



Efficient Computation of Atmospheric Flows with Tempest: Validation of Next-Generation Climate and Weather Prediction Algorithms at Non-Hydrostatic Scales

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Tempest is a next-generation global climate and weather simulation platform designed to allow experimentation with numerical methods for a wide range of spatial resolutions. The atmospheric fluid equations are discretized by continuous / discontinuous finite elements in the horizontal and by a staggered nodal finite element method (SNFEM) in the vertical, coupled with implicit/explicit time integration. At horizontal resolutions below 10km, many important questions remain on optimal techniques for solving the fluid equations. We present results from a suite of idealized test cases to validate the performance of the SNFEM applied in the vertical with an emphasis on flow features and dynamic behavior. Internal gravity wave, mountain wave, convective bubble, and Cartesian baroclinic instability tests will be shown at various vertical orders of accuracy and compared with known results.