



Projection of Changes in Extremes by Very High Resolution Atmospheric Models

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In the IPCC AR4, there are qualitative statements that it is very likely that heavy precipitation events will continue to become more frequent and future tropical cyclones will become more intense with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures. However to quantitatively assess future changes of weather extremes, it is obvious that we need high resolution climate models. In this presentation, I present preliminary results of our project “Projection of the change in future weather extremes using super-high-resolution atmospheric models.” Three 25-year time-slice experiments are conducted with a global 20-km mesh AGCM with emphasis on various extreme events including tropical cyclones and heavy precipitation during the rainy season. Other resolution (60-km, 120-km and 180-km) simulations are also performed. An AMIP-type experiment for the period 1979-2003 using the observed sea surface temperature and sea ice concentration confirmed that representation of large-scale features does improve, although not so much, by increasing horizontal resolution of the model. Topography is better represented by high-resolution model, leading to good representation of orographic precipitation. There is resolution dependency for various extremes indices in the present-day climate. For the future climate projections, we added CMIP3 model ensemble mean changes in their SRES A1B experiments of sea surface temperature and sea ice concentration to the present values, and conducted the 2015-2039 and 2075-2099 simulations. Resolution does not affect much on future projected changes in seasonal mean precipitation, but does affect in its extremes. The 20-km mesh model projects larger increase in precipitation extremes such as the maximum 5-day precipitation total. Furthermore, focusing on the local climate change over Japan, 5-km and 1-km mesh regional atmospheric models embedded in the global model are utilized to investigate the frequency change of heavy precipitation. Uncertainty of projected climate change are quantified with multiple sets of ensemble experiments to provide information on reliability for the users of simulated results based on 60-km mesh AGCM experiments. With the output data from model projections, change of disaster environment regarding landslide, debris flow, flood, drought, storm surge and strong wind are evaluated over Japan. Moreover, flood risk assessment is extended to a global scale. We found it important to have continuous dialogue between climate modelers and risk assessment group within a project to reduce misuse and misunderstanding of climate model output and its uncertainty.