Geophysical Research Abstracts,
Vol. 11, EGU2009-1672, 2009
EGU General Assembly 2009

Observed Large-Scale Conditions and Their Interaction with Convection during TWP-ICE

S. Xie
(xie2@llnl.gov)

Observed Large-Scale Conditions and Their Interaction with Convection during TWP-ICE

Shaocheng Xie, Timothy Hume, Christian Jakob, Stephen A. Klein,
Renata McCoy, and Minghua Zhang

Abstract

Large-scale atmospheric state, diabatic heating and drying profiles were computed from data collected during the January-February 2006 northern Australian monsoon season, as part of the Tropical Warm Pool – International Cloud Experiment (TWP-ICE). The computed profiles exhibit significant variations between four distinct regimes which were observed during the experiment. The active monsoon period is characterized by strong upward motion and large advective cooling and moistening throughout the entire troposphere, while the suppressed and clear periods are dominated by moderate mid-level subsidence and significant low- to mid-level drying through horizontal advection. The mid-level subsidence and horizontal dry advection are largely responsible for the dry middle troposphere observed during the suppressed period and limit the growth of clouds to low-levels. During the break period, upward motion and advective cooling and moistening located primarily at mid-levels dominate together with weak advective warming and drying at low-levels. The different large-scale structures are shown to be of some importance to the interaction of the large-scale state with convection.

It is shown that the variations of the diabatic heating and drying profiles with the different regimes are closely associated with differences in the large-scale structures, cloud types, and rainfall rates between the regimes. Strong diabatic heating and drying is seen throughout the troposphere during the active monsoon period while they are moderate and only occur above 700 hPa during the break period. The diabatic heating and drying tend to have their maxima at low-levels during the suppressed periods.

To further analyze the large-scale structure and its importance for convection with different surface boundary conditions, a composite analysis is conducted to study the evolution of life cycles of the monsoon systems and the coastal and island-initiated convective systems that occurred during the active and break periods, respectively. Significant differences are found in the large-scale structures and diabatic heating and drying profiles between these systems through the life cycles. Implications of these differences for the character of the convection are discussed.