Geophysical Research Abstracts, Vol. 9, 11402, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11402

A multistage error growth conceptual model for moist atmospheric predictability

Fuqing Zhang (1) Naifang Bei (1) Rich Rotunno (2) Chris Snyder (2)
(1) Texas A&M University, (2) NCAR

Through cloud-resolving simulations of the life cycles of the idealized baroclinic waves typical of developing midlatitude cyclones with strong baroclinic and conditionally instability, we will present a multistage error-growth conceptual model of atmospheric predictability. In the initial stage, the errors grow from small-scale convective instability and then quickly saturate at the convective scales. In the second stage, the character of the errors changes from that of convective-scale unbalanced motions to one more closely related to large-scale balanced motions. That is, some of the error from convective scales is retained in the balanced motions, while the rest is radiated away in the form of gravity waves. In the final stage, the large-scale (balanced) components of the errors grow with the background baroclinic instability. Through examination of the error-energy budget, it is found that buoyancy production due mostly to moist convection is comparable to shear production (nonlinear velocity advection). It is found that turning off latent heating not only dramatically decreases buoyancy production, but also reduces shear production to less than 20% of its original amplitude. These new findings further demonstrate of the impacts of moist convection and diabatic heating on the limit of atmospheric predictability at all scales.