Forecast skill of intraseasonal oscillation events over the Maritime Continent in a global cloud-system-resolving model

Tomoe Nasuno[1], Masuo Nakano[1], Kazuyoshi Kikuchi[2], Tim Li[2], Mio Matsueda[3]

1. Japan Agency for Marine-Earth Science and Technology, Japan

2. International Pacific Research Center, University of Hawaii, USA

3. University of Tsukuba, Japan

Email: nasuno@jamstec.go.jp

Abstract

Forecast skill of the intraseaonal oscillation (ISO) events in Nonhydrostatic Icosahedral Atmospheric Model (NICAM [1]) simulations during the Years of the Maritime Continent (YMC) JAMSTEC field campaign period [2] is evaluated in comparison with observations, analysis, and operational forecasts. We aim to understand what is important to realistically simulate the ISO event, by specifying reasons for higher and lower skill simulation cases.

Global 14-km (7-km) mesh 30-day (14-day) long near real-time forecasts were run on daily basis during the 2015 (2017) campaign period from November to January next year. The initial condition for the forecasts were interpolated using 1.0° x 1.0° gridded NCEP final analysis [3], and sea surface temperature was given by the daily climatology plus initial anomaly.

During the 2015 campaign under a peak El Nino condition, convection was stagnant over the Indian Ocean, but a robust ISO event developed in mid-December and crossed over the Maritime Continent (MC) keeping its magnitude. During the 2017 campaign under a La Nina condition, convection was generally active over the MC and ISO signals were less distinct than in 2015. A moderate ISO developed in late November.

The ISO simulation for the 2015 case tended to be disrupted by dry environment over the MC. The good cases successfully simulated the large-scale circulation and the southward path of convective envelope over the ocean surrounding the MC, whereas the poor cases missed the large-scale circulation and quick eastward shift of convection without significant development along an equatorial path. These are supportive of the

arguments in previous studies. As to the 2017 ISO case, the model captured the amplification of the event but with a tendency of overdevelopment, which was opposite to operational forecasts. We speculate that the erroneous ISO behavior was related to the mean biases of stronger lower tropospheric westerlies to the east (west) of the MC in 2015 (2017), which induce stronger convergence and moistening further to the east of (over) the MC through non-linear effects. The mean bias suggests a tendency of excessively strong coupling between convection and circulation in the model. It is suggested that adequate strength of coupling between convection and circulation was important to the successful simulation of the ISO.

References:

[1] 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

[2] YMC web (http://www.jamstec.go.jp/ymc/index.html)

[3] The data is provided by the Data Support Section of the Computational and Information Systems Laboratory at the National Center for Atmospheric Research in Boulder, Colorado. (https://rda.ucar.edu/datasets/ds083.2/)