

# Observational study on boundary-layer moist static energy budget over the tropical Indo-Pacific warm pool domain

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Over the tropical oceanic regions with vigorous cumulus convection, moist static energy (MSE) in the boundary layer (BL) is considered to be an essential thermodynamic parameter that determines the convective activity. It seems thus important to understand the BL MSE budget processes and their variability. Under the BL quasi equilibrium approximation, the MSE import by surface turbulent fluxes is balanced with its export by entrainment process across the BL top, by convective downdraft process, and by radiative cooling. Among these processes, quantitative estimation of contributions from the entrainment and convective downdraft processes have not been examined intensively so far. Recently, a method of estimating the MSE export by the entrainment process and convective downdraft process separately from surface meteorological observation and upper-air sounding data has been developed. In this study, we analyze observational data collected in several field campaigns by Research Vessel *Mirai* performed over the Indo-Pacific warm pool domain to examine temporal and regional variability in the MSE export by the two processes, and compare results with measures of convective activity around the vessel monitored by a shipborne weather radar. Our results include close quasi-linear relationship between estimated convective downdraft contribution and fractional area with high radar reflectivity, and statistically significant relationship between estimated entrainment contribution and low-cloud coverage.

Keywords: Moist static energy budget, Atmospheric boundary layer, Indo-Pacific warm pool domain, Shipborne observation