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

Caption: (top) significant tornado parameter distributions from Thompson et al. (2003); (middle) storm-relative helicity distributions from Esterheld and Giuliano (2008); (bottom) VORTEX2 composite near-inflow hodographs from Coffer and Parker (2017)

NonTor (16)

WeakTor (33)







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 ulletnontornadic events with >= 2.00 in hail
- Both have similar CAPE, tornadic ulletsupercells have lower LCLs
- 0-1 km SRH is the most effective discriminator using ullettraditional 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 lacksquarethe 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





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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?

