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Dynamics of overshooting convection in a rotating spherical shell

LYDIA KORRE, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, NICHOLAS A. FEATHERSTONE, Department of Applied Mathematics, University of Colorado Boulder — Overshooting convection is a physical process by which turbulent convective motions generated in a convectively unstable region can propagate into a stably stratified zone that lies either on top or on bottom of the convective one. This process can lead to mixing of chemical species, thermal mixing, as well as contribute to the transport of magnetic fields and angular momentum. Thus, convective overshooting has direct and significant implications in stellar dynamics. Motivated by the Sun, we investigate these dynamics via numerical simulations that solve the anelastic Navier-Stokes equations in a spherical shell containing a convection zone with an underlying stable region. We present results of our runs which span a range of parameters and illustrate the dependence of convective overshooting on the intensity of the turbulence and degree of stratification of the convective region, the relative stability of the stable zone, the transition width between the two regions, as well as the rotation rate. These results can be particularly useful for gaining a better understanding of convective overshooting processes in stars and for improving existing models prescribed in 1D stellar evolution calculations.

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