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Heat distribution in the Tropical Indian Ocean during the prolonged La-Nina events during 1958–2017

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In the present study, heat distribution in the Tropical Indian Ocean (TIO) associated with the prolonged La-Nina events during 1958–2017 is examined using reanalysis/observations. A detailed analysis revealed that in response to prolonged La-Nina forcing, prominent east-west thermocline gradient in the equatorial Indian Ocean and the eastward extension of thermocline ridge in the southwestern TIO (TRIO) are noted. Anomalous subsurface warming, thermocline deepening, and sea-level increase are also evident in the eastern and southeastern TIO and Bay of Bengal (BoB) during the prolonged La-Nina events. Cross equatorial volume transport near the eastern boundary during the prolonged La-Nina years especially at 50m-150m depth levels indicates the pathways of Pacific water entering the north Indian Ocean (NIO), a feature that has a strong impact on the BoB dynamics and thermodynamics. Intense cooling of TRIO and the Arabian Sea and the eastward extension of TRIO are some of the characteristic features of the prolonged La-Nina years. These may have strong implications on the air-sea interaction associated with inter-annual and intra-seasonal variability over this region. Further, the subsurface heat content (50m–150m) in the eastern and southeastern TIO in general dominated by interannual variability whereas the TRIO region experienced the decadal variability. Subsurface heat content variations associated with prolonged La Niña years are discussed. This study shows that the warming and cooling events of TIO are very closely tied to the internal dynamics of the IO driven remotely by the Pacific through modulation of surface winds.