



1 Data assimilation and adaptive real-time forecasting of water levels in the river Eden catchment, UK.

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This paper introduces a real time flood forecasting algorithm incorporating data assimilation as a means of extending warning lead times, while maintaining accurate real time level forecasts and providing an indication of forecast uncertainty. Research carried out by the authors at the Severn catchment site around Shrewsbury (Shropshire, UK) demonstrated that non-linear dynamic transfer function models can be identified from observational data to capture the dynamic relationship between observed rainfall data and river level at key gauging sites along the river. Following the initial model identification and parameter estimation process, the resulting model structure is highly parsimonious and is ideally suited to real time data assimilation and forecasting through a Kalman filter-type mechanism. The complete algorithm is compact, computationally efficient and reliable and easily interfaces with the Environment Agency's Nation Flood Forecasting System. It also provides a means to attach and update confidence intervals to the forecast. The paper applies the model identification and estimation process and real time data assimilation mechanism to a new data set for the Eden catchment. Importantly, the data includes the 2005 Carlisle flood event. Additional complexities unique to the Eden catchment and events of the scale encountered in 2005 are addressed.