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Simulation of Indian Ocean Dipole and its Impacts with a High-resolution Regional Coupled Model

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A regional coupled ocean-atmosphere model was developed to study the role of air-sea interactions associated with the Indian Ocean Dipole (IOD) and its impact on the Indian summer monsoon rainfall. The coupled model includes the Weather Research and Forecasting (WRF) model as the atmospheric component and the regional ocean modeling system (ROMS) as the oceanic component. The two way coupled model system exchanges sea-surface temperature from the ocean to the atmospheric model and surface wind stress and energy fluxes from the atmosphere to the ocean model every six hours. The coupled model was run for a period 2001-2008. During the study period the Indian summer monsoon was affected by three positive IOD events of 2006, 2007 and 2008. From the comparison of the results between the stand-alone WRF model and the coupled model, it is found that the coupled model captures the main features of the Indian monsoon better than the WRF model during these years. The coupled model produces a substantially more realistic spatial and temporal distribution of the monsoon rainfall compared to the uncoupled atmosphere-only model. The intraseasonal oscillations are also better simulated in the coupled model. These improvements are due to a better representation of the feedbacks between the SST and convection and highlight the importance of air-sea coupling in shaping the Indian Ocean influence on summer monsoon rainfall during the IOD events.

Keywords: Indian Ocean Dipole, WRF, ROMS