Department of Atmospheric Sciences
Seminar Announcement

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Cell merger, cold pool, and mid-level dry air of the afternoon thunderstorms at Taipei on 14 June 2015

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Time: **3:30pm HST**
Zoom Meeting: **https://zoom.us/j/93583080682**
Meeting ID: 935 8308 0682
Passcode: 6daVMR

Abstract:

On 14 June 2015, severe afternoon thunderstorms developed in the Taipei basin, producing intense rainfall (with the rainrate of 131 mm/h) and urban-scale flooding. High-resolution simulations using the Weather Research and Forecasting (WRF) model with the finest grid size of 0.5 km were performed to capture reasonably well the onset of sea breeze, the development and evolution of this afternoon thunderstorm system.

Convection was initiated both by sea breeze at foothill and by upslope wind at mountain peak. Convective available potential energy (CAPE) was increased from 800 to 3200 J/kg with abundant moisture transport by the sea breeze from 08 to 12 LST, fueling large thermodynamic instability for the development of afternoon thunderstorm. Strong convergence between sea breeze and cold-air outflow triggered further development of intense convection, resulting in heavy rainfall. Microphysics experiments show that evaporative cooling played a major role in the propagation of cold-air outflow and the production of heavy rainfall, while melting cooling played a minor role. The local topography of Mount Datun at coastal region produced the channel effect through Danshui River Valley, intensifying sea-breeze circulation and transporting more moisture.

A mid-level dry layer with layer-mean relative humidity of 50% occurred at 500–700 hPa for the Banchiao (near Taipei) sounding at 00 UTC (08 LST). Four sensitivity experiments with the increase or decrease of mid-level relative humidity of 10% and 20% were conducted. Experiments with a drier middle layer would result in stronger cold pool, more organized and deeper convection, stronger updrafts and more latent heating above the melting level, and a much larger area of intense-rainrate region (>80 mm/h). Statistics from 200 backward trajectories indicated that 37% of air parcels within the cold pool came from the middle levels (3–6 km). Domain-accumulated rainfall was not positively correlated to the rainfall rate. Finally, numerical experiments found a nonlinear response of simulated convection intensity to the mid-level moisture content in the environment.