International workshop on seasonal to decadal prediction
Toulouse, France, 13-16 May, 2013

Short-term climate extremes: prediction skill and predictability

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Forecasts for extremes in short term climate (monthly means) are examined to understand current prediction capability and potential predictability. This study focuses on 2 m surface temperature and precipitation extremes over North and South America, and sea-surface temperature extremes in the Niño3.4 and Atlantic hurricane Main Development regions, using the Climate Forecast System (CFS) global climate model, for the period of 1982-2010. The primary skill measures employed are the anomaly correlation (AC) and root-mean-square error (RMSE). The success rate of forecasts is also assessed using contingency tables.

The AC, a signal-to-noise skill measure, is routinely higher for extremes in short-term climate than those when all forecasts are considered. While the RMSE for extremes also rises, especially when skill is inherently low, we find that the signal rises faster than the noise. Permutation tests confirm that this is not simply an effect of reduced sample size. Both 2 m temperature and precipitation forecasts have higher anomaly correlations in the area of South America than North America; credible skill in precipitation is very low over South America and absent over North America, even for extremes. Anomaly correlations for SST are very high in the Niño3.4 region, especially for extremes, and moderate to high in the Atlantic hurricane Main Development Region. Prediction skill for forecast extremes is similar to skill for observed extremes. Assessment of the potential predictability under perfect-model assumptions finds that predictability and prediction skill have very similar space-time dependence. While prediction skill is higher in CFS version 2 than in CFS version 1, the potential predictability is not.