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THE DIURNAL CYCLE OF ATMOSPHERIC CONVECTION AND SURFACE AND BOUNDARY LAYER CONDITIONS OVER THE WARM POOL

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This study synthesizes the observed diurnal cycle of atmospheric convection, surface properties, boundary layer and deep tropospheric conditions in COARE. The diurnal cycle of convection over the COARE domain is closely related to the lifecycle of convective systems. Large-scale atmospheric dynamic and radiative processes strongly affect the lifecycle of cloud systems in the tropics (e.g., Chen and Houze, 1997). The observed diurnal variation of tropical cloud systems suggests that diurnal heating of the tropical atmosphere and ocean surfaces provides favored conditions in the afternoon for the formation of cloud systems; and, as the cloud systems grow and decay with time, the diurnal cycle of cloudiness reflects the lifecycle (initiation, growth, and dissipation) of cloud systems. Satellite infrared data and in situ surface and rawinsonde measurements from COARE are used to examine the diurnal variations of convection in two distinct large-scale flow regimes over the western Pacific warm pool. During the convectively suppressed phases of the intraseasonal oscillation (ISO), the cloud systems are spatially small and their lifetimes are generally short (< 3 h). They form, reach maximum size, and die preferentially in the afternoon, at the time of day when the ocean surface and overlying atmospheric surface layer are warmest from solar heating. During the convectively active phases of the ISO, the cold cloud coverage is dominated by spatially large, long-lived cloud systems. They tend to form in the afternoon (1400-1900 LST) and reach a maximum areal extent of very cold cloud tops before dawn (0000-0600 LST). As part of their lifecycle, the subsequent decay of these large systems extends into the next day; the satellite-observed maximum cloud coverage is dominated by successively warmer cloud tops. In this study, we further examine the relationship between the different diurnal variations of convection and associated surface and atmospheric boundary layer conditions in the two distinct large-scale regimes. The diurnal cycle of radiative heating and cooling is estimated using the COARE soundings and a radiation transfer model. The diurnal cycle of surface latent and sensible heat fluxes are also estimated using surface observations from moored buoys and the COARE flux algorithm. Our preliminary results show that the atmospheric boundary layer depth and mean virtual potential temperature have a distinct afternoon maximum for both suppresses and active periods of the ISO.