



The sensitivity of ENSO to external forcings: insights from the past

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El Niño-Southern Oscillation (ENSO) is the dominant mode of interannual variability within the climate system. However, our knowledge of past changes in ENSO variance remains uncertain, as does our understanding of ENSO's response to external forcings. Here, we explore both questions by combining geochemical data from central Pacific corals with a suite of forced and unforced simulations conducted using the CSIRO Mk3L and GFDL CM2.1 climate system models. On millennial timescales, the coral data reveal a statistically-significant increase in ENSO variance over the past 6,000 years. This trend is not consistent with the unforced model simulations, but can be reproduced once orbital forcing is taken into account. Analysis of the simulations reveals that increasing ENSO variance arises from a weakening of the Asian summer monsoon circulation and an associated weakening of the Pacific Walker Circulation. On decadal timescales, natural forcings do not appear to influence the strength of ENSO; however, there is evidence that anthropogenic influences caused a strengthening of ENSO variability during the industrial period. Combining these results, a picture emerges: (i) on multi-decadal timescales and longer, ENSO can exhibit a systematic response to external forcing, but (ii) on shorter timescales, variability arises from within the ENSO system itself.