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MMM SEMINAR *NCAR*

The Use of Radar Data in the Met Office Convection-Permitting NWP based Nowcasting System

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The Met Office developed a convection-permitting NWP based nowcasting system covering southern England and Wales as a demonstration system for the London Olympics. The system uses a 1.5 km resolution version of the Met Office Unified Model with hourly-cycling 4D-Var data assimilation. The system uses latent heat nudging of radar derived rain rates provided every 15 minutes, direct assimilation in VAR of an hourly 3D cloud cover analysis and high time frequency sub-hourly radar Doppler winds (6 per hour), wind profiler and MSG SEVIRI upper tropospheric water vapour channels every 15 minutes as well as hourly surface synoptic reports, AMDAR reports and EUMETSAT Satellite winds (AMVs). The system produces 6 or 12 hour forecasts every hour.

Boundary condition updates were provided from 1.5 km resolution 6 hourly forecasts from a 3 hourly cycling 3 km 3D-Var for the UK region, UKV model. Observations are extracted in the observation time window T-30 minutes to T+30 minutes. A 45 minute data cut-off was used and forecasts were available within 1 hour of nominal analysis time, which allowed 15 minutes for the observation processing, data assimilation and forecast. Summer 2012 was an excellent time to assess the skill of the system for flash flood prediction due to the extreme weather over the UK during that period, especially from June to August 2012. Results will be shown comparing the NDP with observations and the current UKPP/STEPS blended extrapolation/NWP nowcasts and the 6 hourly UK NWP forecasts. Overall the skill of the NDP precipitation forecasts exceeded that of the longer-range UKV forecasts at all forecast periods and the current UKPP from about T+2 hours onwards. There were a number of cases where the NDP correctly developed lines of thunderstorms missed by the UKV and UKPP.

The nowcasting system is being developed to assimilate radar reflectivity data directly in the Met Office incremental 4D-Var system, which should allow improved forecasts with respect to the current system by utilising information from the reflectivity volume scans together with all other observations in a consistent way. A radar reflectivity operator, and its linearization and adjoint, has been designed. An observation monitoring and quality control system is being developed, and the linear and adjoint physics of the perturbation forecast model have been enhanced to include 3D rainrate increments. Linearization tests have been used to determine appropriate conversion rates of ice and liquid water cloud increments to rainrate increments for the nowcasting system.

The Met Office C-band weather radar network is currently being upgraded. All radars are now Doppler capable, and when the project is completed, all radars will have dual-polarization capability. The extra polarimetric information will support great improvements in data quality, and allow the development of an improved observation operator.

The Met Office is collaborating closely with the University of Reading on techniques which will improve the quality of radar reflectivity observations and their use in the data assimilation system. In heavy rain cases, which are the most critical for the nowcasting application, attenuation of the radar beam by hydrometeors can lead to severe underestimation of precipitation rates. A method to constrain the attenuation correction has been developed at the University of Reading and the Met Office is collaborating with University of Reading partners to implement the technique.

Friday, 27 September 2013, 10:30 AM
Refreshments 10:15 AM
NCAR-Foothills Laboratory
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