

Numerical simulation of heavy rainfall events in the Tokyo metropolitan area

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Heavy rainfall in metropolitan area often draws public attention because of the large social impact. Better understanding of mesoscale and microscale processes, improved forecast, and sophisticated warning system of the severe weather are required for disaster resilience in urban areas. We investigated formation and development processes of an extremely developed thunderstorm on 26 August 2011 (Case 1) and a moderately developed thunderstorm on 18 July 2013 (Case 2) in the Tokyo metropolitan area. Numerical simulations were carried out using the Non-Hydrostatic Model (NHM) of the Japan Meteorological Agency (JMA) incorporating the Square Prism Urban Canopy (SPUC) scheme. Model results fairly represented spatial distribution and amounts of the rainfall. The lower LFC and the thicker easterly flow layer characterized the mesoscale environment in Case 1. Formation of the distinct convergence zone between easterly and southerly flow is likely to trigger active convective systems at around Tokyo in Case 1. Urban impact on precipitation was also examined in comparative experiments using realistic built-up urban condition (CRNT experiment) and less urbanized condition (LURB experiment). Greater amounts of precipitation in the CRNT experiment than in the LURB experiment were simulated in the central urban area. Comparison of the meteorological fields between the two experiments suggests that the intensified convergence and ascending motion in Tokyo due to urban temperature rise can cause precipitation increase at around the central urban area.

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