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An overview of the SOUSEI multi GCM/RCM dynamical downscaling ensemble

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1. Introduction

Today, there are a number of multiple GCM/RCM dynamical downscaling (DDS) ensemble projects throughout the world. These projects include ENSEMBLES, NARCCAP, and CORDEX series to name a few. Selections of GCMs and RCMs have depended on projects' goals and technical aspects (e.g., GCM data availability GCM-RCM compatibility, and computational resources, etc.). However, there are emerging evidences that in comparison to RCMs, variations in GCMs contribute to the ensemble spread more than those in RCMs (e.g., Deque et al. 2007). Yet how best to select GCMs for ensemble downscaling experiments remain as a very active discussion point within the DDS community. The authors have been conducting the SOUSEI multi GCM/RCM DDS experiments for Japan. In our project, GCM selection is made based on a cluster analysis of tropical SST change in CMIP5 GCMs. In this presentation, we will provide an overview of the SOUSEI multi DDS experiment, including GCM selection and its consequences, and some preliminary results from downscaling.

2. Experimental design

The SOUSEI multi GCM/RCM downscaling ensemble is comprised of three GCMs (MIROC5, MRI-CGCM3, and CCSM4) and four RCMs (MRI-NHRCM, NIED-RAMS, Tsukuba-WRF, and AORI-RSM) (Figure 1). Domain configuration is commonly set as Japan and its vicinity at 20km horizontal resolution (Figure 2). Simulation periods are also the same for all ensemble members; 1981-2000 under AR5 historical scenario, and 2081-2100 under RCP4.5 scenario.

SST changes are considered to be important for regional climate changes. From this reason, we selected GCMs based on a cluster analysis on SST future change in CMIP5 GCMs. Here, GCMs are classified into three clusters according to their spatial distribution of tropical SST change under RCP4.5 scenario (Figure 3). For the SOUSEI DDS ensemble, one GCM is selected from each of the three SST clusters. SST change in MIROC5 is characterized by a profound increase in eastern tropical Pacific, whereas MRI-CGCM3 has higher increase in Indian ocean and western tropical Pacific. CCSM4 has relatively more uniform SST increase throughout the tropics. Summer-time future precipitation change in these GCMs around Japan also exhibits marked differences.

3. Lookout

The SOUSEI DDS simulations are still underway. Our ensemble design, with all of the three GCMs downscaled by all RCMs resulting a "filled GCM/RCM matrix", allows us use Analysis of Variance (ANOVA) to attribute GCM and RCM variations to the ensemble spread. Some preliminary analysis, depending on the data availability, will be given using the downscaled seasonal mean temperature and precipitation.

Acknowledgment

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References

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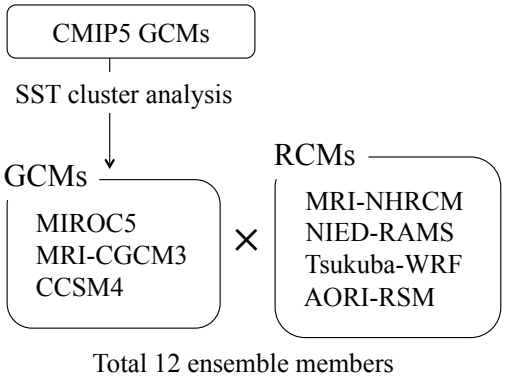

Figure 1. Schematic diagram of the SOUSEI multi DDS experiment.

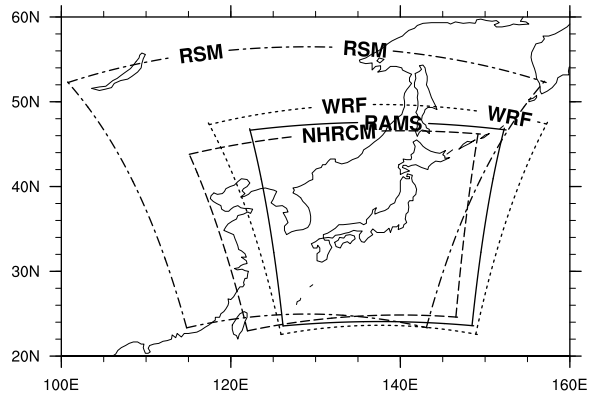

Figure 2. RCM domains for the SOUSEI multi DDS experiment.

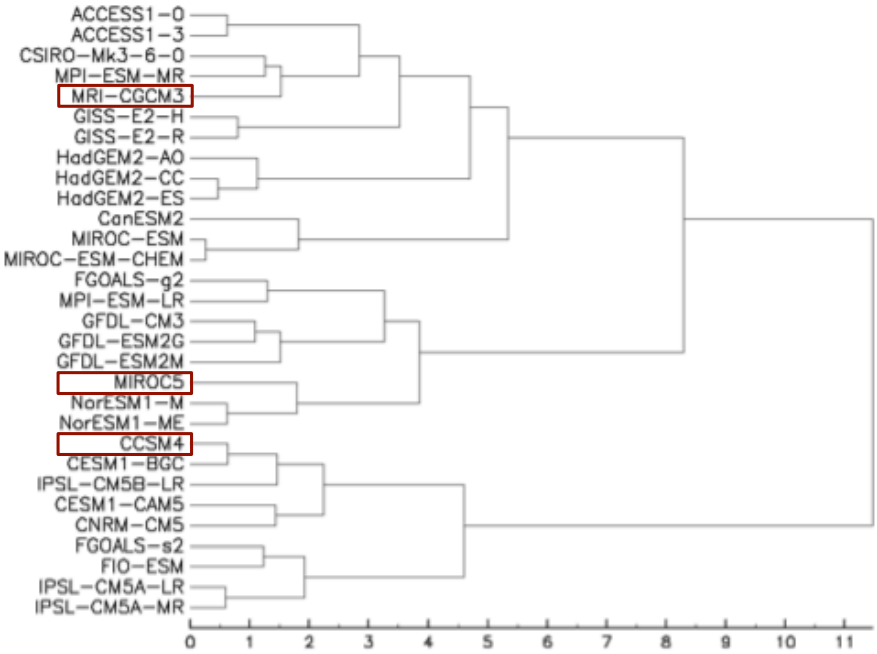

Figure 3. Cluster tree diagram for future tropical SST change in CMIP5 GCMs under RCP4.5 scenario