Pre-Operational trials of the new Met Office Mesoscale NWP Model

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In spring 2002 the Met Office will update the formulation of the Unified Model which is used for mesoscale NWP. The formulation changes include both a new dynamical core for the model (Cullen *et al* (1997), (see also article by Davies et al in this issue)) and a some changes to the parametrizations package. The global model will also be changed to use the new dynamical core and updated parametrizations (see article by Milton et al in this issue) which will reunify the physics used in the operational global and mesoscale versions .

The new dynamics is a semi-implicit, semi-Lagrangian formulation and is non-hydrostatic . Height is the vertical coordinate and the horizontal and vertical grid staggering are different. In the vertical a Charney-Phillips grid staggering is used i.e. potential temperature and vertical velocity are now on the same half levels whereas everything else is held on the full levels. An Awakawa C grid staggering is utilised in the horizontal.

The changes to the physical parametrzations include: modifications to convection to a CAPE based closure and momentum transport; use of the gravity wave drag scheme with a flow blocking scheme. This is the first time that gravity wave drag has been included in the mesoscale model, and was found to have a small but beneficial impact on wind forecasts.

A series of trials have been carried out to compare the performance of the new model (NM) to that of the current operational mesoscale NWP model (OP). The current assimilation of satellite derived cloud and radar rainfall estimates though latent heat nudging are also included. A real time parallel trial has shown that, in general, the impact on forecasts has been small and neutral. The screen temperature and humidity have been significantly improved with a lessening of the cold and overmoist biases (Figure 1). The underforecasting of the 10m wind strength over the UK is also reduced .

During an anticyclonic period when there were several occasions of fog and low visibility the new model forecast visibility better. There was a tendency at the lowest threshold for increased bias but the false alarm rate was less affected than the hit rate so that the overall skil , as measured by the equitable threat score was substantially improved (Figure 2).

The implementation of the new dynamics with its non-hydrostatic capability will , in future, allow substantial improvements to both horizontal and vertical resolution to forecast weather and clouds better.

References

Cullen, M. J. P., T. Davies, M. H. Mawson, J. A. James, S. C. Coulter, and A. Malcolm, 1997: An overview of numerical methods for the next generation UK NWP and climate model. *Numerical Methods in Atmospheric and Ocean Modelling*, Lin, C. A., R. Laprise, and H. Ritchie, Eds., volume The Andre J. Robert Memorial Volume, 425–444.

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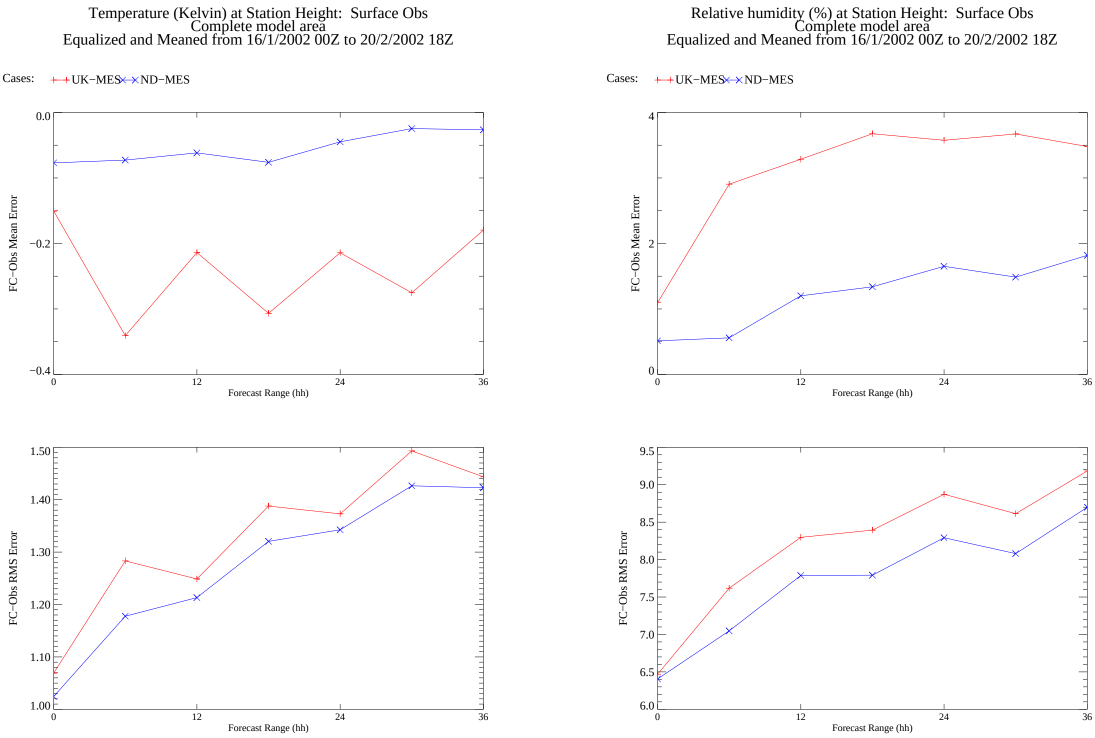

Figure 1: Screen temperature and humidity verification for NM (x) and OP(+); biases (top) and rms errors (bottom)

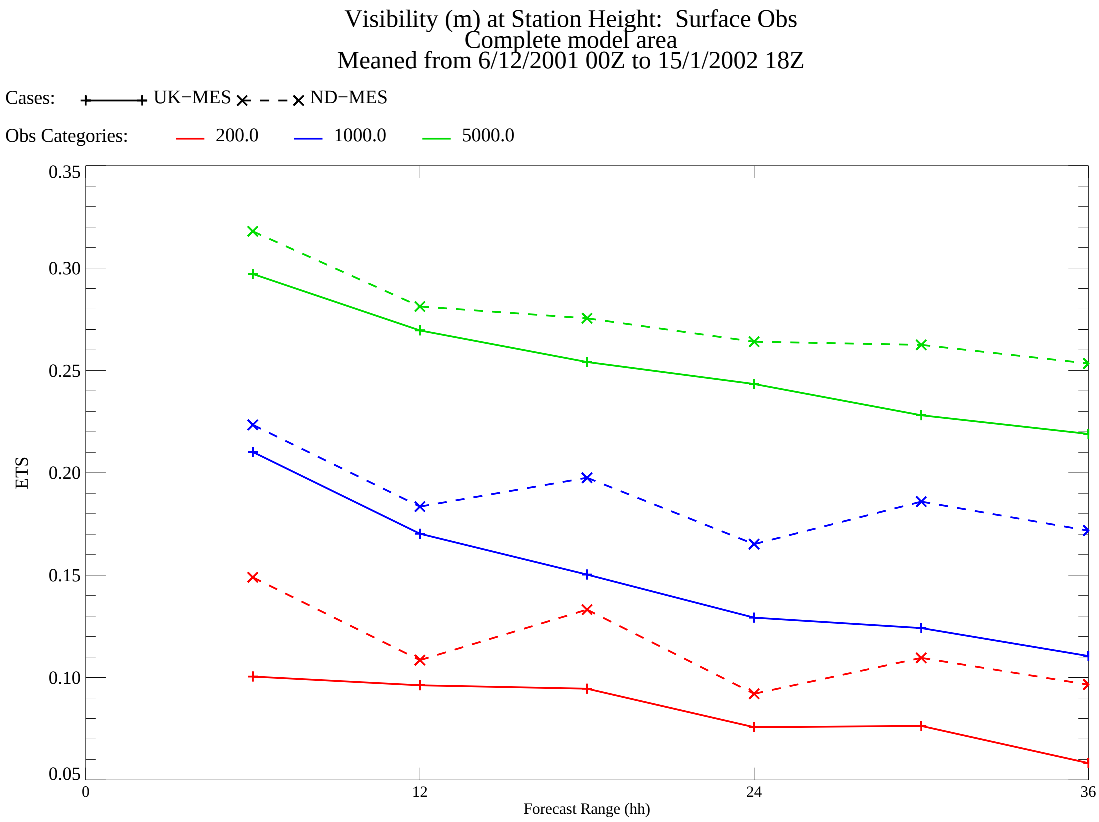

Figure 2: Equitable threat scores for visibility at 5km, 1km and 200m thresholds for NM (dashed) and OP (full)