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Testing the Anelastic Nonhydrostatic Model EULAG as a Prospective Dynamical Core of a Numerical Weather Prediction Model Part I: Dry Benchmarks

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Abstract

In this paper, a feasibility of anelastic approach for numerical weather prediction (NWP) is examined. The study concerns the anelastic nonhydrostatic model EULAG as a prospective candidate for the new dynamical core of a high-resolution NWP model. Such an application requires a series of benchmark tests to be performed. The study presents the results of dry idealized two-dimensional linear and non-linear tests. They include evolution of cold and warm density currents in neutrally stratified atmosphere, inertia-gravity waves in short and long channels, as well as mountain gravity waves for a set of different flow regimes. Detailed comparison of the results with the reference solutions, based mainly on the results of compressible models, indicates a high level of conformity for all of the experiments. It verifies the anelastic approach as strongly consistent with the compressible one for a broad class of atmospheric problems. It also corroborates the robustness of EULAG numerics, an essential requirement of dynamical core of NWP model.

Key words: density currents, mountain waves, inertia-gravity waves, dynamical core, anelastic equations.