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Changing U.S. Extreme Temperature Statistics

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CHANGING U.S. EXTREME TEMPERATURE STATISTICS

Justin M. Finkel

Mentor: Jonathan Katz

The rise in global mean temperature is an incomplete description of warming. For many purposes, including agriculture and human life, temperature extremes may be more important than temperature means and changes in local extremes may be more important than mean global changes. We define a nonparametric statistic to describe extreme temperature behavior by quantifying the frequency of local daily all-time highs and lows, normalized by their frequency in the null hypothesis of no climate change. We average this metric over 1,218 weather stations in the 48 contiguous United States. In the period 1893-2014 there were statistically significantly fewer all-time record lows than would be found in the null hypothesis of unchanging climate. Record highs, by contrast, do not significantly differ from the null hypothesis. The metric is evaluated by Monte Carlo simulation for stationary and warming temperature distributions, permitting description of the statistics of historic temperature records by equivalent warming rates.