Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

ACG033-12 Room: Function Room A Time: May 23 12:00-12:15

Ultra-high resolution climate model development for societal applications

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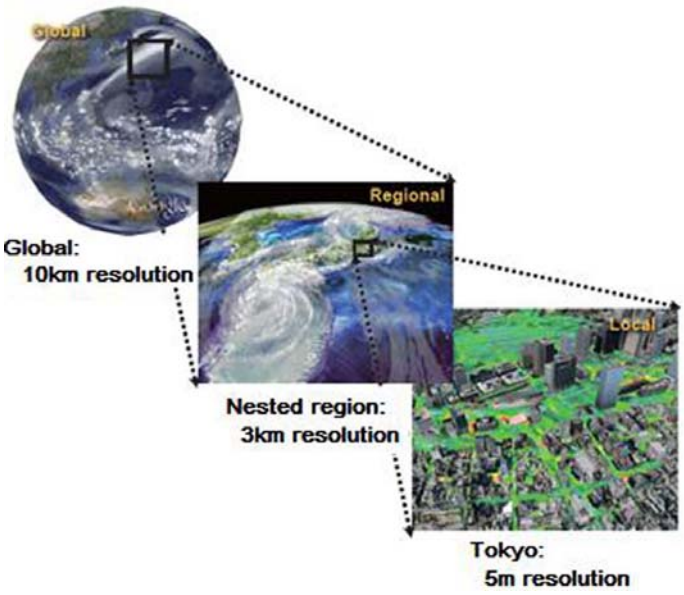

The Application Laboratory (APL) and The Earth Simulator Center have been developing Multi-Scale Simulator for the Geoenvironment (MSSG). MSSG has a non-hydrostatic atmosphere general circulation model, which is coupled to a land model, a non-hydrostatic/hydrostatic ocean model, and an ocean wave model, to be run on the Earth Simulator with high performance computing architectures. The large scale climate determines the environment for microscale and mesoscale processes that govern weather and local climate, and these small scale processes likely have significant impacts on the evolution of the large scale circulation. MSSG has been designed to simulate various multi-scale multi-physics phenomena of the Earth system in a seamless way. It serves as a key component of our understanding of the complex, multi-scale interactions with an aim to advance weather and climate prediction. The accurate representation/prediction of this continuum of variability with MSSG is a challenging goal.

In this presentation, we consider societal impact research and applications targeting in the Southern African Region with MSSG forecasting system, while we show ultra high resolution simulation results in Japan region with downscaling of synoptic-scale disturbances. MSSG has demonstrated skill in simulating the atmospheric water cycle and its variability in the Southern African Region, especially in the Western Cape Province and the Limpopo Province. It is just beginning to reveal the upscaling of regional phenomena with global consequences. Two-way coupling of regional downscaling in MSSG is capable of resolving dynamical processes to global MSSG over sensitive regions and facilitates research on scale interactions. It will be also discussed that the possible transition to regional MSSG opens opportunities to investigate several climate questions in the framework of the multi-model seasonal forecasting analysis in this project.