Density-driven convection between horizontal planes in a conditionally unstable fluid

J. E. H. Weber (1) and G. Broström (2)

(1) Department of Geosciences, University of Oslo, Oslo, Norway, (2) Norwegian Meteorological Institute, Oslo, Norway

Nonlinear density-driven convection in a conditionally unstable fluid is studied theoretically. The novelty here is that the destabilizing basic density gradient is expressed in terms of the vertical perturbation velocity through a unit step function. This is done by introducing a one-way source step function due to phase transitions in the equation for the perturbation density. Then we can model the fact that the density-gradient is unstable when the perturbation vertical velocity is upward (positive), and stable when the vertical perturbation velocity is downward (negative), characterizing conditional stability. Linear analytical solutions as well as numerical results for nonlinear two-dimensional steady convection are presented.