An analytical solution for gravity and sound wave expansion of the linearized compressible, non-hydrostatic Euler equations on the sphere.

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An analytical solution for the expansion of gravity and sound waves for the linearised form of the fully compressible, non-hydrostatic, shallow atmosphere Euler equations on the sphere is derived. The waves are generated by a weak initial temperature and density perturbation of an isothermal atmosphere, which is a slightly modified initial perturbation compared to Skamarock, Klemp (1994). The derived analytical solution can be used as a benchmark to assess dynamical cores of global numerical models which are based on the above mentioned (in general non-linear) equation system. Three different test configurations with or without Coriolis force (in a 'spherical f-plane-approximation') or additional advection are discussed.
Convergence studies for 'small earth' simulations of the newly developed global model ICON of the Deutscher Wetterdienst (DWD) and the Max-Planck Institut of Meteorology (MPI) against this solution will be shown.