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Atmospheric response to the ENSO in a quasi-coupled data assimilation system

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We developed a "quasi coupled data assimilation system," i.e., a data assimilation system in which ocean observation data is adopted for constraining the ocean component of a Coupled atmosphere-ocean General Circulation Model (CGCM), in the Japan Meteorological Agency (JMA)/ Meteorological Research Institute. The system is called MOVE-C here. The CGCM used in MOVE-C is JMA's current operational CGCM, JMA/MRI-CGCM. MOVE-C also adopts the ocean data assimilation scheme of MOVE/MRI.COM-G (the ocean data assimilation system used for operational seasonal forecasts in JMA) for constraining the ocean components with observation data. We expect MOVE-C to be suitable for analyzing the climate variability because it explicitly calculates the interaction between the atmosphere and ocean. It is often pointed out that the forecast skill can be degraded by inconsistency between the initial conditions of the atmosphere and ocean for the coupled model in current seasonal forecasting because they are prepared separately by using non-coupled atmosphere and ocean data assimilation systems. Hence, there is a possibility that seasonal forecasting can be improved by using the coupled atmosphere-ocean analysis as the initial condition. It also enables us to make an ocean analysis that does not depend on any atmospheric reanalysis data and, therefore, is not affected by its errors such as a spurious climate jump due to change of the observing system. The MOVE-C reanalysis (MOVE-C RA) with 5 ensemble members is conducted for the period of 1979-2006. In the reanalysis, in situ temperature and salinity profiles, satellite altimetry data, and COBE-SST (observation-based SST data in JMA) are assimilated into the ocean component of the CGCM. We also performed 5-member ensemble of the AMIP Runs, simulation runs of the atmosphere GCM used in MOVE-C, for comparison. Monthly data of COBE-SST is employed as the ocean boundary condition in the AMIP Runs. Previous study showed that the mean state and variability of the precipitation in the tropics in MOVE-C RA is remarkably improved over the AMIP Runs. In this presentation, we will show that the atmospheric response to the El Ni?o-Southern Oscillation (ENSO) in MOVE-C RA is also improved over the AMIP Runs. For example, the strength of the Walker Circulation over the tropical Indian Ocean is negatively correlated with the NINO3 index. Although this response of the Walker Circulation is underestimated in the AMIP Runs, MOVE-C sufficiently represents the response, and therefore, it has improved zonal wind fields in the lower and upper troposphere around the Indian Ocean. The enhanced response of the Walker Circulation in MOVE-C RA is accompanied by the improved representation of the dry (wet) condition over the maritime continent (the western tropical Indian Ocean), and the divergence of winds in the upper troposphere over the East Asia region. Increase (decrease) of temperature in the lower troposphere over the tropics associated with El Niño's (La NiÒa's) are also reproduced better in MOVE-C RA. The mechanism of these improvements will be also discussed in the presentation.