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Spontaneous imbalance in rotating stratified turbulence

While it is well-established that the frequency disparity between vortical and wave motion is key to understanding the quasi-geostrophic limit, i.e. strong rotation and stratification, the starting point for this work is that it has recently been established that there is no such frequency disparity in stratified turbulence without rotation. It remains to ask what happens in between these two limits, long held as the prevailing dynamics between deformation-scale eddies and the microscale where isotropy is recovered. To do this, ideas from numerical weather prediction were borrowed in order to explore numerically the nonhydrostatic Boussinesq equations starting from initial conditions that are close to our current fuzzy notions of balance for a variety of Rossby and Froude numbers. It is found that evolution is spontaneously away from this balance in the small scales, and from steep to much more shallow spectra. It will be argued these results are robust to uncertainties in the definition of balance and are similar to observations of both atmosphere and ocean. This is joint work with Hossein Amini Kafiabad.