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Short period forecasting of catchment-scale precipitation. Part I: the role of Numerical Weather Prediction

M. A. Pedder, M. Haile, and A. J. Thorpe
Department of Meteorology, University of Reading, Reading RG6 6BB, UK
e-mail for corresponding author: m.a.pedder@reading.ac.uk

Abstract. A deterministic forecast of surface precipitation involves solving a time-dependent moisture balance equation satisfying conservation of total water substance. A realistic solution needs to take into account feedback between atmospheric dynamics and the diabatic sources of heat energy associated with phase changes, as well as complex microphysical processes controlling the conversion between cloud water (or ice) and precipitation. Such processes are taken into account either explicitly or via physical parameterisation schemes in many operational numerical weather prediction models; these can therefore generate precipitation forecasts which are fully consistent with the predicted evolution of the atmospheric state as measured by observations of temperature, wind, pressure and humidity.

This paper reviews briefly the atmospheric moisture balance equation and how it may be solved in practice. Solutions are obtained using the Meteorological Office Mesoscale version of its operational Unified Numerical Weather Prediction (NWP) model; they verify predicted precipitation rates against catchment-scale values based on observations collected during an Intensive Observation Period (IOP) of HYREX. Results highlight some limitations of an operational NWP forecast in providing adequate time and space resolution, and its sensitivity to initial conditions. The large-scale model forecast can, nevertheless, provide important information about the moist dynamical environment which could be incorporated usefully into a higher resolution, 'storm-resolving' prediction scheme.

Keywords: Precipitation forecasting; moisture budget; numerical weather prediction

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