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Estimates of Decadal Climate Predictability from an Interactive Ensemble Model

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Decadal climate predictability has received considerable scientific interest in recent years; yet, the limits and mechanisms for decadal predictability are currently not well known. It is widely accepted that noise due to internal atmospheric dynamics at the air-sea interface influences predictability. The purpose of this paper is to use the interactive ensemble (IE) coupling strategy to quantify how internal atmospheric noise at the air-sea interface impacts decadal predictability. The IE technique can significantly reduce internal atmospheric noise and has proven useful in assessing seasonal-to-interannual variability and predictability. Here we focus on decadal timescales and apply the Nonlinear Local Lyapunov Exponent (NLLE) method to the Community Climate System Model comparing control simulations with IE simulations. This is the first time the NLLE has been applied to the state-of-the-art coupled models. The spatial patterns of decadal SST predictability are discussed from the perspective of internal atmospheric noise and ocean dynamics. Specifically, the analysis in the North Atlantic indicates that reducing internal atmospheric noise reduces decadal variability but can either increase or decreases decadal predictability, depending on locations. Subsurface predictability is also provided and we argue that ocean dynamics plays an important role in decadal variability and predictability.