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Upstream effects of the atmospheric flow over a mountain ridge as represented by the anelastic nonhydrostatic model EULAG

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In this study we examine an anelastic approach to atmospheric blocking as represented by the nonhydrostatic model EULAG. We address this issue since EULAG is considered as a prospective candidate for the dynamical core of a numerical weather prediction (NWP) model, and the problem is suitable for testing a performance of the model. The study extends the classical analysis of the problem from Boussinesq to anelastic and pseudo-compressible sets of equations.
A set of experiments includes linear and strongly non-linear regimes of the flow, depending on the Froude number, with and without Coriolis force. The problem is analyzed in both two and three dimensions. According to the results, the solution does not significantly depend on the density profile, and the sound-proof models correctly reconstruct all characteristic features of the flow, such as columnar modes and upstream blocking, both in good agreement with reference Boussinesq models. Coriolis force and the size of the obstacle perpendicular to the flow direction are the key factors controlling the process.