10.4 Vertical resolution, energetics and dissipation in high-resolution atmospheric simulations.

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We have performed week-long full-physics simulations with the MPAS global model at 15 km and 15-3 km cell spacing using MPAS with vertical mesh spacings of 800, 400, 200 and 100 meters in the mid-troposphere through the mid-stratosphere. We find that the horizontal kinetic energy spectra in the upper troposphere and stratosphere does not converge with increasing vertical resolution until we reach 200 meter level spacing. Examination of the solutions indicates that significant inertia-gravity waves are not vertically resolved at the lower vertical resolutions. Diagnostics from the simulations indicate that the primary kinetic energy dissipation results from the vertical mixing within the PBL parameterization and from the gravity-wave drag parameterization, with smaller but significant contributions from damping in the vertical transport scheme and from the horizontal filters in the dynamical core. Most of the kinetic energy dissipation in the free atmosphere occurs within breaking mid-latitude baroclinic waves. We will briefly review these results and their implications for atmospheric model configuration and for atmospheric dynamics, specifically that related to the dynamics associated with the mesoscale kinetic energy spectrum.