Abstract View

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Hindcast/Forecast of ENSO Events Based upon the Redistribution of Observed and Model Heat Content in the Western Tropical Pacific, 1964–86

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ABSTRACT

The redistribution of observed upper-ocean heat content in the western tropical North Pacific for the four-year period 1979–82 was shown by Pazan et al. to provide a qualitative hindcast capability for the 1982–83 ENSO event. A related study (Inoue et al.) demonstrated that nearly 50% of the observed heat content redistribution in the western tropical North Pacific for the four-year period 1979–82 could be simulated by a linear, upper-ocean, numerical model driven by observed wind stress estimates. In this study, the redistribution of numerical model heat content as evidenced in model dynamic height in the western Pacific during the 22-year period 1964–85 is examined for its ability to hindcast and forecast ENSO events in this period. Complex EOF analysis is applied to the onset phase of ENSO events occurring in 1968–69, 1972–73, 1976–77, and 1982–83; it is used to determine the characteristic redistribution of heat content (dynamic height) prior to the mature phase of ENSO events. The first complex EOF explained 53% of the interannual variance of the numerical model anomalous dynamic height in the 22-year model data records. This analysis finds model dynamic height in the Northern Hemisphere to be characterized by wind-driven westward propagating, baroclinic Rossby wave activity, having a relatively stable period of 3–4 years over the 22-year period. The complex time series associated with these first spatial eigenfunctions are used to construct observed and model hindcast indices that yield high values one year prior to the mature phase of ENSO events of the period. They do not peak when ENSO events do not occur. These indices achieve these high values due to the incidence upon the Philippine coast in fall/winter of a positive anomaly in dynamic height propagating from the east at nondispersive (Rossby) long-wave speeds. The model dynamic height data have the advantage over the observed dynamic height of being available in near-real time (i.e., within a month of the present), which makes it useful in providing a near-real time forecast of future ENSO events. Application of this model forecast index to the upcoming year is discussed.

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