

Will there be a significant change to El Niño in the 21st century?

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The El Niño/Southern Oscillation (ENSO) response to anthropogenic climate change is assessed in the latest version of the NCAR Community Climate System Model (CCSM4). The 20th century ensemble is compared with the pre-industrial control simulation and several 21st century projections, as well as stabilized climate simulations. ENSO variability weakens slightly with CO₂; however, a variety of significance tests reveal that changes are insignificant at all but the highest CO₂ levels. The same lack of significance is seen for climate change-induced alterations in atmospheric teleconnection patterns and leading modes of ENSO variability, as well as other diagnostics. A comparison of long control simulations under 1850 and 1990 conditions then shows that ENSO changes do become significant on centennial timescales, indicating that the lack of signal in the 20th vs. 21st century ensembles is due to the short simulation duration. The tropical thermocline adjustment to climate change has not yet propagated into the tropics by 2100, for any of the 21st century ensembles. This seems to represent a real time lag in the dynamical adjustment to radiative forcing, which cannot be mitigated by increasing the ensemble size. These results strongly suggest that 21st century simulations are simply too short for identification of significant ENSO changes: even a few decades of changes cannot be attributed to present-day CO₂ emissions, only to a combination of natural variability and past radiative forcing.