NCAR | CLIMATE & GLOBAL DYNAMICS

CGD Seminar Series

Future increase in extreme El Nino supported by past glacial changes

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Time: 11am – 12pm

For Zoom information, please contact Tracy Baker tbaker@ucar.edu

For live stream information, visit the CGD Seminar Webpage

ABSTRACT

El Niño events, the warm phase of the El Niño-Southern Oscillation (ENSO) phenomenon, amplify climate variability throughout the world. Uncertain model predictions limit our ability to assess whether El Niño events could become stronger or more frequent in response to greenhouse warming. Paleoclimate records provide estimates of past changes, but it is unclear if they can constrain the mechanisms underlying future ENSO predictions Using numerical simulations we uncover a mechanism driving consistent changes under glacial boundary conditions as well as under future greenhouse warming, allowing model validation against paleoclimate data. The simulated mechanism is consistent with the dynamics of observed extreme El Niño events, which develop when warm pool waters expand rapidly eastward due to strongly coupled ocean currents and winds. We show that this air-sea coupling is highly sensitive to both global cooling and warming via changes in the Walker Circulation and its influence. on the oceanic mixed layer. Under colder glacial conditions, a stronger Walker circulation and a deeper mixed layer weaken air-sea coupling impeding the occurrence of extreme El Niño. This response explains reduced temperature variability during the last glacial period inferred from multiple, independent reconstructions of past ENSO variability. Conversely, under greenhouse warming, a weaker Walker circulation and a shallower mixed layer make ocean currents more responsive to winds. A future strengthening of this air-sea coupling in response to warming could lead to more frequent extreme El Niño, exacerbating the impact of anthropogenic emissions on ecosystems and societies across the globe.