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Land-Atmosphere Coupling Simulation and Its Role in Subseasonal-to-Seasonal Prediction

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Land-atmosphere (L-A) coupling can significantly contribute to subseasonal-to-seasonal (S2S) prediction. During periods of strong L-A coupling, land-atmosphere feedbacks are expected to enhance the memory of the system and therefore also the predictability and prediction skill. This study aims to evaluate S2S prediction of ambient surface air temperature under conditions of strong versus weak L-A coupling in forecasts produced with NASA's state-of-the-art GEOS S2S forecast system. Utilizing three L-A coupling metrics that together capture the connection between the soil and the free atmosphere, enhanced prediction skill for surface air temperature is observed for 3-4 week boreal summer forecasts across the eastern Great Plains when strong L-A coupling is detected at this lead by all three indices. The forecasts with strong L-A coupling in these "hot spot" regions exhibit warm and dry anomalies, signals that are well simulated in the model. Overall, this study provides insight into how better capturing relevant L-A coupling processes might improve prediction on subseasonal-to-seasonal timescales.