Geophysical Research Abstracts,
Vol. 11, EGU2009-1653-1, 2009
EGU General Assembly 2009

A bimodal description of diabatic heating associated with tropical moist convection

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Dominant structures and variability in tropical diabatic heating derived from sounding observations of several field experiments, global reanalyses, and TRMM retrievals are identified. Two rotated EOF leading modes, one deep, one shallow, explain up to 90 percent of the total variance. Based on these two modes, composite profiles of diabatic heating relevant to the large-scale circulation are reconstructed. A statistical calculation leads to most probable transitions from no convection to shallow, deep, then stratiform heating profiles, and back to the no convection situation. Such a structural transition cycle exists in heating data of different temporal resolutions (6 hourly, daily, and pentad), suggesting a "self-similarity" in heating evolution across a wide range of timescales. The evolution of diabatic heating associated with the MJO shows that shallow heating leads deep heating during their eastward propagation over the Indian and western Pacific Oceans. A steady-state linear model forced by the dominant heating profiles produces multiple overturning structures that suggest more than one baroclinic modes in the dynamic field.