Enhanced correlations between SST and precipitation in the weather time scale represented by a coupled atmosphere-ocean data assimilation system

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The Meteorological Research Institute (MRI) of the Japan Meteorological Agency has developed a weakly-coupled atmosphere-ocean data assimilation system, MRI-CDA1, and coupled reanalysis experiments based on MRI-CDA1 are conducted for the period from November 2013 to December 2015. Then we examined the relationship between sea surface temperature (SST) and atmospheric elements in the one-to-ten-day time scale which is the typical time scale for weather variation. In the coupled reanalysis, the variation of SST is positively correlated with the variation of precipitation with one-day lag, and the variation of precipitation is negatively correlated with the variation of SST with one-day lag, particularly in the tropics. High SST, thus, induces atmospheric convection and the convection induces low SST in turn. These lagged correlations mostly disappear between precipitation and prescribed SST data in an uncoupled atmospheric reanalysis. When the prescribed SST is replaced by the SST in the ocean data assimilation system forced by the atmospheric reanalysis, the lagged correlations are recovered but weaker than those in the coupled reanalysis. Thus, the lagged correlations are enhanced with coupled data assimilation. In addition, correlations become weaker also when the prescribed SST is replaced by the SST in the coupled reanalysis, which means that the precipitation field in the coupled reanalysis is changed in order to adjust to the SST field driven by the coupled model. This is contrastive to the longer (intraseasonal) time scale in which the atmospheric field in the coupled reanalysis is mostly unchanged from the conventional atmospheric reanalysis but SST filed is adjusted to the atmospheric fields. This effect of coupled data assimilation enhancing the correlations between SST and precipitation may cause improvement of the precipitation field over the uncoupled atmospheric analysis.

Keywords: Coupled Data Assimilation, Coupled Reanalysis, Air-Sea Interaction, Sea Surface Temperature, Precipitation

