics, Statistics and Engineering Mathematics at the University of Adelaide in South Australia.

Peter first worked on the hydrology of the Mekong River in the late 1990s. From 2003 until he retired in 2016 he worked as an independent consultant, frequently called upon to undertake further studies of this major river basin that is 12th largest in the world and home to more than 60 million people. He soon became the "go-to" person to better understand the behaviour of the Mekong, looking back through nearly a century of records and into the future with climate change. Known for his disciplined, thorough, approach, Peter made a massive contribution to the body of knowledge that was shared with the riparian countries, including writing the annual Mekong River Commission flood report for several years.

A report from Peter was always worth reading, even though at times getting him to actually complete a piece of work could present a challenge. As he delved into a subject, his huge intellect took him off down different pathways of exploration, from which it was not always easy to extract him!

Peter was much liked and respected by his many friends and colleagues in Laos and throughout the Mekong region by whom he will be greatly missed. Colleagues remember him warmly for his pithy anecdotes, dry humour and wit which produced memorable one-liners. He was his own man, often ready to challenge orthodoxy. His breadth of interests extended well beyond water resources into history, geography and the arts. His passing away leaves the world a smaller poorer place. Above all, Peter will be remembered by many as a valued friend, who we will all miss.

UK Hydrological Bulletin: November – January 2023

Despite a notable cold spell in December, the UK registered its third warmest November–January in the Met. Office series from 1884 and, at the national scale, rainfall for the three months was 25% above average. Correspondingly, the hydrological recovery from the spring—early autumn drought conditions was generally reinforced as the focus of concern in many areas switched to flood risk. Exceptionally high river flows — with associated floodplain inundations and transport disruption — characterised much of November. A major synoptic change brought freezing conditions and blizzards through much of December before a sustained series of low-pressure systems triggered a sharp increase in river flows and widespread flood warnings. These continued into January with many groundwater-fed streams and rivers in southern England registering extremely high flows. However, regional variations in rainfall patterns and catchment characteristics were also influential. Groundwater levels remained low in a significant proportion of index wells and boreholes and, whilst overall reservoir stocks for England & Wales increased very substantially over the three months, stocks remained seasonally depressed in south-west England.

November was a remarkably mild month with well above average UK rainfall but regional contrasts were very exceptional — much of southern England and parts of eastern England were extremely wet whilst parts of Northern Ireland and northern Scotland recorded below average monthly totals. With the Jet Stream tracking from the Azores dominating weather patterns across southern Britain early in the month, rainfall totals were notably high. On the 3rd, Lamberhurst (Kent) recorded 68 mm in 24 hrs and many southern rivers were in high spate; flood warnings were extensive with significant transport disruption. During a further cyclonic episode in the third week a two-day rainfall total of 160 mm was recorded at Charr (Aberdeenshire) and extreme flows were triggered in, for example, the Dee, Don and Tay; urban flooding was also significant (e.g. in Edinburgh). Across Great Britain around 50 Flood Warnings and 140 Flood Alerts were in operation.

The steep runoff recovery since the 2022 spring-summer drought is illustrated in Fig.1 Late-November groundwater levels exhibited very substantial

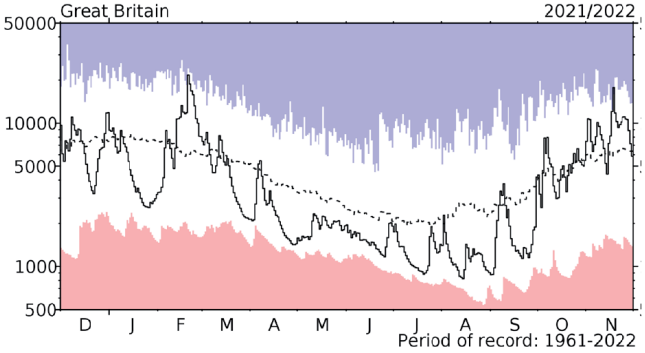

Fig. 1. Daily outflows (m^3s^{-1}) from Great Britain (black trace); the blue and pink envelopes are the long-term max. and min. outflows and the broken trace is the long-term daily average

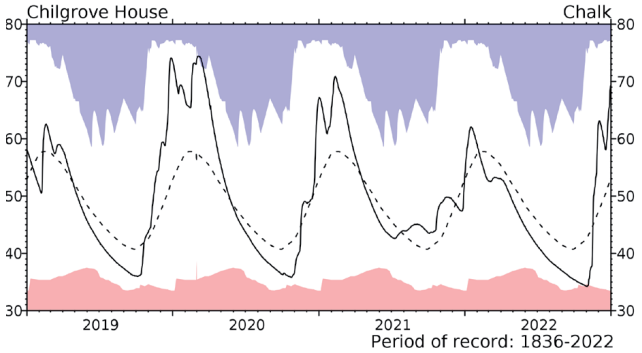

Fig 2. *Groundwater levels at Chilgrove House (black trace); the blue and pink envelopes are the long-term max. and min. outflows and the broken trace is the long-term daily average*

spatial variability, reflecting not only rainfall patterns but the responsiveness of individual aquifer units — very steep recoveries were underway in, for example, the southern Chalk and Jurassic Limestone. Overall reservoir stocks for England & Wales increased by around 30% over the month, closely approaching the late-November average. However, stocks remained depressed in the South West; Colliford reservoir being at 25% of capacity.

December was atypical of the recent past; the coldest and second driest for the UK since 2010. Regional contrasts were, however substantial — Northern Ireland and western Scotland being relatively dry whilst parts of eastern Scotland and southern England notably wet. These areas aside, catchment runoff totals were generally modest, less than 30% of the monthly average for the Waveney in Norfolk and well below average in much of western Scotland. This reflected the influence of a cold northerly airflow which became entrenched from around the 6th. On the 13th, Braemar (Aberdeenshire) recorded an overnight minimum of –17.3°C and blizzard conditions were extensive with major transport disruption — briefly closing the M25 north of London. Steep recessions characterised most rivers through the first half of the month; with the Clyde and the Exe among many approaching their lowest flow on record for the time of year. From the 19th, a major synoptic change brought sustained precipitation, with some blizzards, widespread flooding, and further significant transport disruption. Nonetheless, December catchment runoff totals were generally below average, notably so in parts of East Anglia and north-west Scotland; Northern Ireland also. Groundwater status was spatially very variable reflecting both rainfall patterns and aquifer characteristics. In the Chalk of West Sussex groundwater levels had risen by over 30 metres at Chilgrove since late October (Fig. 2).

The Met Office's temperature series confirms 2022 as the UK's warmest year on record (Fig. 3) and the trend in national rainfall, though less compelling, indicates a linear increase of around 12% since 1884 (Fig. 4).

At the national scale the January rainfall was very close to the long-term average but spatial contrasts were again substantial. Many eastern areas — Northern Ireland also — recorded considerably below the monthly average whilst most of western and northern UK were notably wet. In South Wales, Sennybridge recorded a

67.6 mm rainfall total on the 12th and many major rivers were in spate. Temporary flood barriers were widely deployed (e.g.at Shrewsbury and Bewdley on the Severn) and transport disruption was severe. By mid-month over 100 Flood Warnings and 200 Flood Alerts were in operation across the country with a preponderance across southern Britain. Despite recessions thereafter, the Lune (Lancashire), Towy (Powys) and Dart (Devon) were among index rivers recording their highest January runoff on record. In southern England an important contributory factor was the steep and sustained rise in groundwater levels in the Chalk and Jurassic Limestone aquifers particularly.

At West Dean (East Sussex) levels were the highest in a 80-year series and exceptional flows were recorded in many groundwater-fed streams. Road and basement flooding was very sustained and Flood Alerts remained active in a few parts of spithern England well into February. Whilst end-of-month reservoir stocks in major reservoirs in south-west England remained well below average, overall stocks for England & Wales were within 10% of the average for the time of year entering February.

Terry Marsh
16/02/2023

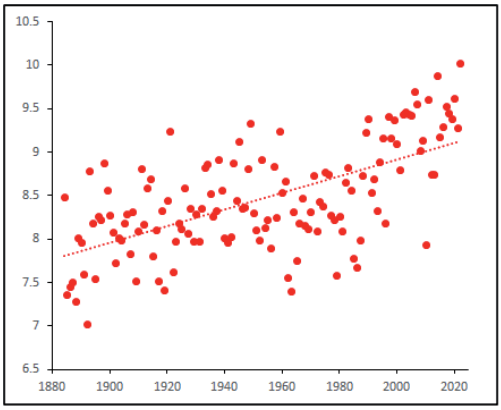

***Fig. 3**. Met Office UK annual rainfall totals (mm) from 1884 with linear trendline*

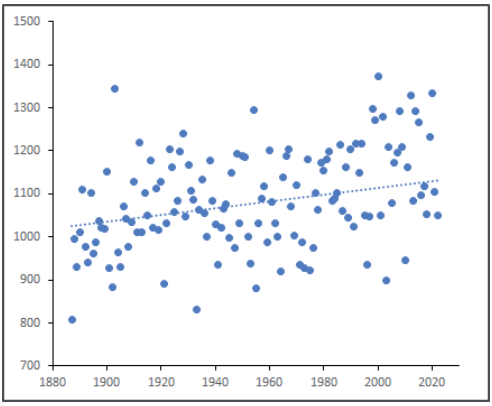

***Fig. 4.** Met Office UK annual mean temperatures (°C) with linear trendline*

This report draws primarily on data and information from the UK Met Office and the CEH/ BGS National Hydrological Monitoring Programme – the latter comprising data supplied by the Environment Agency; Scottish Environment Protection Agency; Natural Resources Wales; Northern Ireland Environment Agency and the UK water companies.

Devastating East Coast floods, February 1953