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TRMM Latent Heating Retrieval and Comparison with Field Campaigns and Large-scale Analyses

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Rainfall production is a fundamental process within the Earth's hydrological cycle because it represents a principal forcing term in surface water budgets. Its energetics corollary, latent heating (LH), is one of the principal sources of atmospheric diabatic heating. Latent heat release itself is a consequence of phase changes between the vapor, liquid, and frozen states of water. The vertical distribution of LH has a strong influence on the atmosphere, controlling large-scale tropical circulations, exciting and modulating tropical waves, maintaining the intensities of tropical cyclones, and even providing the energetics of midlatitude cyclones and other mobile midlatitude weather systems. Moreover, the processes associated with LH result in significant non-linear changes in atmospheric radiation through the creation, dissipation and modulation of clouds and precipitation.

TRMM was launched in November 1997 with overriding goals of providing accurate four-dimensional estimates of rainfall and LH over the global tropics and subtropics. This paper examines the retrieval, validation, and application of LH estimates based on rain rate quantities acquired from the TRMM. Specifically, this paper describes (1) relationship between rainfall, LH, and radiation, (2) differences between two TRMM LH Standard Products (SLH and CSH), (3) results from validation of LH profiles using sounding estimates from field campaigns (SCSMEX, DYNAMO and others), (4) comparison LH between large-scale analyses, (5) major findings from the satellite-based latent heating estimates, and (6) areas for further improvement. These results are based on a recent review presented in Tao et al. (2013).