Geophysical Research Abstracts, Vol. 7, 02195, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02195

Mesoscale responses to observed fine-scale latent heating structure

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Cloud resolving models (CRMs) typically require a factor of 10 higher resolution than the scale of the phenomena they are intended to describe because of the scale-dependent dissipation that is needed to keep such models stable. Observed latent heating structures within deep convection have common horizontal scales of a few km which would require < 1 km resolution in a CRM. Trade-offs between resolution and domain size are inevitable, but limit the range of scales of forcing and response that can be studied in such models. Hurricane models are an extreme example, where even with nesting, the finest resolution grid has not been capable of describing the small-scale latent heating structures observed. We examine the mesoscale wave responses to observed fine-scale latent heating structures input to a dry-CRM that are based on precipitation radar measurements. The conversion of precipitation radar reflectivity to latent heating is highly uncertain if computed solely from first principles, so we use an empirical approach comparing the modeled wave response to boundary layer radar observations taken at the same location and time, which tightly constrain the forcing magnitudes. Our model results suggest a strong dependence of the wave response on the background winds which affect both wave generation and vertical propagation via critical level filtering and trapping effects. The trapped waves are prominent in the lower troposphere and can trigger remote convective events. We investigate the directional effect of the wind on trapping using a linear wave reflection/transmission model. The results explain the directional anisotropy for high phase speed waves. The high phase speed waves have deep vertical structure that can potentially be observed via satellite. We will show examples of waves observed by AIRS, and discuss plans for using these techniques in January 2006 during the TWP-ICE campaign in Darwin, Australia.