

Quantifying relationship between convective downdraft mass flux and rainfall amount over the Indo-Pacific warm pool domain using shipborne observations

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The Indo-Pacific warm pool domain is characterized by high sea surface temperatures, which cause vigorous deep cumulus convection with large amount of rainfall, developing upward branch of Hadley and Walker circulations. It is important to understand how intensity of convective activity and rainfall amount are determined, which is one of the fundamental questions of tropical meteorology. Toward this goal, we analyze in situ observations of the weather radar, ceilometer, upper-air sounding, and surface meteorology onboard Research Vessel *Mirai* in her 8 cruises over the warm pool domain, with periods examined here more than 200 days in total. We examine how moist static energy in the atmospheric boundary layer, which is one of the essential thermodynamic factors that determine the intensity of convection and is imported by the surface turbulent flux, is exported to the free troposphere, and estimate mass flux across the boundary layer top due to convective downdrafts using the method proposed by Yokoi and Katsumata (2022, *J. Atmos. Sci.*, *in press*). The estimated convective downdraft mass flux is then compared with a measure of convective activity around the vessel obtained by the weather radar. We find that day-to-day and intraseasonal variation of the mass flux correlates significantly with the convective activity. Furthermore, differences in the mass flux between the cruises also exhibit tight relationship with those in the convective activity, and a regression coefficient between the mass flux and rainfall amount observed by onboard rain gauge is quantified.

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