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Improving StocSIPS forecasts by exploiting SST data: StocSST

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At time-scales longer than the lifetimes of planetary sized atmospheric structures — the macroweather regime¬¬ — global circulation models become stochastic with internal variability having scaling fluctuations over wide ranges. The Stochastic Seasonal and Interannual Prediction System (StocSIPS[1]) model, exploits the system's huge memory and uses historical data that force predictions to converge to the real world climate. StocSIPS is already skillful even though it only uses atmospheric data. Indeed, it is close the theoretical stochastic predictability limits expected when only atmospheric temperatures are used. Since the lifetime of ocean structures is longer, so is the corresponding ocean deterministic predictability limit. Therefore, combining sea surface temperatures (SST) with atmospheric data can potentially further improve the forecasts. In this work, we utilized the minimum square framework to optimally combine StocSIPS forecasts with various SST-based climate indices.
We found that for lag times between 0 and 12 months that macroweather global forecast skill improved up and somewhat beyond the atmosphere-only stochastic predictability limits. The regional 5° x 5° hindcasts also show improved skill, in particular over oceanic grid points. This mixed forecast offers a perfect complement to long range forecasting systems and the minimum square framework used here can be itself helpful for combining forecast systems.

[1] Lovejoy, S., Amador, L. del R., & Hébert, R. (2015) Earth System Dynamics, 6, 637–658.