



## **The Likelihood of Recent Record Warmth**

Michael Mann (1), Stefan Rahmstorf (2), Byron Steinman (3), Martin Tingley (4), and Sonya Miller (1)

(1) Department of Meteorology, Pennsylvania State University, (2) Earth System Analysis, Potsdam Institute for Climate Impact Research, (3) Large Lakes Observatory and Department of Earth and Environmental Sciences, University of Minnesota-Duluth, (4) Departments of Meteorology and Statistics, Pennsylvania State University.

2014 was nominally the warmest year on record for both the globe and northern hemisphere based on historical records spanning the past one and a half centuries. It was the latest in a recent run of record temperatures spanning the past decade and a half. Press accounts reported odds as low as one-in-650 million that the observed run of global temperature records would be expected to occur in the absence of human-caused global warming. Press reports notwithstanding, the question of how likely observed temperature records may have been both with and without human influence is interesting in its own right. Here we attempt to address that question using a semi-empirical approach that combines the latest (CMIP5) climate model simulations with observations of global and hemispheric mean temperature. We find that individual record years and the observed runs of record-setting temperatures were extremely unlikely to have occurred in the absence of human-caused climate change, though not nearly as unlikely as press reports have suggested. These same record temperatures were, by contrast, quite likely to have occurred in the presence of anthropogenic climate forcing.