AOGS 2005

Three-Dimensional, Transient Response of a Stably Stratified Atmosphere to Convective Heating

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The transient response of a stably stratified atmosphere to convective heating in three dimensions is theoretically investigated to explain some common dynamical aspects behind convectively forced mesoscale circulations. The airflow system considered is a three-dimensional, time-dependent, linearized, hydrostatic, nonrotating, inviscid, and Boussinesq system. Solutions for the equations governing small-amplitude perturbations in constant basic-state horizontal wind and buoyancy frequency with convective heating are analytically obtained using the Green function method. We will characterize stationary and transient modes forced by convective heating, which are convectively forced internal gravity waves, and connect our theoretical findings with some parts of mesoscale phenomena.

Keywords: stably stratified atmosphere, convective heating, internal gravity waves.