

Are there really different types of ENSO? What can be learned from reanalyses, reconstructions, and the CMIP5 historical runs

Benjamin Giese, Hank Seidel, and Chunxue Yang
Texas A&M University

Sulagna Ray
LOCEAN/IPSL

There are now ocean reanalyses, SST reconstructions and CMIP5 historical runs that depict the state of the tropical Pacific Ocean for at least the last 150 years. These data sets are used to determine several characteristics of ENSO, including the location, strength, frequency, duration, and direction of propagation of ENSO events. We address two questions: Are there distinctly different types of ENSO based on these characteristics? Is there an identifiable change of these characteristics over time?

The ocean reanalysis that we use is based on an 8-member ensemble of reanalyses (SODA 2.2.6) using ensemble member forcing from an extended run from the 20CR atmosphere reanalysis. The ocean reanalysis covers the period from 1861-2010 and assimilates observed SST data from ICOADS 2.5. The reanalysis shows that there is a broad range of variability in all of the characteristics. The reanalysis shows that the location of ENSO is normally distributed about a single mean value, suggesting that there are not different types of ENSO based on location. The distributions of strength and duration are not obviously normal, so that it is possible that there are different types based on these characteristics. All of the ENSO characteristics have some manifestation of decadal variability, however none of the characteristics have a trend that can shown to be significantly different than zero. However, given the large variance of ENSO characteristics, even 150 years does not contain enough ENSO events to accurately determine if ENSO has changed.

The reanalysis results are largely supported by both the SST reconstructions and CMIP5 historical runs. After the 1950s the ENSO in the reconstructions is similar to ENSO in the reanalysis. Before the 1950s, the timing of ENSO events is similar between the various products, but the amplitude of events can be different. The CMIP5 models show a wide range of characteristics, with ENSO events that range from too far in the west to too far in the east, and from some models showing very weak ENSO while some models have quite realistic strength. None of the models appear to have different types of ENSO, in agreement with the reanalysis and the reconstructions.