

Trans-Niño and Springtime Tornado Outbreaks in the U.S

Sang-Ki Lee^{1,2}, Robert Atlas², David Enfield^{1,2}, Chunzai Wang², and Hailong Liu^{1,2}

¹Cooperative Institute for Marine and Atmospheric Studies, University of Miami, Miami, Florida, USA

²Atlantic Oceanographic and Meteorological Laboratory, NOAA, Miami Florida, USA
USA

Abstract

The record-breaking U.S. tornado outbreaks in the spring of 2011 prompt the need to identify long-term climate signals that could potentially provide seasonal predictability for U.S. tornado outbreaks. Here we use both observations and model experiments to show that a positive phase Trans-Niño may be one such climate signal. Among the top ten extreme outbreak years during 1950-2010, seven years including the top three are identified with a strongly positive phase Trans-Niño. The number of intense tornadoes in April - May is nearly doubled during the top ten positive Trans-Niño years from that during ten neutral years. Trans-Niño represents the evolution of tropical Pacific sea surface temperatures (SSTs) during the onset or decay phase of the El Niño-Southern Oscillation. A positive phase Trans-Niño is characterized by colder-than-normal SSTs in the central tropical Pacific and warmer-than-normal SSTs in the eastern tropical Pacific. Modeling experiments suggest that warmer-than-normal SSTs in the eastern tropical Pacific work constructively with colder-than-normal SSTs in the central tropical Pacific to force a strong and persistent teleconnection pattern that increases both the upper-level westerly and lower-level southeasterly over the central and eastern U.S. These anomalous winds advect more cold and dry upper-level air from the high-latitudes and more warm and moist lower-level air from the Gulf of Mexico converging into the east of the Rockies, and also increase both the lower-tropospheric (0 ~ 6 km) and lower-level (0 ~ 1 km) vertical wind shear values therein, thus providing large-scale atmospheric conditions conducive to intense tornado outbreaks over the U.S.