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Climate change impact assessment of water related natural hazards in Japan

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Under the KAKUSHIN Program, Meteorological Research Institute (MRI) of Japan Meteorological Agency, Disaster Prevention Research Institute (DPRI) of Kyoto University, and International Centre for Water Hazard and Risk Management (ICHARM) of Public Works Research Institute (PWRI) have been performing climate projections for the near future and for the end of the 21st century using atmospheric models of unprecedented super-high-resolution. The climate change studies have been based on a global 20-km mesh atmospheric general circulation model (GCM); emphasis has been placed on extreme events, including tropical cyclones and heavy precipitation during the East Asian summer monsoon season.

DPRI has been performing "Prediction and evaluation of disaster environment in Japan" with the sub-project title of "Integrated assessment of climate change impacts on watersheds in a disaster environment". One of the important subjects in this sub-project is the interface between GCM and RCM, and various models on natural hazard. For example, MRI slightly changed its GCM and RCM so that they could output hourly rainfall from GCM. It is the typhoon resolving output from the GCM that has realized the impact assessment on Japanese river regime. Namely, GCM with the super-high spatio-temporal resolutions (20 km-1 hour) made it possible to evaluate extreme hazard (ex. Max. discharge) in Japan. (However, we must make sure that this does not mean that we can evaluate the changes in such a high spatial resolution.

Results from typical climate change assessments on disaster environment in Japan will be shown as projections of change in design value. Most of the design value is expected to increase as expectation. This means that we can get approximate projection on changes in return period of extreme events. However, there is a risk that the return period does not have enough accuracy. Also, there is no guarantee that quite extreme events could be properly projected within the limited number of ensembles as GCM output with such a high resolution. On the other hand, the risk management deals with phenomena beyond design hazards. In this sense, it is very important to take into account the result from the worst case scenario, which was produced by a physically based virtual shifts of typhoon track, as one of the forcing for risk management on climate change. Taking into consideration above items, it is very important for climate change adaptation to discriminate more between planning with uncertain design level and risk management with the worst case scenario.

Keywords: climate change, global warming, heavy rainfall, typhoon, extreme events, disaster