Geophysical Research Abstracts
Vol. 14, EGU2012-5039, 2012
EGU General Assembly 2012

Attributing varying ENSO amplitudes in climate model ensembles

M. Watanabe (1), J.-S. Kug (2), F.-F. Jin (3), M. Collins (4), M. Ohba (5), and A. Wittenberg (6)

(1) The University of Tokyo, Kashiwa, Japan (hiro@aori.u-tokyo.ac.jp), (2) Korea Ocean Research and Development Institute, Ansan, Korea, (3) University of Hawaii at Manoa, Honolulu, USA, (4) University of Exeter and Met Office Hadley Centre, Exeter, UK, (5) Central Research Institute of Electric Power Industry, (6) Geophysical Fluid Dynamics Laboratory, Princeton, USA

Realistic simulation of the El Niño-Southern Oscillation (ENSO) phenomenon, which has a great impact on the global weather and climate, is of primary importance in the coupled atmosphere-ocean modeling. Nevertheless, the ENSO amplitude is known to vary considerably in a multi-model ensemble (MME) archived in the coupled model inter-comparison project phase 3 (CMIP3). Given a large uncertainty in the atmospheric processes having a substantial influence to the models' ENSO intensity, we constructed physics parameter ensembles (PPEs) based on four climate models (two of them are included in the CMIP5 archive) in which parameters in the atmospheric parameterization schemes have been perturbed. Analysis to the 33-member PPEs reveals a positive relationship between the ENSO amplitude and the mean precipitation over the eastern equatorial Pacific in each model. This relationship is explained by the mean state difference controling the ENSO activity but not by the ENSO rectification of the mean state. The wetter mean state in the eastern equatorial Pacific favors an eastward shift in the equatorial zonal wind stress response to El Niño/La Niña, which acts to increase the ENSO amplitude due to enhanced coupled instability. Such a relationship, however, cannot be seen in both CMIP3 and CMIP5 MMEs, indicating that the above mechanism does not explain the diversity in ENSO amplitude across the models. Yet, ensemble historical runs available for some of the CMIP5 models show the positive relationship
between the ENSO amplitude and the mean precipitation, providing a useful insight into the ENSO changes under the global warming in individual models.