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Comparative Study of Meso-Scale Numerical Weather Models for Water System Analysis

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Water system analysis typically needs reliable hydrometeorological data such as rainfall, wind, temperature, solar radiation, humidity, atmospheric pressure etc. for hydrological or hydraulics modelling. The requirements for those data also often include spatial and temporal changes as well as accurate quantification. As a consequence, many in the water engineering community have begun to make use of meso-scale numerical weather prediction (NWP) models as a means of producing high-resolution meteorological variables for their water system analyses. The availability of community models such as the Weather Research and Forecasting (WRF) model has opened the door to non-meteorologists who wish to run NWP for their own scientific purposes. In the UK the Met Office's Unified Model (UM) is the operational model used for all official weather forecasting. Moreover the UM forecast rainfall prediction is instrumental for the UK Environment Agency's Flood Forecasting Centre. To date, research conducted by the water engineering community using anything else but the UM cannot be made operational since community models such as WRF have not been tested extensively for the UK weather conditions. However the UM is not portable and it is usually necessary to run the model through a third party host, adding a layer of complexity which does not exist with models such as WRF.

A comparative study between the community model WRF and the Unified model (UM) has been carried out on selected high precipitation events for the purpose of estimating weather phenomenon important to hydrology, i.e. precipitation, wind velocity and direction, pressure, temperature, humidity. The similarities and deviations between these two models are analysed. The results are useful for water engineers who are interested in using either the WRF or UM in their practical modelling projects. In addition, for those weather variables with similar results between WRF and UM, research from the WRF community could be more readily deployed into the UM, and vice versa.

Keywords: Weather Research and Forecasting (WRF) model, numerical rainfall forecasting, Unified Model (UM), Water System Analysis