Testing new environmental proxies for supercell tornadogenesis using HRRR analyses

Current state of the science

- Lower tropospheric SRH and LCLs, in addition to composite parameters, have improved our ability to forecast significant tornadic supercells versus nontornadic supercells
- Recent literature has highlighted the importance of near-ground shear, albeit with limited sample size
- VORTEX2 composite soundings have contrasting orientations of horizontal vorticity between nontornadic and tornadic supercells and this leads to specific storm scale features favorable for tornadogenesis/failure
- Testing new proxies is difficult unless calculated a priori
- Looking at shallower layers, in addition to the individual components of streamwise and crosswise horizontal vorticity, may lead to clearer boundaries between nontornadic and tornadic supercells

HRRR era proximity sounding database

- Using tornado reports from June 2015 to July 2018
- 3424 tornadoes filtered down to 1587 (804 EF1+)
- Null database of severe, nontornadic reports from 2017 courtesy of SPC
- HRRR analyses obtained from NCAR HPSS archive
- Proximity soundings from nearest neighbor grid point in the HRRR 00 h analyses

Old proxies and new proxies

- Comparing tornadic EF1+ supercells and nontornadic events with >= 2.00 in hail
- Both have similar CAPE, tornadic supercells have lower LCLs
- 0-1 km SRH is the most effective discriminator using traditional proxies, effective layer is the least useful depth for SRH calculations
- Differences in STP are not statistically significant at the 95% confidence interval
- Streamwise horizontal vorticity in the lowest 500 m has the greatest statistical significance between nontornadic and tornadic supercells tested so far
- Crosswise horizontal vorticity is not a useful predictor
- Statistical separation is greatest when focusing on the Great Plains region

Lots of future work!

- Redo analysis using 1-h or 2-h forecasts from the HRRR rather than 0-h analyses
- Generate soundings from a spatial average to smooth heterogeneity in HRRR?
- More stringent quality control with regard to precipitation
- Look at large scale patterns using Self Organizing Maps
- Calculate new parameters...what do you think might be important to tornadogenesis?