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Detection of the eastern edge of the western Pacific warm pool

Christophe Maes (1), Joël Sudre (2), and Véronique Garçon (2)
(1) IRD, LEGOS, Toulouse, France (christophe.maes@ird.fr), (2) CNRS, LEGOS, Toulouse, France

The eastward advection of warm and less saline water from the western Pacific together with the westward advection of cold and more saline water from the central-eastern Pacific induces a convergence of water masses at the eastern edge of the so called western Pacific warm pool. The simultaneous zonal migrations of the western Pacific warm pool and atmospheric deep convection are essential precursors of the warming associated with the arrival of El Nino conditions in the eastern Pacific. These zonal displacements, ranging over about one fifth of the equatorial circumference of the Earth, are in phase with the Southern Oscillation and the characteristics of the main parameters involved in the air-sea interactions have been shown to be nearly constant on each side of such convergence zone. The zonal displacements associated with the western Pacific warm pool are at the origin of a notable modification of the delayed action oscillator theory, the leading theory for the El Nino–Southern Oscillation (ENSO) phenomenon. The variability of the eastern edge of the warm pool is thus crucial to understand and to monitor within the context of seasonal-to-interannual climate variations. The analysis of satellite-based ocean color data shows that low concentrations of surface chlorophyll-a found in the equatorial region of the Pacific Ocean varies in phase with the eastern edge of the western Pacific warm pool. As is true for high sea surface temperatures, the existence and maintenance of these low concentrations are linked to the upper ocean stratification due to salinity. The present study also establishes the quasi permanence of a frontal zone in chlorophyll-a separating the regimes of the western region and the eastern-central cold tongue and, through the identification of this front in satellite-based ocean color data, it provides, for the first time, a reliable method for locating the eastern edge of the warm pool from surface observations only. Finally, the recognition of this front offers the opportunity to define a simple and robust index of the horizontal extension of the western Pacific warm pool within the context of ENSO variability. These results suggest that coupled models used for El Nino research and forecasting should be able to reproduce these important features.