Geophysical Research Abstracts, Vol. 7, 03057, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03057

Moisture effects in baroclinic cyclones

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The growth rate of linear dry baroclinic modes scales as (mf/N) (where m is the vertical shear of the mean zonal wind, f the Coriolis parameter and N the static stability). In the presence of moisture, saturated motions are subject to a small "equivalent" static stability that accouts for the release of latent heat. As (1/N) becomes larger the growth rate of moist baroclinic waves is increased, but, beyond a certain value, smaller-scale (conditional convective and symmetric) instabilities arise which can disrupt the large-scale flow. Therefore the maximum effect of moisture on baroclinic waves must occur when the equivalent static stability is right at the marginal value for small-scale instabilities. Large-scale environments satisfying this condition, identified by zero equivalent potential vorticity (q_e=0), can be designed with a jet-like motion field which supports baroclinic waves. The characteristics of moist baroclinic lifecycles in such an environment are studied numerically and compared with the dry evolution.