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TRAM: A New Nonhydrostatic Fully Compressible Numerical Model

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A new model (TRAM, at present just dynamical core) has been built using a nonhydrostatic and fully compressible version of the Navier-Stokes equations. Advection terms are solved using a Reconstruct-Evolve-Average (REA) strategy over the computational cells. These cells consist of equilateral triangles in the horizontal. The classical z-coordinate is used in the vertical, allowing arbitrary stretching (e.g. higher resolution in the PBL). Proper treatment of terrain slopes in the bottom boundary conditions allows for representing accurately the orographic forcing. To gain computational efficiency, time-splitting is used to integrate separately fast and slow terms and acoustic modes in the vertical are solved implicitly. For real cases on the globe the Lambert map projection is applied and all Coriolis and curvature terms are retained. No explicit filters are needed.

A variety of benchmark tests in 2D and 3D shows that TRAM model is suitable to simulate processes ranging from small-scale thermal bubbles ($\approx$ 100 m scale) to synoptic-scale baroclinic cyclones (> 1000 km size), including orographic circulations. It will be shown that TRAM performs at least as well as state-of-the-art models. For the next future it is planned to complete the model with appropriate physical parameterizations and reexamine the real cases and consider additional tests (e.g. simulation of convective and precipitation systems). The final idea is to exploit the capabilities of the new tool in the academic and research arena, with particular focus on regional problems.