Verifying surface heat fluxes in Reanalyses and CFSv2 with Revelle and RAMA observations during the DYNAMO period

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Air-sea interaction is an important process in the evolution of the Madden-Julian Oscillation (MJO). To correctly represent the air-sea interaction, numerical models are required to realistically simulate surface fluxes and the associated sea surface temperature (SST). In this study, we verify the surface solar radiation (SW) and latent heat (LH) fluxes at 80.5E/0N in three reanalyses (CFSR, MERRA, and ERA-I) and NCEP climate forecast system version 2 (CFSv2) for October and November 2011 of the DYNAMO campaign period. There were two strong MJO events during these two months. The reanalyses and CFSv2 forecast are verified against observations from Revelle and RAMA (Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction). Revelle covered the Special Observing Period (1 October - 9 November 2011) and RAMA covered the. In addition to SW and LH fluxes, forecast rainfall and SSTs from CFSv2 are also analyzed.

The analysis shows that reanalyses reproduced the overall evolution in the observation. However, there exist substantial uncertainties between individual reanalyses and the observation, and the reanalysis ensemble mean gives the best match with the observation. All reanalyses over estimate LH when evaporative cooling is strong and CFSR also underestimates LH when evaporative cooling is weak. The performance of CFSv2 forecast depends on lead time. During the first 10 days, CFSv2 reproduced the observed evolution with reasonable amplitude. In the forecast after 10 days, CFSv2 forecasted heat fluxes lagged the observed, especially for the second MJO event in November 2011. Such lagged heat fluxes in the CFSv2 correspond to a phase lag in the forecasted SST. The lag in surface heat fluxes and SST are associated with slower eastward propagation of the convection in the CFSv2.