



A 215 year coral proxy record reveals time-varying relationship between El Niño-Southern Oscillation and sea surface temperatures in the Leeuwin Current of the southeast Indian Ocean

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The Leeuwin Current (LC) is a key driver of the marine environment offshore western and southwestern Australia. Interannual variations in LC strength are related to the El Niño-Southern Oscillation (ENSO) events originating in the equatorial Pacific, with marked stronger flow during La Niña years and weaker flow during El Niño years (Feng et al., 2008). A prominent recent example is the 2011 heat wave off Western Australia caused by the unusually strong 2010-2011 La Niña event, increased heat flux into the ocean and a record strength of the LC (Pearce and Feng, 2012).

To investigate the longer term variability of the LC we measured annually-resolved proxy records (Sr/Ca and oxygen isotopes) of sea surface temperature (SST) from coral cores for the past \sim 200 years. Corals were sampled from the Houtman Abrolhos islands within the core of the LC. Our data were combined with a previously published oxygen isotope record (Kuhnert et al., 2000) to provide a well replicated proxy dataset that extends from 1795 to 2010.

The Houtman Abrolhos coral data indicate a strong warming trend over the past 200 years that exceeds the trend in SST reconstructions based on HadSST1 and ERSSTv3b. The coral data show a significant correlation with variation in LC's strength as monitored by sea-level changes in Fremantle (Western Australia) since 1900. The variability of the Fremantle sea-level record is significantly correlated with ENSO (Feng et al., 2004). The correlation of our coral index with the Nino3.4-Index (ENSO; 1854-2010) was strongest over the past 30 years when SST at the Abrolhos were warmest. The relationship with ENSO weakened between 1960-80 and was stable between 1920-1960, while between 1890-1920 the correlation was again weaker. Pre-1890, the correlation of the coral index with ENSO increased slightly. Our results are largely consistent with similar correlations based on HadSST1 and ERSSTv3b for the Houtman Abrolhos.

Our new coral index provides new historical perspectives on variability and changes of the thermal history in this significant oceanographic feature and new insights into long-term ENSO teleconnections of the Leeuwin Current.

References

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