AOGS 2005

Convective activities and convectively induced gravity waves in the Indonesian equatorial region during the CPEA campaign period

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To investigate equatorial convective activities and its influence on the middle and upper atmosphere, an intensive observation campaign of the CPEA (Coupling Processes in the Equatorial Atmosphere) with various radar instruments and upper sounding was conducted over the maritime continent during 10 April-09 May 2004. In the experience, the equatorial atmosphere radar (EAR), boundary layer radar (BLR), weather radar, and weather Doppler radar were operated at Koto Tabang (KT; 100.32°E, 0.20°S), West Sumatera. Radiosonde was also launched at 3-4 times a day at 7 stations in Indonesia, Singapore, and Malaysia. In this study, we present diurnal features of convective activities and characteristics of convectively induced atmospheric waves, using a satellite IR data and the ground-based observation data.

In the CPEA campaign period, the first and second halves are defined as the inactive and active phases of MJO (Madden and Julian Oscillation), respectively. In the active phase, three super cloud clusters (SCCs) pass over Sumatera at an interval of 5-7 days. In the passage of SCCs, regional convections with a diurnal cycle are predominant in the whole region of Sumatera from the evening to the early morning. In the inactive phase, they appear in the evening and concentrate around the west coast of Sumatera. The difference of the convective activities between the both phases is closely related to a low-level convergence over Sumatera, obtained from the upper sounding network data. The low-level convergence indicates 5-7 day variations through the observation period, and it significantly intensifies in the active phase.

Based on the upper sounding data at KT, dominant oscillations for gravity waves with periods of 1-2 days and vertical wavelengths of 4-5 km are detected in U, V, and T perturbations. The gravity wave energy is enhanced at altitude of around 20 km in association with the low-level convergence variations. A downward phase propagation of the U, V, and T perturbations is clearly seen in the lower stratosphere, while upward and downward phase propagations coexist in the troposphere.