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Initialisation and data assimilation of a distributed flood forecasting model

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Distributed models are increasingly being considered for flood forecasting, especially where flood warning is needed for areas with no local river gauging. They offer an area-wide forecasting approach naturally suited to encompass ungauged locations. Simple physical-conceptual distributed model formulations offer the prospect of linking spatial datasets on terrain, land-cover and soil/geology directly to model 'properties', leaving only a few regional parameters to calibrate using gauged flows. The real-time application of such models brings two important and related research challenges. The first is how best to initialise the distributed model states using observations at gauged locations in the model domain so as to avoid a long spin-up period. Such initialisation will be needed when first installing the model within a forecast system, and also in the event of a system or telemetry failure that precludes effective recovery from a previous set of stored model states. The second, and closely related, research challenge is that of data assimilation. Here, the aim is to increase forecast accuracy by updating in real-time the model states using available flow observations in the model domain up to the time the forecast is made. Preliminary work is reported on developing initialisation and assimilation schemes for an area-wide distributed model, the Grid-to-Grid model. The results demonstrate the effective spatial transfer of information from a gauged site used for model initialisation to other locations within the model domain. Sequential data assimilation is shown to be more effective than a simple model re-initialisation at each time-origin. Forecast accuracy across a range of lead-times, relative to model simulations, is significantly increased for chosen locations treated as ungauged. The data assimilation scheme employs empirical state-correction as a

simple, pragmatic alternative to more complex procedures based on the Kalman filter.