Overview of Recent Activities by NICAM Working Team

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1. Introduction

NICAM (Nonhydrostatic ICosahedral Atmospheric Model) is a global cloud resolving model (GCRM) for the very high resolution simulation, which was first developed by cooperation of FRCGC (now, RIGC/JAMSTEC) and CCSR (now, AORI in the University of Tokyo) so as that it can be run with high computational efficient and accuracy. Several new numerical techniques are employed on the dynamical part, e.g., modified icosahedral grid (Tomita et al. 2001) and for the new non-hydrostatic scheme with total energy conservation (Satoh 2003), a simple but accurate horizontal advection scheme (Miura 2007). The physics are also developed vigorously, e.g., the 6 categories microphysics (Tomita 2008) and the new PBL scheme (Noda et al. 2009), and so on. Recent model description is found in Satoh et al. (2008). In this paper, we give an overview for our recent activities and future directions.

2. A highlighted recent result

Since the successful simulation of Madden-Julian Oscillation was performed (Miura et al. 2007) by GCRM (NICAM), we have been intensively promoting the research of reproducibility and mechanism of intra seasonal variation, monsoon, and tropical cyclone and relation between them(Taniguchi et al. 2010, Oouchi et al. 2009, Nasuno et al. 2009 etc.). Recently, we have conducted the time-slice experiment under future warmed climate to investigate the change of tropical cyclones (Yamada et al. 2010). One distinct change on tropical cyclone distribution between present and future climate is that the generation area in the north-west Pacific ocean moves eastward due to modulation of Walker circulation by El Nino like SST forcing, which also affected less generation of TCs in the Atlantic ocean by the intensive vertical shear (Figure 1). Although the integration period is relatively short (five months for each run), the tendency of less number and stronger intensity of TCs under the warmed climate was ob-

tained. These results are consistent with the previous studies by cloud-parameterized GCM (e.g. Oouchi et al. 2006) and would support them.

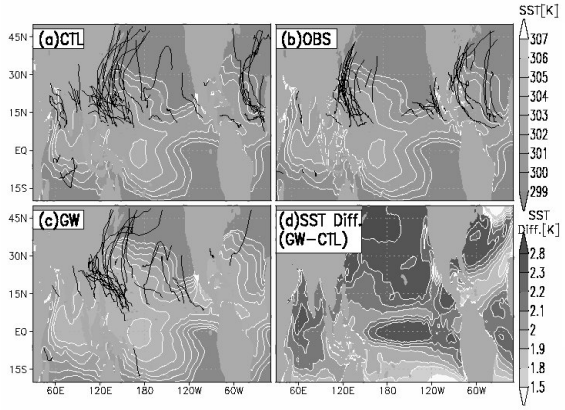

Figure 1: Distribution of TCs and SST. (a) present climate (2004 June-Oct.), (b) observation(2004 June-Oct.), (c) future climate(June-Oct.), (d) SST difference between two climates.

3. Ongoing projects and future directions

In order to examine the impact of global high resolution run, we are now collaborating with COLA, ECMWF, NICS, and Cray under the Athena project (http://wxmaps.org/athena/home/). In this project, the model intercomparison between NICAM (7 km horizontal resolution) and IFS (10 km horizontal resolution), which is hydrostatic operational model in ECMWF. From the first quick analysis, we found that the diurnal cycle in the cloud resolving model is better represented than the cloud-parameterized hydrostatic model. On the other hand, NICAM has still a large precipitation bias over the tropics, especially over the Indian ocean. The reduction of this bias is one of main subjects.

In 2012, the K-computer, which is a high-performance super-computer with 10 PFLOPS speed and 1PB memory, will be operated in Japan. NICAM will be fully used in the strategic program of theme “preventing disaster”. By using this machine, we will investigate the extended predictability of tropical weather and the change of TCs under the future climate with statistical approach.

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References

All the references in this paper can be found in http://www.nicam.jp/hiki/?NICAM+Papers.