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Role of Indonesian Throughflow in the interannual climate variations and predictability of the tropical Indo-Pacific Ocean

Dongliang Yuan, Hui Zhou, Xia Zhao, Jing Wang, Tengfei Xu, and Peng Xu
Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China (dyuan@qdio.ac.cn)

The role of Indonesian Throughflow (ITF) in forcing the tropical Pacific Ocean interannual variations is studied using lag correlations of observational data and dynamics studies based on numerical modeling. The significant lag correlation between the sea surface temperature anomalies (SSTA) in the southeastern Indian Ocean (SEIO) in fall and the SSTA over the Pacific cold tongue at the one-year time lag indicates potential predictability of ENSO beyond the period of one year. Significant correlations between the sea level anomalies (SLA) in SEIO in fall and the equatorial SLA in the Indonesian seas and in the western Pacific Ocean suggest that ITF play an important role in connecting the Indian Ocean Dipole (IOD) with the Pacific ENSO one year later. Significant correlation between SSTA in SEIO in fall with the subsurface temperature anomalies in the equatorial Pacific vertical section also support the oceanic channel dynamics of the two basins. Numerical simulations using a hierarchy of ocean models and climate coupled models have shown that the interannual sea level depressions in SEIO during IOD force enhanced ITF to transport warm water of the Pacific warm pool to the Indian Ocean, producing cold subsurface temperature anomalies, which propagate to the eastern equatorial Pacific and induce significant coupled ocean-atmosphere evolution. The ocean channel dynamics of the two basins are found to persist through the spring barrier, suggesting the importance of ITF in the predictability of the ENSO events. The latest CMIP5 model simulations are analyzed to assess the ability of the climate models in simulating this inter-basin connection.