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The representation of convection in high resolution (km-scale) NWP models.

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The Met Office UKV model has been running routinely since 2009. It is the operational variable resolution version of the Unified Model (UM) and contains an interior fixed resolution region of gridlength 1.5km. In this model, convection is represented explicitly. In nearly all situations the model shows a large improvement in the representation of showers compared to models where the convection is primarily parameterised. However it is clear that there are also deficiencies in this representation, mainly that the convective cells tend to be too large and intense and convective initiation is delayed.

Decreasing the model gridlength may improve the model's representation of the showers but computer power puts constraints on the resolution, both horizontal and vertical, used in operational models. A study of convection in models with horizontal gridlengths as small as 100m may inform decisions on the improvement of convection in km-scale models as well as providing an understanding of the trends of model behaviour with gridlength and an assessment of the capability of future high resolution forecast systems.

Investigations into how well convection is represented in models with gridlengths of a kilometre and below are carried out using a suite of nested UM models centred over the Chilbolton Advanced Meteorological Radar in southern England. The models have gridlengths of 1.5km, 500m, 200m and 100m with each model downscaling the next larger one. A statistical assessment is carried out using data gathered on 40 days during the DYMECS (Dynamical and Microphysical Evolution of Convective Storms) project, a collaborative project between The University of Reading and the Met Office. Comparisons are also made with NIMROD radar data.

Diagnostics including trends in size, number and strength of convective cells, turbulent fluxes and spectra of vertical velocity as the resolution increases are studied to understand the behaviour of the models at different resolutions.