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Multiplatform observations of boundary layer structure in the outer rainbands of landfalling typhoons

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This study analyzes data collected from a new set of observational platforms in the coastal area of China, which consist of a mobile observation system, meteorological tower, automatic weather station, and Doppler radars, to investigate the mean and turbulent boundary-layer structure and evolution during the landfall of typhoons. An example of these data is provided from Typhoon Morakot (2009). Vertical profiles of wind velocities and thermodynamic parameters from the observed data allow us to identify different boundary-layer structures during and after landfall. These structures, sampled in regions of the outer core, are stratified into periods where convection is occurring (termed "convective") and periods where convection has recently (< 2 h) occurred (termed "post-convective"). Data analyses show that the thermodynamic mixed-layer depth and inflow layer depth are higher during the convective period than the post-convective period. The mixed-layer depth is found to be within the strong inflow layer, but the height of the maximum tangential wind speed is above the inflow layer during both periods, contrary to recent observational studies of the boundary-layer structure of tropical cyclones over water. High-frequency wind data show that momentum flux, turbulent kinetic energy (TKE) and integral length scales of wind velocities are all much larger during the convective period than the post-convective period. The results suggest that convective downdrafts may play an important role in modulating turbulent flux, TKE, vertical mixing and boundary layer recovery processes.