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Moving towards a fully probabilistic, end-to-end, impact-based, flood forecasting and warning system

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Set up in 2009, the UK Flood Forecasting Centre (FFC), is a successful partnership between the Environment Agency and the Met Office to provide national, operational, flood risk guidance. At the same time, we have a development programme to continuously improve flood forecasting. Operational for over a decade, the FFC has a strong portfolio and reputation amongst its users and customers. For example, the 2019 Responder Survey reported that 94% of those who have had contact with the FFC within the last 12 months are satisfied with the services provided.

High impact, low probability events have been a feature of the first 10 years of the Flood Forecasting Centre. Probabilistic forecasting and risk-based approaches provide approaches to identify, forecast and warn for such events. Indeed, whilst these are currently successfully employed by various National Meteorological Hydrological Centres, there is also recognition (for example, World Meteorological Organisation) that effective forecasting and warning systems should be:

- **'impact-based'**;
- driven by ensembles or realistic scenarios through an **'end-to-end'** system (rather than precipitation ranges being simplified);
- more **objective**, so using new tools such as ensemble 'sub-setting', pattern recognition and machine learning to extract most value.

The Environment Agency is implementing a new Delft-FEWS forecasting system this year, termed Incident Management Forecasting System (IMFS). This will introduce a step change in capability for probabilistic impact-based forecasting. Initially, rainfall and coastal scenarios (termed 'best-estimate' and 'reasonable worst case') will be used to drive end-to-end forecasting, which includes for example impact data bases for property, infrastructure and communities. This is very much a stepping stone in the technical (systems) and adaptive (people, culture) transformation to a **fully probabilistic, end-to-end, impact-based, flood forecasting**.

I will share some of our recent approaches to:

- objective, ensemble based, forecasting, including the Natural Hazards Partnership surface

water hazard impact model (driven by the Met Office MOGREPS precipitation ensembles) which goes live this year;

- scenario generation and ensemble sub-setting to provide input to end-to-end, impact-based forecasting (IMFS);
- next steps in moving to a fully probabilistic, end-to-end, impact-based, flood forecasting and warning system

I will also highlight some of our current challenges that we would love to work with others to solve.

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