Seasonal prediction of North American temperature extremes in the GFDL SPEAR forecast system

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Skillful prediction of temperature extremes on seasonal scales is beneficial to multiple sectors. This study shows that the frequency of North American summertime (June–August) hot days and wintertime (December-February) cold days is skillfully predicted several months in advance in the newly developed Geophysical Fluid Dynamics Laboratory (GFDL) Seamless System for Prediction and Earth System Research (SPEAR) seasonal forecast system. Using a statistical optimization method, the average predictability time, we identify three large-scale components of the frequency of North American summer hot days that are predictable with significant correlation skill. It is shown that global warming, SST anomalies in the North Pacific, North Atlantic, tropical Pacific and local soil moisture anomalies all contribute to the skill. We also identify three predictable components of North American winter cold extremes that are skillfully predicted on seasonal scales. The predictability sources of cold extremes are the external radiative forcing, central Pacific El Nino and snow anomalies over mid-to-high latitudes of the North American continent. Potential application of this study is to reconstruct predictions of temperature extremes based upon the most predictable components, which has shown higher skill than model raw predictions.

Keywords: temperature extremes, prediction, seasonal, North America, GFDL SPEAR

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