

What are the challenges of forecasting and preparing for surface water flooding in a changing climate?

Host: Sally Brown, South West Flood & Coastal. Bournemouth, Christchurch and Poole Council.

Panellists: Annabel Beasley, Devon County Council. Harriet Freestone, JBA Consulting. Linda Speight, University of Oxford.

Surface water flooding occurs when the amount of precipitation exceeds that of the drainage system or the ground's capability to hold the water. The risk of surface water flooding is growing, with the Environment Agency estimating 4.6 million properties at risk from flooding today, growing to 6.1 million properties by 2060 when accounting for climate change.

Surface water flooding is unpredictable, unexpected and can ruin people's lives. Forecasting for events remains challenging and new approaches are needed to develop more targeted warnings. Increased awareness of surface water flood risk is needed to ensure that people take warnings seriously and are prepared to take appropriate action when and where needed. On homes, resilience measures, such as one-way valves or flood gates, help to reduce impacts, but uptake remains low.

These ongoing challenges were discussed by three surface water flooding experts: Dr Linda Speight, a hydrometeorologist from the University of Oxford, whose work explores flood warning systems and how forecast information is used in practice. Annabel Beasley from Devon County Council, who works with communities to ensure that emergency plans are in place and instigates different measure to reduce the risk of flooding. Harriet Freestone from JBA Consulting who focuses on emergency planning and resilience, including multi-agency exercises to respond to flooding.

Each expert discussed their perspectives on the issues related to surface water, and the challenges they face, including potential solutions. Four common themes emerged:

- **There are many different approaches to forecasting surface water flooding. The surface water community is working on effective methods that can support the diverse range of users' needs.** Forecasting surface water flooding is complex and complicated. Today's forecasts of surface water flooding can identify large areas of the country as potentially at risk. This provides limited traction for people to act, as when flooding does occur impacts can be very local. Creative approaches to provide more targeted warnings are needed. Doing this will require improved precipitation data across the country, an understanding of triggers, different types of models for forecasting plus experiments in different techniques, such as machine learning. Other evidence such local CCTV, doorbell footage and social media are additions to the forecaster's forensic investigation into how and where a flood occurred and can be used to improve forecasting approaches. It is also important to work with users and communities to understand the triggers that enable action. This may include when and how communities are alerted that surface water flooding is a possibility based on a forecast given several days' notice, or triggers that enable local communities to prepare for flooding when given a warning window of a few hours.
- **There are multiple approaches to reduce the risk within the surface water flood system.** Every action to reduce flood impacts is of value and reducing surface water flood risk will require a tapestry of action across scales, from natural flood management on the hills reducing flow, to measuring rates of rainfall, creating more 'sponge cities', alerting those in properties of imminent risks or creating a flood plan. Using combinations of measures are important, as surface water flooding is unpredictable and if one

measure is not as effective as thought or fails, other options are available. These methods need to be tried and tested in different locations to determine their suitability and the benefits they bring. Property flood resilience measures can also be very effective in reducing risk, especially where measures need no preparation or actions and are integrated into the property. Greater encouragement in the uptake of these methods is needed, including funding to do this for property owners and the relevant authorities to promote these outcomes.

- **Communities need different levels of support to plan for flooding.** Multiple approaches to reduce flood risk are needed to support the community, particularly where frequent flooding occurs. Each approach brings trade-offs, so support and actions need to be considered at individual level to ensure it works for each individual or community. Support may include information, grants or moral support to bring in or instigate flood resilience measures. A three-step approach is often used. Firstly, ensure those impacted are aware and prepare for a potential flood. Secondly, that if flooding is predicted, ensure that individuals can act. Thirdly, when a flood event does occur, ensure movement away from the area. These approaches need to be targeted towards sector-specific groups, such as schools, hospitals and care homes, most especially as their vulnerability means proactive actions are needed, rather than reactive. Experience found this was often stronger in rural area, as there was a greater sense of community and less turnover of residents, that led to greater learning and support. Preparation is key: Surface flooding remains unpredictable, so frequent reminders are needed about what to do.
- **We need to be increasing proactive with dealing with surface water flooding, despite the uncertainty that comes with it.** Developing and testing new science to forecast surface water flooding in high resolution will take time. Given the urgency of the risk, there is a need to learn to live with uncertainty and focus on immediate actions to reduce impacts when flooding does occur. This could be warning motorists about low-lying areas flood-prone areas or advice not to travel or installing passive property flood resilience measures which are in place even before a forecast or warning occurs. Other unknowns include access to resources (e.g. input data to models, staff time), decision making (e.g. when triggers instigate action) or communication methods (e.g. when or what language to use). Being comfortable making decisions given the inherent uncertainty is critical to learning. Striking a careful balance between action to reduce risk and complacency to avoid thinking 'it will never happen to me' remains a significant challenge.

This enjoyable and thought-provoking session reminded the audience of the significant challenges in forecasting and acting on surface water flooding. We cannot avoid flooding but need to be increasingly innovative and interactive in reducing risk and encouraging the uptake of resilience measures.