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Regional climate simulations over Asia under the global warming nested in a general circulation model

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The impact of hydrological change as a result of global warming caused by anthropogenic emissions of greenhouse gases is a fundamental concern. In order to control water resources in the face of drought, flood, and soil erosion, which frequently present a serious threat to human life and natural ecosystems, risk assessments are being required more seriously by policy-makers. Though hydrological predictions associated with the global climate change are already being performed mainly through the use of General Circulation Models (GCMs), coarse spatial resolutions and uncertain physical processes limit the available information for water management on a regional scale. Currently, as one of the methods for downscaling the GCM results, dynamical downscaling using a regional climate model (RCM) is in progress. Higher resolution simulation by a regional climate model is expected to be able to improve regional circulation pattern and mesoscale precipitation such as orographic precipitation resulting from realistic topography. We have developed a regional climate model, NIES-RAMS, and conducted present and future Asian regional climate simulations which were nested in the results of Atmospheric General Circulation Model (AGCM) experiments. The regional climate model could capture the general simulated features of the AGCM and also some regional phenomena such as orographic precipitation, which did not appear in the outcome of the AGCM simulation, were successfully produced. About one degree Celsius increase of annual mean 2m air temperature in the tropical region and about 3-4 degree Celsius in the mid-high latitudinal region are projected from the present climate (1981-1990) to the future (2041-2050). El Nino like responses can be found in the projected results by the AGCM under the global warming. Active convection area over the western Pacific Ocean shifted to the eastward. As a result, Walker circulations were modulated and the sinking motions were

stronger over the Western Pacific Ocean, which caused the negative anomaly of precipitation. Under the global warming, the increase of water vapor associated with the warmed air temperature was projected. It was projected to bring more abundant water vapor to the south of India and the Bay of Bengal and to enhance precipitation especially over the mountainous regions, the western part of India and the southern edge of the Tibetan Plateau. As a result of the changes in the synoptic flow patterns and precipitation under the global warming, the increases of annual mean precipitation and surface runoff were projected in a lot of Asian regions. However, both the positive and negative changes of surface runoff were suggested in some regions in summer. It might increase the risk of mismatch between water demand and water availability in the agricultural season.