

Interaction between El Nino and Extreme Indian Ocean Dipole

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Climate variability in the tropical Indo-Pacific sector has undergone dramatic changes under global ocean warming. Extreme Indian Ocean Dipole (IOD) events occurred repeatedly in recent decades with unprecedented series of three consecutive episodes during 2006-2008, causing vast climate and socio-economic impact worldwide and weakening the historic El Nino-Indian monsoon relationship. Major attention has been paid to El Nino influence on the Indian Ocean, but how the IOD influences El Nino and its predictability remained an important issue to be understood. On the basis of various forecast experiments by activating and suppressing air-sea coupling in the individual tropical ocean basins using a state-of-the-art coupled ocean-atmosphere model with demonstrated predictive capability, the present study shows that the extreme IOD plays a key role in driving the 1994 pseudo-El Nino, in contrast with traditional El Nino theory. The pseudo-El Nino is more frequently observed in recent decades, coincident with a weakened atmospheric Walker circulation in response to anthropogenic forcing. Our results suggest that extreme IOD may significantly enhance El Nino and its onset forecast that has being a long-standing challenge and El Nino in turn enhances IOD and its long-range predictability. The intrinsic El Nino-IOD interaction found here provides a hope for enhanced prediction skill of both of these events, and it sheds new light on the tropical climate variations and their changes under the influence of global warming.

Keywords: ENSO, IOD, air-sea interaction, climate prediction, coupled GCM