Abstract
Although warm El Niño-Southern Oscillation (ENSO) events, also called El Niño events, first caught the attention of the wider scientific community for their impacts on global seasonal weather anomalies, it is now widely recognized that cool-ENSO (La Niña) events, also drive socio-economically important anomalies. The importance of better understanding the effects and processes controlling the predictability and impacts of La Niña events rivals the importance of improving the understanding of these aspects of El Niño events. We show here that subseasonal events of easterly wind stress in the western and central tropical Pacific play an important role in the onset and evolution of La Niña events. These easterly wind surge events are identified using reanalysis wind stress fields, validated against buoy measurements. Analysis of the observed changes in sea surface temperature following them in the 1986-2012 period. As well as experiments with easterly wind surge forcing of an ocean general circulation model, show that these easterly surges, whose frequency is a function of ENSO state, are able to affect La Niña events in a fashion analogous to their westerly wind event counterparts that have been shown to be important in the onset and evolution of El Niño events.

Zonal Wind Spectra in the Western Tropical Pacific

EWS Composite Wind Stress

EWSs have smaller wind speed scales than WWEs, but comparable wind stress anomaly amplitudes. EWSs occur across the entire ENSO Pacific Ocean, with highest numbers near the Date Line.

Near-Date Line Eq. Pac. Wind Stress Anomaly

A single EWS that occurs during ENSO-neutral conditions drives waveguide cooling of a few tenths of a degree C, just like single WWEs drive a few tenths of warming.

Model SSTA from a series of EWSs

A series of EWSs that includes the ramp-up in frequency associated with cooler ENSO SSTAs is sufficient to drive a La Niña in the model.

High outgoing-longwave-radiation (OLR) days link to easterly wind stress events

Warming the number of “clear sky” days seen from Mar to Dec each year leads to an OLR La Nina index that clearly identifies a subset of the years defined as La Niña based on Niño3.4 and the common definition. We refer to these as the “OLR La Nina” years. In the 1974-2012 period there are 8 OLR La Nina years, and 6 others with La Nina status by SSTA, but not OLR (the “non-OLR La Nina years”).

The OLR La Nina years have a usefully strong connection to seasonal weather anomalies over most of the regions conventionally found to have La Nina-associated anomalies. The non-OLR La Nina years have much weaker associations.