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A Control Simulation Experiment for August 2014 Severe Rainfall Event Using a Regional Model

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Torrential rainfall is a threat in the modern society. To predict severe weather, convection resolving numerical weather prediction (NWP) is effective. This study explores a Control Simulation Experiment (CSE) aimed at controlling precipitation amount and locations to potentially prevent catastorphic disasters by simulating different scenarios of interventions of small perturbations taking advantage of the chaotic nature of dynamics. In this study, we perform a CSE using a regional model SCALE-RM for a severe rainfall event which caused catastrophic landslides and 77 fatalities in Hiroshima, Japan on August 19 and 20, 2014.

We perform a 1-km-mesh, hourly-update, 50-member observing system simulation experiment (OSSE) for this rainfall event initialized at 0000 UTC August 18. This provides the initial conditions for a 6-hour ensemble forecast initilaized at 1500 UTC Augest 19. To create small perturbations to change the nature run, we take the differences of all model variables between an ensemble member having the heaviest rain and another ensemble member having the weakest rain. Moreover, we normalize the perturbations so that the maximum wind speed is 0.1 m s-1. In this preliminary CSE, we try to control the heavy rainfall by giving the perturbations to the nature run in the OSSE at each time step from 1500 UTC to 1600 UTC on August 19, although the perturbations for all variables at all grid points are something beyond human's engineering capability. In the nature run, 6-hour accumulated rainfall amount from 1500 UTC to 2100 UTC reaches 210 mm at the peak grid point. By contrast, the rainfall amount decreases to 118 mm in the CSE. We plan to apply limitations to the perturbations.