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Assessing the 21st century shift in ENSO variability in terms of the Bjerknes stability index

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A decadal change in the character of ENSO was observed around year 2000 towards weaker amplitude, higher frequency events with an increased occurrence of central Pacific El Niños. Here these changes are assessed in terms of the Bjerknes stability index that serves as a measure of the growth rate of coupled ocean-atmosphere interactions. The individual terms of the index are calculated from ocean reanalysis products separately for the time periods 1980 to 1999 and 2000 to 2010. The spread between the products is large, but they show a robust weakening of the thermocline feedback owing to a reduced thermocline slope response to anomalous zonal wind stress as well as a weakened wind stress response to eastern equatorial Pacific SST anomalies. These changes are consistent with changes in the background state of the tropical Pacific: cooler mean SST in the eastern and central equatorial Pacific result in reduced convection there together with a westward shift in the ascending branch of the Walker circulation. This shift leads to a weakening in the relationship between eastern Pacific SST and longitudinally averaged equatorial zonal wind stress. Despite a steeper mean thermocline slope in the more recent period, the thermocline slope response to wind stress anomalies weakened due to a smaller zonal wind fetch that results from ENSO related wind anomalies being more confined to the western basin. As a result, the total BJ index is more negative, corresponding to a more strongly damped system in the past decade compared to the 1980s and 1990s.