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Does the Signal-to-Noise Paradox Exist in Subseasonal Predictions?

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One of the emerging topics in climate prediction is the issue of the so-called “signal-to-noise paradox”, characterized by too small signal-to-noise ratio in current model predictions that cannot reproduce the realistic signal. Recent studies have suggested that seasonal-to-decadal climate can be more predictable than ever expected due to the paradox. But no studies, to the best of our knowledge, have been focused on whether the signal-to-noise paradox exists in subseasonal predictions. The present study seeks to address the existence of the paradox in subseasonal predictions based on (i) coupled model simulations participating in phase 5 and phase 6 of the Coupled Model Intercomparison Project (CMIP5 and CMIP6, respectively), and (ii) subseasonal hindcast outputs from the Subseasonal Experiment (SubX) and the Subseasonal-to-Seasonal Prediction (S2S) projects. Of particular interest is the possible existence of the paradox in the new generation of GFDL SPEAR model, through the diagnosis of which may help identify potential issues in the new forecast system to guide future model development and initialization. Here we investigate the paradox issue using two methods: the ratio of predictable component defined as the ratio of predictable component in the real world to the signal-to-noise ratio in models and the persistence/dispersion characteristics estimated from a Markov model framework. The preliminary results suggest a potentially widespread occurrence of the signal-to-noise paradox in subseasonal predictions, further implying some room for improvement in future ensemble-based subseasonal predictions.