



# Spring Tornado Activity in the United States Related to the GWO

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## Introduction

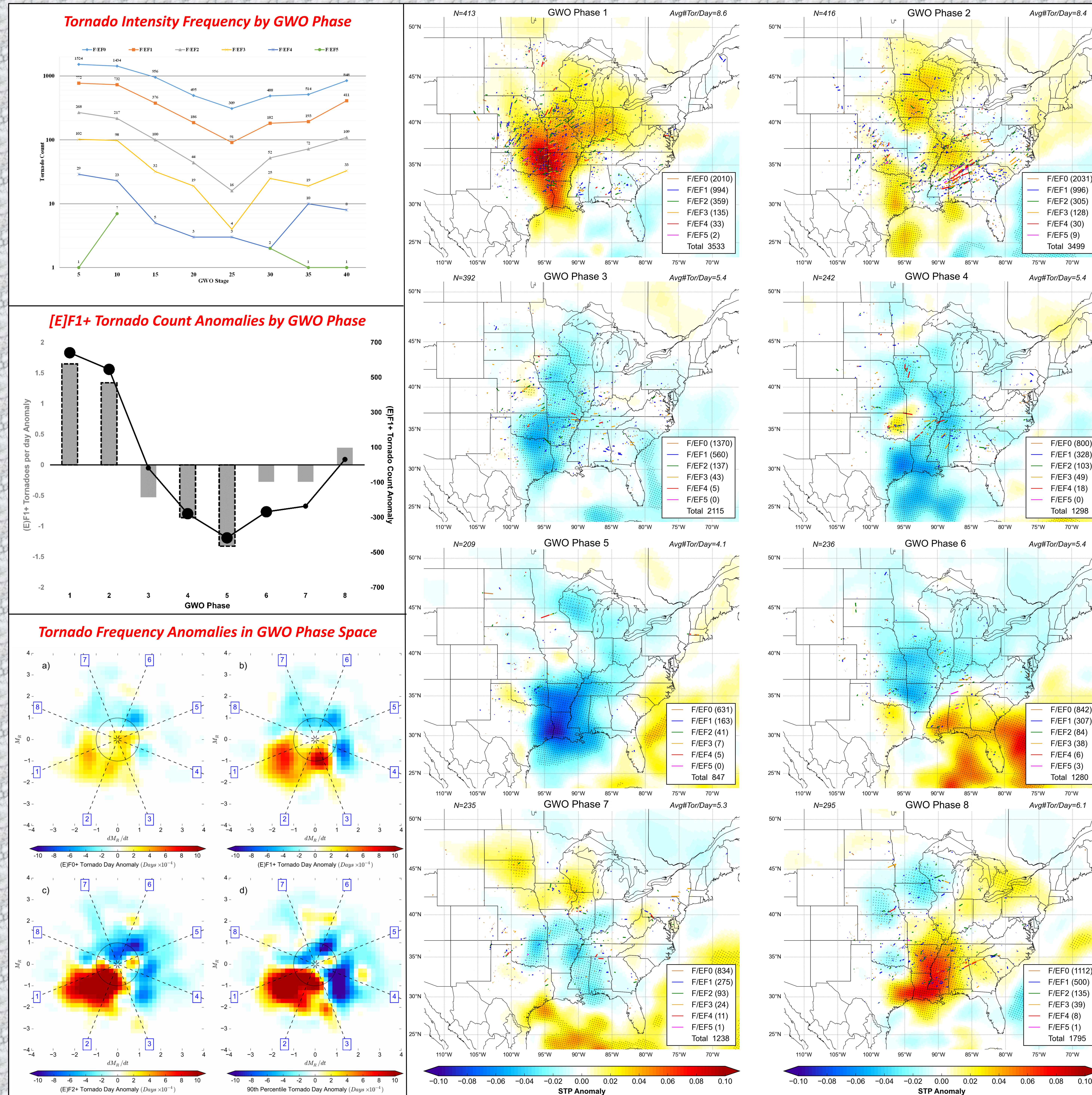
Global relative angular momentum, and the first time derivative, are used to explain nearly an order of magnitude in the variability of 1994–2013 United States boreal spring tornado occurrence. When plotted in a phase space, the **global wind oscillation (GWO)** is obtained. This global index accounts for changes in the global budget of angular momentum through interactions of tropical convection anomalies and extratropical dynamics including the engagement of surface torques. **This study shows that tornadoes are more likely to occur in low angular momentum base states and less likely to occur in high angular momentum base states.**

## Data & Methods

March–June tornado data were retrieved for the years 1994–2013 from the Storm Prediction Center (SPC). Corresponding GWO phase data were obtained from the Earth Systems Research Laboratory (ESRL).

Tornado counts, tornado days (a day in which a particular intensity tornado occurred), and tornado intensity were all binned by phase of the GWO (upper left figures). Various intensity levels and tornado outbreaks (a day in the CONUS with > 15 tornado reports) were also mapped as anomalies in GWO phase space, similar to that used for the MJO (lower left figures).

Spatial anomalies of the significant tornado parameter (color fill) and associated tornado reports by GWO phase are shown on the right. Stippling indicates 95% confidence using a Mann-Whitney U-test for the medians.



## Results

Various tornado frequency metrics are shown to increase when the global relative angular momentum budget and first time derivative are negative (GWO phases 8, 1, and 2).

This is similar to MJO phases found to favor tornado outbreaks (Thompson and Roundy, 2013), tornado activity (Barrett and Gensini, 2013), and severe hail (Barrett and Henley, 2015).

Significant tornado parameter environmental anomalies strongly correlate with the greatest density of tornado reports by GWO phase.

Overall, angular momentum explains a large amount of variance in U.S. spring tornado activity.

**For more information, please see:** Gensini, V. A., and A. Marinaro, 2016: Tornado frequency in the United States related to global relative angular momentum. *Mon. Wea. Rev.*, DOI: 10.1175/MWR-D-15-0289.1 [in press]

## Future Work

- Examine more seasons.
- Longer temporal record using NCEP/NCAR R2 data.
- Explore relationship in other parts of the world.
- Analyze hail and convective wind gusts.
- Sub-seasonal forecasts (ongoing).

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