Technical Workshop Report: Floodplain Flow Measurement

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FDRI Floods & Droughts Research Infrastructure
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The Floods and Droughts Research Infrastructure and British Hydrological Society hosted a workshop on floodplain flow measurement at the Edinburgh Climate Change Institute on 11-12 February, with45 attending in person and another 75 online. The aim was to bring together a community interested in sharing both the challenges and solutions to measuring floodplain flows, vital to improving flood early warning systems and improve resilience.

1.1 Workshop purpose

The meeting was organised to address the challenges of measuring floodplain flows. Many hydrologists have access to well-developed models, necessary topographic maps and water level data=for simulating floodplain flows. However, we face many difficulties in the validation of rated flows at gauging stations by direct measurements. These include getting to the flooded site, what methods to use if you do manage to get there, and how to do so safely. These challenges increase with flood magnitude, and yet, if there are no measurements during extreme floods, then the uncertainties in the reported flood flows for gauging sites remain high, and the potential impacts on flood risk estimation nationally are substantial. An example was provided for a gauging station at which a maximum flood flow estimate had recently been increased from 186 m^3/s to 336 m^3/s without any new observational data.

FDRI has a particular interest in these challenges given the limitations they impose on our understanding of flood dynamics. FDRI will address such priority hydrological questions through system-level hydrological monitoring, a digital platform bringing together hydrological data into research-ready formats, and communities of practice to drive innovative solutions to water research challenges It will be to the advantage of future users of FDRI data if flood flows can be quantified with accuracy, even during extreme floods; the perennial challenge of closing the water balance will be well served if flows can be reported within acceptable levels of accuracy for all events. The impetus provided by FDRI arises at a time when new opportunities for water velocity measurement are proliferating. The programme of oral presentations therefore included experts involved in hydrometry, hydraulic modelling, operational flood forecasting and management, innovators and representatives of the National River Flow Archive (NRFA) and the British Standards Institution (BSI).

1.2 Workshop structure and participant profile

The workshop was held in three parts: quickfire oral presentations and discussions, a field visit to see key FDRI sites and interactive workshop activities. In-person delegates were drawn from the FDRI project itself and UKCEH, from universities, measuring

authorities and consultancies. Some participants were specialists in data capture, while others had little prior involvement in flow data generation but were keen to find out more. This is a brief summary of the meeting. If you were unable to attend, we encourage you to watch the recordings and view the slides on FDRI's website here. Future planned outputs will provide more detail of what was covered, and a proposed way forward.

1.3 Learnings from presentations and site visits

The first three presentations came from the Environment Agency (EA). Olly Baldwyn presented an overview of EA work assessing surface alpha values from camera and acoustic doppler (ADCP) sources: the depth-averaging correction factors needed for application to surface velocity measurements. Values are found to be site specific, difficult to predict, but during floods often differing between main channels and floodplains, with values of 1-1.4 typical in main channels but 0.8-0.85 more typical of floodplains. Jackie Spencer provided a customer-facing perspective, illustrating how flow measurement accuracy feeds through into model performance and quality of service, noting that with climate change, the need to accurately quantify flood flows is only going to increase. Richard Maxted extended the focus by looking specifically at washlands, where flood storage volume assessment is of equal or perhaps greater importance than the oft-found focus on flood peaks. The hazard to communities persists after the time of peak occurrence; teams often face the challenge of issuing warnings to locations at a distance from the nearest monitoring site, but ultimately the authority and reputation of agencies rests on the service that is experienced by users, irrespective of where they are.

Steve Turner (UKCEH) provided an overview of the processes underpinning the peak flows dataset of the National River Flow Archive (NRFA), covering the use of consistency checks, analogue catchments, rainfall data and ISO standards via automated and manual processes, involving close collaboration with all the contributing measuring authorities and a group of regional NRFA representatives. The current dataset comprises 279,082 flood peaks and, given >15k downloads since 2015, meets a high level of demand from the research and practitioner communities.

Presentations by Nick Everard (UKCEH) and Peter Chinkin (Thurn Group) both focused on technical innovations. Nick rapidly summarised a huge volume of work involving imaging from drones and satellites with lidar, optical and thermal sensors and velocimetry methods. Peter explained the growing range of applications of drones for carrying sensors across flooding rivers, spanning velocity radar and laser doppler systems. As well as the novel technique of dipping a drone-carried ADCP into the water,

e.g. to obtain a transect of depth-profiled velocity measurements. Together these presentations demonstrated the rapid evolution of methods to obtain velocity data like we've never had before.

The presentation by David Cameron (JBA Consulting) returned to more established approaches, illustrating the application of 1D/2D modelling of flood flows for the Tweed at Peebles, and underscoring the importance of using all available sources of observations, and the application of sound hydrological judgement, to support the creation and development of homogenous long-term records.

Finally, Rod Wilkinson (representing BSI) challenged the audience to think about the role of technical standards in an area experiencing such a volume of current and likely future innovation.

Site visits (hosted by Scottish Environment Protection Agency (SEPA)'s Euan Cameron and Jack Gillespie), and two parallel workshops on Day 2 (led by David Cameron and by Steve Turner, Antonia McDonald (EA) and Katie Muchan (EA)) facilitated discussion of the practicalities of velocity/flow measurement in the field, and the challenges of extending ratings beyond the limits of observational data. These activities, and the social time afforded by the 1.5-day format, allowed delegates to explore and reflect on the limits of what we think we know, and discuss potential for observational and analytical advances. Delegates left the meeting with a clear sense of considerable potential, which we are excited to harness into a community of practice on this topic, including the organisation of future events.

The organisers are grateful for all the contributions of presenters, chairs, participants, BHS and FDRI for their support, alongside ECCI for generously providing a venue.

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Partners

Funder:

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