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Flood forecasting for ungauged locations: what approach is best?

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One of the most important and difficult challenges of hydrological science concerns modelling the river response to storm rainfall at ungauged locations for the purposes of flood forecasting. The choice of approach to pursue can vary from simple empirical transfer methods, through techniques using lumped model simplification combined with parameter association with catchment characteristics, to ones based on distributed physically-conceptual formulations specified through measurable spatial properties rather than catchment-integrated characteristics and parameters. Whilst the latter distributed approach is the more scientifically appealing, it is not straightforward to implement due to the complex nature of hydrological response, the question of how best to identify and represent the dominating processes, and the difficulty of using property measurements at the appropriate model scale. The presentation will critically review examples of the different approaches to flood forecasting at ungauged locations. It will then report on recent developments in pursuing the physical-conceptual modelling approach, developing formulations of only moderate complexity that have real operational value for flood warning. One form of the model links lateral soil water conveyance to terrain and soil properties and represents hillslope-channel interactions as a 'return flow' from groundwater to surface water flow paths. The grid-based area-wide model formulation can be used for flood forecasting across a region of interest containing gauged and ungauged locations requiring warning of impending flooding. Future challenges for this type of modelling approach will be discussed in an operational flood watch and warning context.