EGU2020-20391
https://doi.org/10.5194/egusphere-egu2020-20391
EGU General Assembly 2020

Reviewing operational and near operational progress in surface water flood forecasting for urban areas

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Surface water flooding is caused by intense rainfall before it enters rivers or drainage systems. As the climate changes and urban populations grow, the number of people around the world at risk of surface water flooding increases. Although it may not be possible to prevent such flooding, reliable and timely flood forecasts can help improve preparedness and recovery. Unlike river and coastal flooding where flood forecasting methods are well established, surface water forecasting techniques that address the challenges around predicting the location, timing and impact of events are still in their infancy.

Over the past five years there has been a rapid development of convection permitting numerical weather prediction models and probabilistic forecasting. Combined with an increase in computational ability, this has meant that it is potentially feasible to develop operational surface water forecasting systems for urban areas. The ability to make flood risk management decisions based on such forecasts depends on an interdisciplinary understanding of their strengths and limitations.

In 2019, the Scottish Environment Protection Agency (SEPA) commissioned a systematic review of UK and international surface water forecasting capabilities to inform the development of forecasting capabilities for Scotland (Speight et al, 2019). As part of the review process a literature review of international examples of operational surface water forecasting tools was conducted alongside discussion with a number of industry experts and leading academics to incorporate emerging capabilities.

This PICO will summarise the three approaches to surface water forecasting identified as part of this review; empirical based rainfall scenarios, hydrological forecasts linked to pre-simulated impact scenarios, and, real time hydrodynamic simulation. International examples of each type of approach will be presented along with discussion of their ability to meet the varying needs of decision makers. It will conclude by identifying 'grand interdisciplinary challenges' that still need to be addressed to provide effective solutions for reliable and timely surface water forecasts. For example although the emergence of new meteorological and hydrological capabilities is promising

there is a scientific limit to the predictability of convective rainfall. To overcome this challenge re-thinking of the established role of flood forecasting is needed alongside developing interdisciplinary solutions for communicating uncertainty, making the best use of all available data and increasing preparedness.

Speight, L., Cranston, M., Kelly, L. and White, C.J. (2019) Towards improved surface water flood forecasts for Scotland: A review of UK and international operational and emerging capabilities for the Scottish Environment Protection Agency. University of Strathclyde, Glasgow, pp 1-63, doi:10.17868/69416 Available online at https://strathprints.strath.ac.uk/69416/