A Reanalysis Experiment using a Coupled Atmosphere-Ocean Data Assimilation System in JMA/MRI

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JMA/MRI have developed a coupled Data Assimilation (DA) system, MRI-CDA1, based on JMA’s operational systems. The system adopts so-called weakly-coupled data assimilation procedure in which a coupled atmosphere-ocean model simulates the time-evolutions of the atmosphere and ocean fields while separated analysis routines generate analysis increments of the atmosphere and the ocean for modification of the coupled model fields. MRI-CDA1 is composed of the global atmosphere DA system for numerical weather predictions, NAPEX, the global ocean DA system for seasonal predictions, MOVE-G2, and the coupled atmosphere-ocean model for seasonal predictions, JMA/MRI-CGCM2.

MRI-CDA1 is applied to a coupled reanalysis experiment for the period from November 2013 to December 2015. Comparison of the reanalysis result with Japanese 55-year Reanalysis (JRA-55) indicates that the overestimation of the sea surface latent heat flux found in JRA-55 disappears in the reanalysis of MRI-CDA1. Consequently, the coupled system improved the global ocean heat budget. MRI-CDA1 also effectively suppresses the excess rainfall in the tropics in JRA-55, particularly in the Intertropcal Convergence Zone (ITCZ) in the Pacific. Anomaly correlation coefficients of precipitation in MRI-CDA1 with observation-based datasets (CMAP and GPCP) have quite similar distributions with the distribution for JRA-55, but decreases in a few areas. Although the sea surface temperature field is well reproduced by MRI-CDA1, the equatorial Pacific thermocline is shallower and the Pacific Equatorial Undercurrent is weaker than those in an uncoupled ocean reanalysis generated by MOVE-G2. These differences are likely to stem from difference of the bulk formula of the wind stress fields which force the ocean model.

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