



Diurnal cycle of precipitation observed in the western coastal area of Sumatra Island, Indonesia: offshore preconditioning by gravity waves

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In November and December of 2015, we conducted a field campaign, named Pre-YMC (Years of the Maritime Continent), in the western coastal area of Sumatra Island, during which we performed weather radar observation, 3-hourly radiosonde observation, and so forth, at the Research Vessel *Mirai*, deployed about 50 km off the coast, and at a coastal city, Bengkulu. Diurnal cycle of precipitation observed during the campaign period is found to have many similarities with statistical behavior of the diurnal cycle as revealed by previous studies, such as afternoon precipitation peak over land and nighttime offshore migration of precipitation zone. Composite analyses of radiosonde data demonstrate that, over the vessel, the lower free troposphere starts cooling in late afternoon, a couple of hours earlier than the boundary layer does, making the lower troposphere thermally more unstable before the arrival of the precipitation zone. As the nighttime offshore precipitation tends to be more vigorous on days when this cooling is larger, the destabilization probably contributes to the offshore migration of the precipitation zone via enhancement of convective activity. We also find that this cooling is substantially due to vertical advection by an ascent motion, which is possibly a component of shallow gravity waves. These observational results support the idea that gravity waves excited by convective systems over land play a significant role in the offshore migration of the precipitation zone.