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S2S Reboot: An Argument for Greater Inclusion of Machine Learning in Subseasonal to Seasonal (S2S) Forecasts

Judah Cohen (1,2)

(1) AER, Lexington, MA, United States (jcohen@aer.com), (2) Dept of Civil and Environmental Engineering, MIT, cambridge, MA, United States (judah@mit.edu)

The discipline of seasonal climate prediction began as an exercise in simple statistical techniques. However, today the large government forecast centers almost exclusively rely on complex fully coupled dynamical forecast systems for their subseasonal to seasonal (S2S) predictions while statistical techniques are mostly neglected and those techniques still in use have not been updated in decades. We argue that new statistical techniques mostly developed outside the field of climate science, collectively referred to as machine learning, can be adopted by climate forecasters to increase the accuracy of S2S predictions. We present an example of where unsupervised learning demonstrates higher accuracy in a seasonal prediction than the state-of-the-art dynamical systems. Finally, we show by comparing real-time dynamical model forecasts with observations from winter 2017/18 that dynamical model forecasts are almost entirely insensitive to polar vortex (PV) variability and the impact on sensible weather. Instead, statistical forecasts more accurately predicted the resultant sensible weather from a mid-winter PV disruption than the dynamical forecasts. The important implication from the poor dynamical forecasts is that if Arctic change influences mid-latitude weather through PV variability, then the ability of dynamical models to demonstrate the existence of such a pathway is compromised.