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Diabatic potential vorticity sources in numerically simulated North Atlantic cyclones: Sensitivity to model configuration and impacts on storm evolution

Jeffrey Chagnon, Suzanne Gray, and John Methven
University of Reading, Meteorology, Reading, United Kingdom (j.chagnon@reading.ac.uk)

Representation of diabatic process and their impact on evolving extratropical cyclones is a possible source of skill degradation in operational numerical weather prediction systems. For example, global model forecasts exhibit a tendency to simulate troughs that are insufficiently sharp along their downstream side — a bias which may be due to underestimation of negative potential vorticity anomalies (PV) at tropopause level at the end of warm conveyor belts. This investigation examines the source, structure, and magnitude of diabatic potential vorticity (PV) anomalies generated by small-scale and parameterized processes in mesoscale and global model simulations of developing midlatitude cyclones in the North Atlantic. Simulations of several storms that occurred during the autumn months of 2008 and 2009 were performed using the Met Office Unified Model (MetUM). Total PV sources and sinks were partitioned among the contributions from the various segments of the model including the boundary layer scheme, cloud microphysics, diffusion, the convection scheme , radiation, and others. Preliminary results demonstrate that the diabatic PV generated by the model's convection scheme is of smaller magnitude in global model simulations than in limited-area simulations at higher resolution. Ongoing analysis includes the evaluation of model simulations against data collected from a pilot observational campaign conducted from the UK during November 2009.