

## **Climate Variability of the Tropical Pacific and Indian Oceans**

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Research on the tropical Indo-Pacific climate variability dates back to the pioneering work of Walker about a century ago. Although some recent studies reemphasized the connection between the Pacific and Indian Oceans, the two basins are often studied separately, with a lot more attention to the El Niño-Southern Oscillation (ENSO) phenomenon in the Pacific basin. As a result, tremendous progress has been made in the theory, observation and prediction of ENSO. There is no doubt that ENSO mainly results from the ocean-atmosphere interaction within the tropical Pacific, but uncertainties remain on how strong this interaction is, on how much influences come from outside of the tropical Pacific and, consequently, on how predictable ENSO can be. It has been suggested that the impact of the Indian Ocean needs to be taken into account in order to further improve our understanding and prediction of ENSO.

The climate variability in the tropical Indian Ocean has been a subject of hot debate in recent years. Many empirical analyses indicate that the dominant interannual variability in the Indian Ocean is related to ENSO, with a basin-wide warming during El Niño, resulting from weakened Walker circulation and surface latent heat flux. On the other hand, some other studies suggest the existence of an Indian Ocean dipole (IOD), a mode of variability internal to the Indian Ocean, characterized by fluctuation of equatorial zonal temperature gradient. It is argued, however, that this mode is not truly independent since it is highly correlated with ENSO when the correlation is lagged and seasonally stratified. While the triggering processes of IOD is still not well understood, there are clear indications that, once started, it evolves through local ocean-atmosphere interaction, with dynamics similar to that of ENSO.

Considering the existence of the huge warm water pool that encompasses the tropical western Pacific and eastern Indian Oceans, and the coexistence of the atmospheric double-cell Walker circulation, it is only natural to assume that the climate variations in these two basins may take place hand in hand, and that a reasonable approach is to look at the larger picture of the whole tropical Indo-Pacific region and examine the common patterns of variability. Here we try to identify the dominant mode of short-term climate variability in the tropical Indo-Pacific, which we refer to as the Indo-Pacific Tripole (IPT), and to explore the main characteristics, the possible excitation mechanisms, and the practical implications of IPT. Our emphasis here is not just on ENSO, nor on IOD, but on the ocean-atmosphere interactions in both tropical Pacific and Indian Oceans, as well as the two-way connections between the two basins that may provide a unified view on the ENSO-IOD relationship.