Precipitation-SST relationship in a reanalysis dataset by a coupled atmosphere-ocean data assimilation system of JMA/MRI

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Precipitation amount of a global atmospheric reanalysis dataset is the accumulated amount of precipitation predicted in assimilation cycles and is not a value directly analyzed. However, it indicates the performance of the data assimilation system comprehensively. In particular, the local relationship between precipitation and sea surface temperature (SST) has been used as an indicator of simulation performance of atmospheric-ocean interactions in a reanalysis.

In this study, we focused on the lag correlation between precipitation and SST on the intra-seasonal time scale using two-year reanalysis experiments of a coupled atmosphere-ocean data assimilation system which is under development at Japan Meteorological Agency/ Meteorological Research Institute (JMA/MRI) (Fujii et al., 2017). The experiment was evaluated by comparing with observation datasets, JRA-55, and an uncoupled reanalysis experiment.

Relationship between precipitation and SST in the coupled reanalysis experiment simulates the observed-relationship better than that of JRA-55 in the western equatorial Pacific, although there are differences such as the different timings of the peaks of the positive and negative correlation and the underestimation of the simultaneous correlation. In the uncoupled reanalysis experiment, the relationship is similar to that in JRA-55. Therefore, the coupled data assimilation system simulates the observed-relationship most appropriately among these reanalysis datasets.

However, when using the same SST to examine the lag correlation of the precipitation in the two experiments, the lag correlation of the coupled reanalysis experiment is almost consistent with that of the uncoupled experiment. The difference of the lag correlation between the two reanalysis experiments attributes to the different SSTs. This suggests that the precipitation of the coupled assimilation system in the target area are strongly constrained by atmospheric data assimilation, rather than determined by SST variation.

Keywords: coupled atmosphere-ocean data assimilation system, simulation performance of precipitation-SST relationship in the tropics