

RAOB Program - Tornado~TC index

Tornado~TC is an index that indicates potential for tornado development with landfalling tropical cyclones. It is completely sounding data independent.

Numerous meteorologists have spent hundreds of hours over many years studying tornadoes that were associated with landfalling tropical cyclones. Nearly all of these studies discussed the creation of a Tropical Cyclone Tornado Parameter - or TCTP. While most studies included predictors from multiple sources (such as soundings, radar imagery, cyclone movements, and storm proximity relationships), only one study was found which produced a TCTP algorithm composed solely from sounding data (Eastin, et al). While this algorithm lends itself to sounding program automation, these and many other research authors also recommend inclusion of a predictor not readily available to today's sounding programs. This predictor is the elusive mid-level dry intrusion layer, sometimes associated with TC-embedded frontal systems.

The RAOB Program not only combines the significant results from all these TCTP studies, but RAOB also incorporates the mid-level dry layer into its tornado parameter, called the Tornado~TC index. RAOB is able to find and quantify mid-level dry layers. It does this using RAOB's unique ability to employ "pattern recognition" scanning. Similar to today's medical CT-Scan technology, which virtually slices an object using multi-angle scanning, RAOB similarly performs multi-parameter scans of the entire sounding profile at 1-mb intervals. RAOB doesn't just make one scan, it makes multiple scans for key thermodynamic data, including temperature, humidity, CAPE, wind components and other data. RAOB's pattern recognition system uses these scanned profiles to perform bottom-up and top-down examinations to locate thermodynamic patterns in the sounding's profile. This is how RAOB is able to produce realistic Cloud layers, define significant Hazards, identify Heat Burst conditions, detect Flooding potential, and now RAOB can find and measure mid-level dry layers for its tropical cyclone tornado index.

While specific Tornado~TC component coefficients remain proprietary, the contributing components are (1) Favorable environmental lapse-rate structure*, (2) Low-level shear, (3) SRH, and (4) mid-level dry layer*. RAOB's Tornado~TC index is a combination of statistical and empirical relationships. Most importantly, it is completely composed of sounding data and independent of external data. As with any meteorological predictor, the user must apply local conditions to maximize parameter effectiveness. All TCTP studies find that the greatest probability for tornado development is in the right-front quadrant of moving tropical cyclones -- which the Tornado~TC index always assumes.

Since the Tornado~TC index is a numerically objective parameter, it provides a quick and consistent measure of tornado potential using only radiosonde data. Even though the Tornado~TC index is the first operational parameter of its kind, algorithm refinements will continue as more case studies and sample profiles become available, especially with respect to the mid-level dry layer.

* These parameters are determined by using RAOB's "pattern recognition" methodology.