ENSO Predictability: Initial Condition Signal vs. Uncoupled Atmospheric Noise

Despite substantial progress in recent years in our ability to simulate and to a lesser degree predict ENSO, a clear picture of what processes limit predictability remains elusive. Indeed, many studies argue that predictability is determined by the strength of the buildup of heat content along the subsurface equatorial Pacific Ocean, or preconditioning, whereas others assert that uncoupled atmospheric noise both internal and external to the tropical Pacific ultimately determines the limit of predictability. Yet outstanding questions remain about where, when, and how preconditioning is most effective in increasing predictability, how preconditioning and uncoupled noise impact predictability in concert, and to what extent low frequency changes in the background state alter predictability estimates. Confronting these questions is critical for assessing and improving our prediction systems, identifying forecasts of opportunity, and will affect how we design observing systems in the future. To address these questions, we propose a suite of ENSO predictability experiments. This approach not only facilitates a complete assessment of the role of preconditioning in ENSO amplitude and evolution, but also allows us to quantify the role of uncoupled atmospheric noise and changes in the background state in our predictability estimates. This work will advance our understanding of the physical mechanisms limiting our ability to predict ENSO events, with direct applications to both basic ENSO theory and real-time prediction.

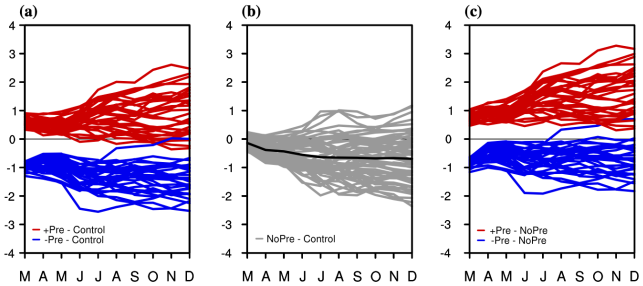

Figure 5a & 5b: Niño-3.4 SSTA in ° C computed by removing the Control annual cycle climatology from each R-Model-Cycle (labeled +Pre and –Pre) experiment, and R-Model (labeled No Pre) ensemble member. c) SSTA computed by removing the ensemble mean R-Model Niño-3.4 SST from each ensemble member in R-Model-Cycle.

We have two PhD positions available for this project!

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