Preliminary results of a high-resolution climate simulation using the Non-hydrostatic Icosahedral Atmospheric Model, NICAM, for CMIP6 HighResMIP

*小玉 知央[1]、佐藤 正樹[2,1]、大野 知紀[1]、野田 暁[1]、八代 尚[3]、山田 洋平[1]、中野 満寿男[1]、清木 達也[1]、那須野 智江[1]、Chen Ying-Wen[2]、宮川 知己[2]、杉 正人[4]、Roh Woosub[2]
*Chihiro Kodama[1], Masaki Satoh[2,1], Tomoki Ohno[1], Akira T Noda[1], Hisashi Yashiro[3], Yohei Yamada[1], Masuo Nakano[1], Tatsuya Seiki[1], Tomoe Nasuno[1], Ying-Wen Chen[2], Tomoki Miyakawa[2], Masato Sugi[4], Woosub Roh[2]

1. 独立行政法人海洋研究開発機構、2. 東京大学大気海洋研究所、3. 理化学研究所計算科学研究機構、4. 気象研究所
1. Japan Agency for Marine-Earth Science and Technology, 2. Atmosphere and Ocean Research Institute, the University of Tokyo, 3. RIKEN Advanced Institute for Computational Science, 4. Meteorological Research Institute

We introduce a series of climate simulations using the Non-hydrostatic Icosahedral Atmospheric Model, NICAM. Though our typical resolution range is 3.5-14 km for seasonal integration, a relatively coarser mesh size is chosen for multi-decadal integration. In Kodama et al. (2015, J. Meteor. Soc. Japan), we have performed the AMIP-type 30-year simulations with a mesh size of 14 km under the present and future boundary conditions. Although we switch off cumulus parameterization scheme in order to keep physics schemes consistently across resolutions between 3.5 and 14 km, the simulated climatology is fairly good, competitive with other climate models. The advantage of a fine-mesh global climate simulation is that atmospheric multi-scale phenomena ranging from large-scale circulation to meso-scale features associated with convection, front, severe rainfall, atmospheric gravity waves are represented in a seamless manner. For example, we discuss statistics of detailed structure of multi-scale convective systems and extremes such as tropical cyclones; Yamada et al. (2017, J. Climate) analyzed the NICAM AMIP-type simulation dataset and showed widening of the intense wind speed area around the tropical cyclones due to global warming. Now, targeting the CMIP6 HighResMIP, we are performing further longer time integrations for 65 years. The simulations are initialized on 1st January 1950. Because multiple choice of resolution is required, we use mesh sizes of 14, 28, and 56 km. The model used here has been updated and tuned in terms of cloud microphysics (Roh and Satoh, 2014, J. Atmos. Sci.), aerosol, orographic gravity wave and land model to improve performance of the simulated climatology. Of particular interest here is performance in genesis, development, track and structure of tropical cyclone, and we will show some preliminary results including impact of the horizontal resolution on tropical cyclone statistics.

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