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An hourly cycling convection permitting forecast system using 4D-Var and the Met Office Unified Model

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The Met Office has developed a high resolution (1.5km) NWP system covering southern England and Wales for nowcasting (NDP) using the Unified Model and hourly cycling 4D-Var data assimilation. The system produced 6 or 12 hour forecasts every hour. The system uses latent heat nudging of radar derived rain rates provided every 15mins, direct assimilation in VAR of an hourly 3D cloud cover analysis and high time frequency subhourly radar Doppler winds (6 per hour), wind profiler and MSG SEVIRI upper tropospheric water vapour channels every 15mins as well as hourly surface synoptic reports and AMDAR reports. Eumetsat Satellite winds (AMVs) are used but they are very coarse horizontally and temporally eg at T-30mins only.

Boundary condition updates were provided every 30mins from 1.5km resolution 6hourly forecasts from a 3hourly cycling 3-km 3D-VAR for the UK region, UKV model. The NDP uses a 4D-Var data assimilation system with 1/2 UM resolution (i.e. 3km), hourly assimilation windows with 10 minute LS states, and 100 second timestep. The PF model and its adjoint have dimensions of 180 x 144 x 70. Observations are extracted in the observation time window T-30 mins to T+30 mins. The 1.5km UM (360 x 288 x 70) uses 50 sec time-stepping on 6 nodes in 12 x16 decomposition. 4D-Var increments are added to UM at the initial forecast time T-30 mins (at first UM time step). A 45 minute data cutoff was used and forecasts were available within 1 hour of nominal analysis time ie taking 15mins for observation processing, data assimilation and forecast.

This paper will describe experiences from running the system in real time from March 2012 to spring 2013, the development of the background errors, inclusion of new observation types and investigation of forecast skill.