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Using alternative data sources to reduce the uncertainty in modelling floodplain flows

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In flood modelling for flood forecasting and flood management, one of the most significant uncertainties in model simulations is the ability and accuracy of the models to represent the interaction or coupling between the river and floodplain flow including processes of overbank (spilling) flow and the flow of water along the floodplain. Accurate representation of these processes is critical both in assessing the extent, severity and expected flood damage of flooding and in making flood forecasting decisions for flood warning, implementing evacuation measures and the deployment of temporary flood protection measures. Traditionally, however, observation data is limited to flows or water levels within the river channels and few, if any, observations of either overbank flows or inundation flows and levels are available in the floodplain areas at risk. Furthermore hydrological analyses show the flood risk in these areas is highly sensitive to groundwater levels and antecedent moisture conditions and therefore validation against other data was required.

This paper addresses these uncertainties in two parts. Firstly the development and evaluation of a new integrated flood modellng tool is presented that has been developed to address the requirements of floodplain managers and the Floods Directive, based on the comprehensive process-based hydrological model, MIKE SHE. Within the MIKE SHE framework, a coupled 1-D and 2-D hydraulic modelling capability has been developed to represent the spilling process and floodplain flows. This new tool is evaluated for a case study in South Boulder Creek, USA using high resolution topographical data and archived maps and aerial photographs for model validation. Sensitivity analyses are presented to evaluate the impact of scale on the model predictions and uncertainty. This tool can address new problems such as groundwater generated flooding, dynamic surface water-ground water interactions, and evaluating infiltration and evaporation effects on flood hazard mapping. Results from a case study in the Koondrook Perricoota Forest, Australia illustrate the impact of the infiltration and evaporation processes on flooding in this forest ecosystem.