EGU24-2466, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-2466
EGU General Assembly 2024

Asymmetric Influences of ENSO Phases on the Predictability of North Pacific Sea Surface Temperature

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The North Pacific sea surface temperature (SST) exerts profound climatic influence. El Niño-Southern Oscillation (ENSO) significantly impacts North Pacific SST, yet the influence from ENSO's distinct phases on SST predictability remains unclear. Overcoming model limitations, this study assesses SST predictability under diverse ENSO phases using reanalysis. Quantifying predictability limits (PL), results unveil asymmetry: El Niño PL at 5.5 months, La Niña at 8.4 months, and Neutral at 5.9 months. This asymmetry mirrors contemporary multimodal prediction skills. Error growth dynamics reveal La Niña's robust signal strength with slow error growth rate, contrasting El Niño's weaker signal and faster error growth. Neutral exhibits intermediate signal strength and elevated error growth. Physically, predictability signal strength aligns with SST variability, whereas error growth rate correlates with atmospheric-ocean heating anomalies. La Niña, inducing positive heating anomalies, minimizes atmospheric noise impact, resulting in lower error growth. The results are beneficial for improving North Pacific SST predictions.