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Simulation of localized heavy precipitation in South Korea on 20 June 2014: sensitivity test of integration time-step size and an effect of topographic resolution using WRF model

Joon-Woo Roh, Joon-Bum Jee, A-Young Lim, and Young-Jean Choi
WISE Institute, Hankuk University of Foreign Studies, Yong-In city, South Korea (neolegacy@gmail.com)

Korean warm-season rainfall, accounting for about three-fourths of the annual precipitation, is primarily caused by Changma front, which is a kind of the East Asian summer monsoon, and localized heavy rainfall with convective instability. Various physical mechanisms potentially exert influences on heavy precipitation over South Korea. Representatively, the middle latitude and subtropical weather fronts, associated with a quasi-stationary moisture convergence zone among varying air masses, make up one of the main rain-bearing synoptic scale systems. Localized heavy rainfall events in South Korea generally arise from mesoscale convective systems embedded in these synoptic scale disturbances along the Changma front or convective instabilities resulted from unstable air mass including the direct or indirect effect of typhoons. In recent years, torrential rainfalls, which are more than 30mm/hour of precipitation amount, in warm-season has increased threefold in Seoul, which is a metropolitan city in South Korea. In order to investigate multiple potential causes of warm-season localized heavy precipitation in South Korea, a localized heavy precipitation case took place on 20 June 2014 at Seoul. This case was mainly seen to be caused by short-wave trough, which is associated with baroclinic instability in the northwest of Korea, and a thermal low, which has high moist and warm air through analysis. This structure showed convective scale torrential rain was embedded in the dynamic and in the thermodynamic structures. In addition to, a sensitivity of rainfall amount and maximum rainfall location to the integration time-step sizes was investigated in the simulations of a localized heavy precipitation case using Weather Research and Forecasting model. The simulation of time-step sizes of 9-27s corresponding to a horizontal resolution of 4.5km and 1.5km varied slightly difference of the maximum rainfall amount. However, the sensitivity of spatial patterns and temporal variations in rainfall were relatively small for the time-step sizes. The effect of topography was also important in the localized heavy precipitation simulation.