EGU24-8581, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-8581
EGU General Assembly 2024

Increased predictability of extreme El Niño from decadal interbasin interaction

Xuan Ma[1], Rizhou Liang[1], Xiaosong Chen[1], Fei Xie[1], Jinqing Zuo[3], Cheng Sun[2], and Ruiqiang Ding[2]
[1]School of Systems Science / Institute of Nonequilibrium Systems, Beijing Normal University, Beijing, China.
[2]Key Laboratory of Environmental Change and Natural Disasters of Chinese Ministry of Education / College of Global Change and Earth System Science, Beijing Normal University, Beijing, China.
[3]CMA Key Laboratory for Climate Prediction Studies, National Climate Centre, China Meteorological Administration, Beijing 100081, China.

Predicting extreme El Niño–Southern Oscillation (ENSO) events remains a formidable task. Utilizing eigen microstates (EMs) of complex systems, we elucidate the interplay of two key sea surface temperature (SST) anomaly modes, the newly identified North Atlantic–west Pacific Mode (NAPAM) and discovered Victoria Mode (VM). Our findings demonstrate that a cold NAPAM phase coupled with a positive VM phase markedly elevates the probability of extreme El Niño events; NAPAM's decadal variability serves as a key modulator of extreme El Niño events' frequency. Our empirical model, capitalizing on these modes, achieves robust forecasts with a 6–8 month lead time and boasts a 0.73 correlation with the observed ENSO index in hindcasts. Notably, the model precisely forecasts the intensity of four landmark extreme El Niño episodes: 1982/1983, 1987/1988, 1997/1998, and 2015/2016. Our findings offer promising avenues for refining ENSO predictive frameworks and deepen our understanding of the key climatic drivers.