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Abstract

The Bjerknes stability (BJ) index has frequently been used to measure the stability of the Pacific climate state with respect to the occurrence of El Niño-Southern Oscillation (ENSO) events. Although it has been recently criticized for not always reflecting the heat budget accurately, the BJ index nicely distinguishes the effects of different feedbacks on the growth of the ENSO mode of variability. Its main disadvantage is, however, that it has been determined from reanalysis products but not from available observations. This work proposes a similar stability index which is easier to evaluate. Tools of complex network theory are used to reconstruct a climate network from available sea surface temperature data. The new stability index S_d is derived from one of the topological properties (connectedness) of this network. By using output from the Cane-Zebiak model, we demonstrate that S_d provides similar information as the BJ index and can monitor whether an ENSO event is sub- or supercritical. By considering observed temperature data, we show that the 1972 and 1982 events were subcritical (excited by stochastic noise) while the 1997 and 2009 events were supercritical (sustained oscillation).