Evaluating convective storm characteristics against radar observations around the world

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Abstract:

Regional convection-permitting simulations have supported operational forecasting for more than a decade now. Forecasts based on global simulations at convection-permitting resolutions are within reach and such simulations are already being used for research. When observations are readily available and forecasts are run routinely, model evaluation no longer needs to rely on case studies, and long-term statistical comparisons can be made instead. In the DYMECS project, in southern England, convective storms were tracked with the Chilbolton radar in real-time for 40 days of convective weather in 2011 and 2012. The radar observations were used to evaluate storm 3D morphology, life cycles, and updraft strength and size in the Met Office Unified Model at various convection-permitting resolutions. We found that, for this model, a 200-m grid length was best at physically representing convective storms, while at 100-m the storms became too narrow. Here, we will focus on subsequent analysis of features of turbulence observed within these storms, and how turbulence is represented in the 100-m and 200-m grid-length models.

We will also consider the importance of performing model evaluation in other regions of the world. A model evaluation against radar observations in South Africa shows that performance improves when the sub-grid mixing length is increased, contrary to results from the UK. Comparing model performance over the US and the UK in terms of lightning frequency indicates a critical dependence on the presence of graupel. If future operational forecasting is to rely on global convection-permitting simulations, its challenge will be to develop a single model configuration that performs well (and that can be evaluated) across the globe.