Evaluation of the Global MPAS for Nonhydrostatic Supercell Simulations

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An important capability of nonhydrostatic global models is the ability to explicitly treat moist convective processes for applications in which the grid resolution approaches cloud-resolving scales. To evaluate the viability of the Model for Prediction Across Scales (MPAS) to explicitly represent moist convection, we have conducted idealized simulations of the evolution of an isolated supercell storm in one-directional shear, following the experimental design outlined by Weisman and Klemp (MWR, 1982). To resolve moist convective processes at reasonable computational expense, we simulate this case on a reduced-radius sphere. With the unstructured Voronoi (nominally hexagonal) global mesh in MPAS, we can also reconfigure this mesh to produce a domain that corresponds to a doubly periodic flat plane. Through comparisons with the flat-plane simulations, we can ensure that our configuration on the reduced-radius sphere minimizes any artificial spherical influences. By incorporating highly simplified model physics (Kessler microphysics, constant viscosity) these supercell simulations can be converged at high resolution to provide a reliable reference solution. This test case documents that the MPAS supercell simulations are fully comparable to the accuracy of the well-tested WRF-ARW Model, which was designed specifically for meso/cloud scale applications. We believe this may provide a good test case for broader evaluation and intercomparison of nonhydrostatic global models.