Session: C39 Poster: TH165A

Short-term climate extremes: prediction skill and predictability

Emily Becker†; Huug van den Dool; Malaquias Pena
† Climate Prediction Center (NCEP/NWS/NOAA), USA
Leading author: ejbecker@gmail.com

In this study, we seek an answer to the question "how well can we currently predict short-term climate extremes?" By 'short-term climate', we mean, in practical terms, forecasts of monthly or seasonal means at long leads - i.e. not weather extremes, and not long-term climate change. Short-term climate extremes (STCE) have important implications for energy use, agriculture, and flood or drought preparation. In this study, we investigate our current ability to predict STCE at lead times of one to eight months over the Americas, with the goal of understanding the strengths and weaknesses of current models, and possibly more fundamental limitations to the ability to predict. We investigate both present-day prediction skill (what we can do now) and "predictability" (what we can do ultimately). We have examined prediction skill and predictability of near-surface STCE, in the form of monthly anomalies in 2-meter temperature, precipitation rate, and sea-surface temperature, using retrospective forecasts from two versions of the operational NOAA Climate Forecast System (CFS), a "state of the art" coupled ocean-land-atmosphere model. Extremes in soil moisture were assessed using the Leaky Bucket model with the CFS 2-meter temperature and precipitation. Three scenarios were studied: the prediction skill of the models over the entire timeseries of reforecasts; when an extreme event occurred in the observed record (i.e., an extreme occurred, was it predicted?); and verification of a predicted extreme (i.e. the model predicted an extreme, did one occur?). The forecast skill in this study is assessed using the anomaly correlation (AC) and root-mean-square error (RMSE). Skill is examined for the reforecasts both with and without cross-validation. As an assessment of the (potential) predictability under perfect model assumptions, the N-1 member ensemble mean was verified using the one remaining member. Prediction skill (measured by AC) is higher when only extremes are considered; this is true for all three parameters considered. Sea surface temperature extremes in the Niño 3.4 region have the highest ACs, with high scores out to eight month leads; ACs are also high in the Intra-American Seas region, which is relevant for Atlantic hurricane development. 2 m temperature extremes over South America have higher scores than over North America, especially at longer leads. Precipitation rate ACs are generally low beyond leads of a few months, and are substantially reduced when cross-validation is applied.