A preliminary result in the DYAMOND project by NICAM

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Abstract

Project DYAMOND (Dynamics of the Atmospheric general circulation Modeled On Non-hydrostatic Domains) is an inter-comparison project which describes a framework for the inter-comparison of an emerging class of atmospheric circulation models resolving a non-hydrostatic scale in the atmospheric motion. The first stage of the Project DYAMOND is based on a 40-day-simulation initialized on 1 August 2016 by NICAM (Satoh et al., 2014) with dx~3.5 km and 7.0 km, ICON (Zängl et al., 2014) with dx~2.5 km and 5.0 km, SAM (Khairoutdinov et al., 2001) with 4.0 km, and FV-3 (Harris and Lin, 2013) with 3.25 km. It is confirmed that the global mean Outgoing Long Radiation (OLR) and precipitation agree surprisingly well among models, despite none of the models was tuned. Note that the global mean precipitation in the models is slightly higher than in GPCP, which is consistent with past inferences that GPCP underestimates the amount of precipitation. In addition, the structure of the tropical cyclone "Howard" is successfully simulated by all models after 36h forecast time as a hindcast experiment. However, some notable differences in the horizontal map of precipitation are found over Bay of Bengal and the Western North Pacific, in terms of the location of the local maximum and the degree of the aggregation. This is likely attributable both to difference in the representation of the large-scale circulation associated with the Asian monsoon, and that in the cloud-radiation interaction resolved by different microphysics schemes in the models. In addition, the distribution of the ice clouds over the warm pool is simulated few times and at lower heights in ICON, many times and at higher heights in NICAM, and moderate in SAM and FV3. These preliminary results suggest that, even though the global averaged OLR and precipitation is quite similar, the horizontal/vertical distribution of clouds which are simultaneously generated in the models is not deterministic in the global atmospheric models with the storm resolving scales. Further analysis will be made about the explicitly resolved momentum/specific humidity transport by convection.

References:

Satoh, M., H. Tomita, H. Yashiro, H. Miura, C. Kodama, T. Seiki, A. T. Noda, Y. Yamada, D. Goto, M. Sawada, T. Miyoshi, Y. Niwa, M. Hara, T. Ohno, S. Iga, T. Arakawa, T. Inoue and H. Kubokawa: The Non-hydrostatic Icosahedral Atmospheric Model: description and development. *Progress in Earth and Planetary Science* 2014, **1**:18. doi: 10.1186/s40645-014-0018-1

Zängl G, Reinert D, Rípodas P, Baldauf M, 2014: The ICON (ICOsahedral Non-hydrostatic) modelling framework of DWD and MPI-M: Description of the non-hydrostatic dynamical core. Quart J Roy Meteor Soc, doi:10.1002/qj.2378.

Khairoutdinov, M. F., and D.A. Randall, 2001: A cloud resolving model as a cloud parameterization in the NCAR Community Climate System Model: Preliminary Results. Geophys. Res. Lett., 28, 3617-3620.

Harris, L. M., & Lin, S.-J., 2013: A two-way nested global-regional dynamical core on the cubed-sphere grid. Monthly Weather Review,141(1), 283–306.