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Moisture Budget Analysis of a Heavy Rain Event Over Taiwan in Meiyu Season

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During the period of 29-30 May 2001, the development and northeastward propagation of a series of MCSs produced heavy rainfall with a maximum 9-h accumulated rainfall of 215 mm over Taiwan. Moisture budget analysis of the MCSs development associated with this heavy rainfall event is carried out by utilizing high-resolution numerical simulation results from the atmospheric part of the triply nested, nonhydrostatic Coupled Ocean/Atmospheric Mesoscale Prediction Systems (COAMPS). The diagnosis reveals that the water vapor essential for maintaining convective precipitation either over land or ocean surface is mainly accumulated by grid-scale resolvable processes, i.e., large scale horizontal moisture flux convergence in the lower troposphere. Water vapor accumulated in the lower boundary layer is mostly carried by grid-scale vertical moisture divergence away from the boundary layer. However, 20% (30%) of total water vapor can be transported vertically from lower atmosphere into the convective cloud by sub-grid scale turbulent processes during convection development over land (ocean). The near-surface evaporation over land provides only 0.1% to the total amount of water vapor transported into convective cloud. On the other hand, evaporation near ocean surface provides 9.4% of water vapor compared to the total amount transported through grid-scale vertical moisture flux divergence prior to convection initiation. These diagnoses illustrate that for this heavy rainfall event during May 2001, sub-grid scale processes such as near-surface evaporation and turbulent transport below the cloud play relatively more important role in oceanic convective system initiation and development compared to convections developed over land.