Role of Ocean Data Assimilation in improving NCEP-CFS based monsoon forecast

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The Indian summer monsoon (from June to September) rainfall is of great importance to India's agriculture and economy as 60-90% of annual rainfall is received during this season. Severe flood and drought conditions over the Indian subcontinent are the result of intraseasonal oscillations within the monsoon period. The fundamental driving mechanism of the monsoon cycle is the thermal contrast between land and ocean, sea surface temperature (SST) and moisture are crucial factors for its evolution and intensity [Cherchi et al., 2007]. Recent studies highlight the role of tropical Pacific and Indian Ocean SST in Indian summer monsoon and its interannual variability.

National Centers for Environmental Prediction (NCEP) Coupled Forecast System (CFS) is selected to play a lead role for monsoon research (seasonal prediction, extended range prediction, climate prediction, etc.) in the ambitious Monsoon Mission project of Government of India [Samir et al., 2013]. Global Ocean Data Assimilation (GODAS) is the ocean data assimilation model for the Modular Ocean Model (ocean component of CFS).

It is important to note that improvement in ocean initial state and an improved SST analysis will lead to better monsoon forecast with the coupled forecast system. The present study investigates the role of ocean data assimilation in improving the CFS- based monsoon forecast. The GODAS assimilation method is the 3DVAR scheme [Derber and Rosati, 1989]. Surface and subsurface ocean data (temperature and salinity) from different observational platforms like ARGO, RAMA etc are assimilated to prepare the ocean analysis. To quantize the role of ocean data assimilation, a control run is also carried out without assimilating observations to MOM4. The results indicate that ocean data assimilation provides improved SST analysis (by improving the SST up to ~2°C) compared to control run and leads to better monsoon forecast. The data assimilations resulted better ocean dynamics and represent the thermocline structure well. The improvement in the monsoon rainfall forecast is mainly due to the evolution of better SST in the coupled model. The role of ocean data assimilation in capturing interannual monsoon variability is also examined.

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