

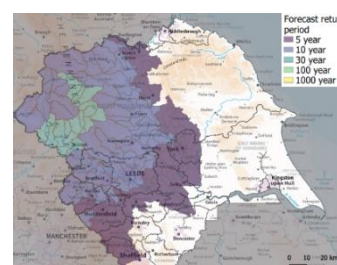
iCASP Enhanced Surface Water Flood Forecast workshop

Executive summary

- Surface water flood forecasts, with higher spatial resolution than the Flood Guidance Statement, were trialled through a workshop for flood responders.
- Responders really value the existing Flood Guidance Statement and National Severe Weather Warnings but the broad warning areas and lack of spatial detail make it difficult to apply them at a local level.
- All flood responders that attended the workshop agreed that the enhanced forecasts would be used routinely if offered as a complement to existing operational forecast information.
- Responders prioritised accurately forecasting major, high impact flood events over capturing a large number more minor events.
- Responders stated they would use the forecasts up to three days in advance of an event they placed particular value on the forecasts issued within 36 hours of an event.
- Aspects of the forecasts that require further improvement include presenting the forecasts as something other than in return periods, reducing the occurrence of the highest flood risk levels and addressing the “jumpiness” between forecast lead times.
- Next steps include implementing the suggested improvements, evaluating the forecasts over all major surface water flood events that have occurred in the North of England in the last decade, and scaling up and testing the forecasts over all of England and Wales during summer 2023.

Surface water flood forecasting testbed

The core project team ran a surface water flood (SWF) forecasting testbed over summer 2022, where new flood forecast tools were developed and tested over Yorkshire. The forecasts link reasonable worst-case rainfall scenarios generated from the Met Office’s operational ensemble forecast system with thresholds from the national Risk of Surface Water Flood mapping database to give an indication of flood risk at the catchment scale.



Enhanced flood forecast, issued day before, for Yorkshire Dales flood on 30th July 2019

Responder workshop

A workshop was held in Leeds in November 2022 with flood responders, which aimed to assess:

- If the new enhanced flood forecast products would be useful to responders.
- Whether access to the new products would change actions before a flood event, compared to actions based only on current operational forecasts.
- How the enhanced flood forecast products could be further improved.



The event was attended by 21 participants, including flood responders from local authorities, the emergency services and community flood warden groups. Forecast providers from the Met Office, Flood Forecasting Centre and Environment Agency, and academics and attendees from the private sector also participated.

Participants were shown operational National Severe Weather Warning Service (NSWWS) and Flood Guidance Statement (FGS) warnings, and the newly developed forecast tools, for three recent SWF case-study events in Yorkshire:

- major floods across the NE Yorkshire Dales (July 2019)
- extremely localised, minor flooding in Shipley (June 2022)
- flooding in Sheffield following the breakdown of the major summer heatwave in August 2022

Feedback was collected through facilitated group discussions and individual surveys, centred around actions that would be taken by responders in response to forecast information at various lead times.

Reflections on existing forecasts and warnings

Operational NSWWS and FGS warnings were valued by the participants, and are consulted regularly. While getting a national picture of the risk is valued, some users reported that the broad warning areas and lack of spatial detail make it difficult to apply them at a local level.

Professional responders appeared to place particular importance on the risk matrices included in these warnings products, far more so than the mapped areas-of-concern, with changes in the risk matrix generating significant attention and often changing actions put in place. The detailed language and descriptions of impacts used in the FGS were also generally considered more useful than the prescriptive “very low” or “low” headline warnings, which can sometimes lead to detail within these categories being missed.

Feedback on the enhanced forecast information

The overall takeaway from the workshop was that the enhanced flood forecasts were valued by SWF responders and would be used routinely if offered as a complement to existing operational forecast information. All flood responders stated that their organisation would use these forecasts one day in advance of potential flood events for action planning and up to three days in advance for routine monitoring, with particular value placed on forecasts issued within 36 hours of an event.

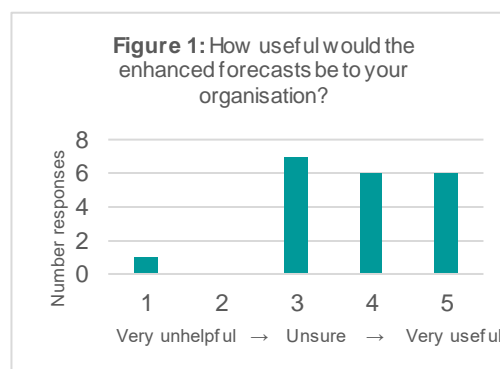
Aspects of the enhanced forecasts which were particularly valued by participants were:

- the improved level of local detail
- the clear information and presentation of the enhanced flood forecasts
- the indication of the time of day flooding was expected
- the translation of the rainfall forecasts into a visual impact forecast.

Aspects which require further improvement were:

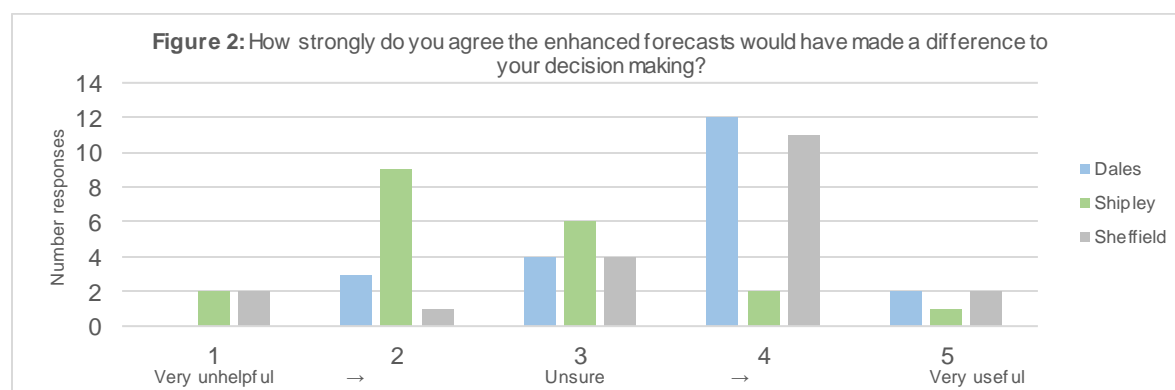
- the communication of flood severity through return periods, which was considered confusing by many
- the appearance of extremely high return period values in some forecasts
- the “jumpiness” of forecasts as lead time decreased
- the lack of any likelihood indication.

In the final survey participants answered questions about the enhanced forecast products on a scale of 1-5, where 5 is strongly agree, 3 neither agree or disagree and 1 strongly disagree. The question about whether the new forecast products would be useful to their organisation scored a mean of 3.8 across all workshop participants (Figure 1), with all flood responders scoring the forecasts at 4 or 5. Similarly, 16 participants (including all flood responders) agreed that the enhanced forecast information was easy to interpret.



Responses to questions about how useful participants found the operational NSWWS and FGS warnings for decision-making found similar results, with mean scores of 3.9 and 3.7 respectively, although some flood responders gave scores of 3 or below. This reflects the limitations around spatial detail; typical headline phrases “very low” and “low” used to communicate flood risk and the need, to some users, for more localised forecast information in decision making.

The three workshop case studies were deliberately selected to enable responders to consider the value of the enhanced forecasts to their decision making for different types of surface water flood scenarios. Responses to the question of how strongly participants agreed that the enhanced forecasts would have made a difference to their decision varied by case study (Figure 2).



The flooding in the Shipley case was caused by an extremely intense, but isolated and short-lived, shower, and was minor in extent and impact (i.e. no properties were flooded). From a forecasting perspective such events were considered impractical to predict for a specific location, while it was clear from discussions during this case study that, from a response perspective, such events are not of high concern. Many responders indeed questioned whether this event classified as a flood, and also noted that its impacts could be dealt with reactively, and were likely amplified by social media sources and timing (peak rush hour). Although participants did not generally find that the enhanced forecast information made a difference to their decision making in this situation, they agreed that the existing NSWWS, FGS and new tool all did a good job of not flagging any increased risk.

For the Yorkshire Dales and Sheffield flood events, which were more significant and widespread, participants felt that the enhanced forecasts would make a difference to their decision making (Figure 2). A clear outcome from discussions throughout the workshop was that the primary concern for flood responders is major SWF events that lead to property damage and widespread disruption. Improving forecasts for such floods should be the priority,

rather than trying to anticipate more minor events. In this respect, the higher scores for these much more significant events offer reassurance that the enhanced forecasts are already on the correct route towards meeting the needs of users.

In conclusion, the forecasts are certainly usable in their current state, which was described as clear and informative, but there is room to improve presentation around colour scales and the description of flood risk. The enhanced forecasts would also assist flood responders in their actions, especially at lead times of 1 day or same day. Flood responders found the increased spatial resolution from county-level in the FGS to river catchments in the new tools and the inclusion of event timings within a 24 hour period particularly helpful. The new forecasts would allow advanced action such as rearranging shift patterns and would also be used to justify decisions to managers and colleagues.

Next steps

The project team will:

- Further reflect on the workshop discussion and survey results.
- Conduct quantitative evaluation of the forecast method for SWF events that have occurred in the last decade across Northern England. The accuracy of the forecasts by lead time and the false alarm rate will also be quantified.
- Use evidence from the workshop and quantitative evaluation to inform further development of the forecasts, particularly around the choice of thresholds, lead times and spatial resolution.
- Write a peer-reviewed academic paper summarising the results from the workshop, the quantitative evaluation of the forecasts and project outcomes.
- Publish a summary of the project outcomes in an accessible format, through an article in a publication such as the British Hydrological Society Newsletter or the CWEM Environment Magazine.
- Expand the forecast domain to cover all of England and Wales and test over summer 2023
- Use the evidence we have gathered to develop a business case for the operational roll out of the forecasts at the national level.

From informal discussions with workshop participants it was clear that the opportunity to share practice and learn about new innovations was highly valued. The project team will work with other key SWF professionals and academics to develop a UK SWF network with an initial aim of organising a knowledge sharing and strategy workshop in 2023.

If you have any comments, suggestions or questions please get in touch:

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