Abstract View

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Evolution of the ENSO Signal over the Indo–Pacific Domain *

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ABSTRACT

The evolution of the El Niño–Southern Oscillation (ENSO) in the Indian and western Pacific Oceans is investigated. Observations of sea surface temperature (SST), heat storage in the upper 400 m (HS), zonal surface wind stress (ZSWS), and meridional surface wind stress (MSWS) are mapped monthly onto a 2° latitude–longitude grid over as much of the Indian and western Pacific Oceans (i.e., 40°S–50°N, 40°E–180°) as possible for a 13-year period (1979–91). This grid resolution allows upper-ocean temperature variability to be resolved in the eastern Indian Ocean (i.e., Timor Sea) and the western Pacific Ocean (i.e., Philippine Sea). Time sequences of these variables at each grid node are band-passed filtered to yield the ENSO period scales of 3 to 6 years. Extended empirical orthogonal functions analysis is applied to the filtered time sequences, yielding an animation of the ENSO development in Indian and western Pacific Oceans. For the first modes of the four variables (SST, HS, ZSWS, and MSWS) peak amplitudes occur during the winter–spring of 1982–83 and 1986–87 at the same time as the peak phase of El Niño off the west coast of South America. Lag sequences for the four variables display signals in upper-ocean temperature along the East African coastline, which are instigated by ENSO signal alongshore wind stress there. From there, these signals propagate slowly eastward from the western to the eastern Indian Ocean and then on into the western Pacific Ocean where they merge with ENSO signal propagating slowly equatorward along the maritime western boundaries. The slow eastward propagation from there into the western Pacific Ocean occurs in the atmosphere, with the ocean either carried along with it or through ocean–atmosphere–land interaction. Time–longitude diagrams find the average speed of this eastward propagation ranging from 15 to 25 cm s^{-1} in SST, HS, and ZSWS. Westerly ZSWS anomalies tend to point toward warm SST anomalies. This suggests that the eastward propagation of the anomalies in the Indian Ocean results from ocean–atmosphere coupling on ENSO timescales as hypothesized for the equatorial Pacific Ocean.

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