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Whole system modelling and hydroinformatics

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Abstract The increasing trend towards the coupling of complex model systems in a cascade is a particular feature of future "Whole System Modelling" approaches. Major advances in numerical weather prediction (NWP) have made it possible to provide rainfall forecasts, along with many other meteorological data fields at high spatial and temporal resolutions. The incorporation of high-resolution mesoscale model output directly into real-time flood forecasting systems provides extended lead-times and also allows the development of a "Whole Systems Approach" to the treatment of uncertainty. The uncertainties inherent in the NWP can be propagated into hydrological and hydraulic domains, and may be magnified by the scaling process. As ensemble weather forecasts become operationally available, it is of particular interest to note the potential and implications of ensemble inputs to real-time hydroinformatic modelling systems in terms of uncertainty propagation. This paper discusses the use of ensemble forecasts from a short-range high-resolution mesoscale weather model (MM5). The results derive from a series of applications using a fully distributed rainfall–runoff model (GBDM) and include a special study of extreme flooding in the Thames Estuary due to a North Sea storm surge. The concluding comments indicate the importance attached to emerging techniques for uncertainty handling in complex model cascades and acknowledge the ongoing HEPEX (Hydrological Ensemble Prediction Experiment) initiative.

Key words uncertainty; hydroinformatics; whole system modelling; numerical weather prediction