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Numerical Study of the Influence of Indian Ocean Dipole Mode (IODM) on Tropical Pacific Ocean——Roles of the Ocean Dynamic Process

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Indian Ocean dipole zonal mode (IODM) could affect the tropical Pacific Ocean and Atmospheric General Circulation through atmospheric remote teleconnection or ocean internal dynamic process. A number of research work have been done to study the former. In this study, we mainly discuss whether anomalous signal in the Indian Ocean could affect Pacific circulation through the ocean internal dynamic process or not. The numerical experiments are designed using the IAP/LASG Ocean General Circulation Model (OGCM) and the regional coupling version of a coupled GCM FGOALS_g1.1, in which the atmosphere and the ocean are coupled only in the tropical Pacific ocean (120E-280E, 15S-15N). In the OGCM, the ERA40 wind stress anomaly and surface heat fluxes anomaly from 1958-2000 are specified over the Indian Ocean whereas the surface forcing over the other regions is the climatological fields. We use the regionally coupled model to do the similar experiment, but in the tropical Pacific Ocean (120E-280E, 15S-15N) the ocean is coupled with the atmosphere. The results of these experiments show that the OGCM forced by the assimilated wind stress and heat flux of the European Center for Medium-range Weather Forecast could simulate the IOD event from 1958-2000. The upper ocean temperature anomalies and sea level anomalies related to the IOD events in the Indian Ocean propagate into the equatorial Pacific Ocean through the Indonesian Seas, and then produce significant SST and sea level anomalies in the eastern equatorial Pacific Ocean. Similarly, the regional coupled model could also simulate the propagation of the Indian Ocean abnormal signal into the Tropical Pacific Ocean through the wave process. But the response of the tropical Pacific Ocean to the IOD event has half year time-lag compared with the OGCM experiment, the anomalous signal of the tropical Pacific Ocean appears in second model year. The reason may be that the air-sea interaction processes and the mechanism are more complex when air-sea coupling is introduced in the coupled GCM.