Session: B2 Oral presentation

Connecting tornado and extreme convective weather occurrence to climate variability and change

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The current year brings to the forefront a number of outstanding issues regarding the occurrence of tornadoes and other extreme convective weather, and how this relates to both internal climate variability and anthropogenic climate change. The first issue regards knowledge of the "true" climatology and historical trend of convective weather hazards. Note that tornado occurrence, for example, is derived from eyewitness reports, and that tornado intensity is based on damage. Thus, the historical time series is necessarily convolved with the growth of population, changes in reporting procedure, development of education and awareness programs, etc. We will demonstrate our methodology of using measurements from Doppler weather radar to constrain the damage-based intensity, and thus improve trends in intensity. We will also present our parallel effort of using of high-resolution dynamical downscaling for trend correction and reconstruction. Our basic approach involves a multi-decadal sequence of daily, high-resolution integrations of the Weather Research and Forecasting model, with artificial neural networks to identify and classify the severe convective weather in the model. The physical connection between the variability of convective weather and regional-scale atmospheric circulations is not well understood, but of course is of considerable interest. We will describe our means of deriving (seasonal, and regional) tornado anomalies, and then show how they compare to anomalies constructed using the North American Regional Reanalysis data from the period 1979-present. Insight is provided by some fairly basic sets of variables, such as soil moisture, 850-hPa specific humidity, mean sea-level pressure, and 500-hPa geopotential height. A multi-linear regression model is developed which includes these and a few other predictor variables. Some discussion will be devoted to how this approach could lead to seasonal outlooks for tornadoes and other convective weather hazards. We will conclude with a discussion of how our work is being extended to investigate the potential effects anthropogenic climate change on tornadoes and other extreme convective weather.