DVD's Severe Weather Guidance Summary: How Does This Thing Work?

In a nutshell, the formula is as follows…using SREF or GFS Ensemble data, it takes the maximum probability of one of the following 11 combinations happening at each grid point.

1) Probability of sbcape >= 50 j/kg * probability of LCL <= 500 meters * probability of 0-1 km shear >= 42 kts * probability of 0-6 km shear >= 60 kts * PoP
2) P[sbcape] >= 100 * P[LCL] <= 600 * P[0-1 km shr] >= 40 * P[0-6 km shr] >= 55 * PoP
3) P[sbcape] >= 250 * P[LCL] <= 750 * P[0-1 km shr] >= 35 * P[0-6 km shr] >= 50 * PoP
4) P[sbcape] >= 500 * P[LCL] <= 850 * P[0-1 km shr] >= 30 * P[0-6 km shr] >= 45 * PoP
5) P[sbcape] >= 750 * P[LCL] <= 925 * P[0-1 km shr] >= 25 * P[0-6 km shr] >= 42 * PoP
6) P[sbcape] >= 1000 * P[LCL] <= 1000 * P[0-1 km shr] >= 20 * P[0-6 km shr] >= 40 * PoP
7) P[sbcape] >= 1500 * P[LCL] <= 1250 * P[0-1 km shr] >= 15 * P[0-6 km shr] >= 37 * PoP
8) P[sbcape] >= 2000 * P[LCL] <= 1350 * P[0-1 km shr] >= 10 * P[0-6 km shr] >= 35 * PoP
9) P[sbcape] >= 2500 * P[LCL] <= 1500 * P[0-1 km shr] >= 7* P[0-6 km shr] >= 30 * PoP
10) P[sbcape] >= 3000 * P[LCL] <= 1600 * P[0-1 km shr] >= 5 * P[0-6 km shr] >= 27 * PoP
11) P[sbcape]>=1 * P[mlcape] >=600 * P[700-500 mb lapse rate] >= 6.8 * P[0-6 km shr] >=35 * PoP

The first 10 checks are looking primarily for tornadoes or straight line winds, and the 11th check is looking exclusively for large hail. **Note: This algorithm will not work on summer "pulse" severe convection yet, but I hope to add checks for that by next summer.** The program also displays the probability of a favorable "sig severe" environment on the map similar to what SPC does by hatching the 10% or greater sig severe environment. The program currently uses the following thresholds for that.

1) P[sbcape] >= 100 * P[LCL] <= 500 * P[0-1 km shr] >= 42 * P[0-6 km shr] >= 62 * PoP
2) P[sbcape] >= 250 * P[LCL] <= 600 * P[0-1 km shr] >= 40 * P[0-6 km shr] >= 60 * PoP
3) P[sbcape] >= 500 * P[LCL] <= 750 * P[0-1 km shr] >= 35 * P[0-6 km shr] >= 55 * PoP
4) P[sbcape] >= 750 * P[LCL] <= 850 * P[0-1 km shr] >= 30 * P[0-6 km shr] >= 50 * PoP
5) P[sbcape] >= 1000 * P[LCL] <= 925 * P[0-1 km shr] >= 27 * P[0-6 km shr] >= 45 * PoP
6) P[sbcape] >= 1500 * P[LCL] <= 1000 * P[0-1 km shr] >= 25 * P[0-6 km shr] >= 40 * PoP
7) P[sbcape] >= 2000 * P[LCL] <= 1250 * P[0-1 km shr] >= 17 * P[0-6 km shr] >= 37 * PoP
8) P[sbcape] >= 2500 * P[LCL] <= 1350 * P[0-1 km shr] >= 10* P[0-6 km shr] >= 35 * PoP
9) P[sbcape] >= 3000 * P[LCL] <= 1500 * P[0-1 km shr] >= 7 * P[0-6 km shr] >= 30 * PoP
10) P[sbcape]>=1 * P[mlcape] >=1200 * P[700-500 mb lapse rate] >= 7.5 * P[0-6 km shr] >=40 * PoP

As an example, even if there is an 80% chance of any of the 5 individual things in any of the individual scenarios happening, the map would only display 0.8*0.8*0.8*0.8*0.8=33% chance of a favorable environment being in place, i.e. the probability of all 5 things happening at once. Whichever of the 11 checks contains the highest probabilities will be the one that is displayed on the map for a particular grid point. Once a map of probabilities is created, the conversion to the SPC outlook guess is as follows:

No area: 0-4%
Level 1 risk ("marginal"): 5-29%
Level 2 risk ("slight"): 30-44%
Level 3 risk ("enhanced"): 45-79%
Level 4 risk ("moderate"): 80-94%
Level 5 risk ("high"): 95-100%

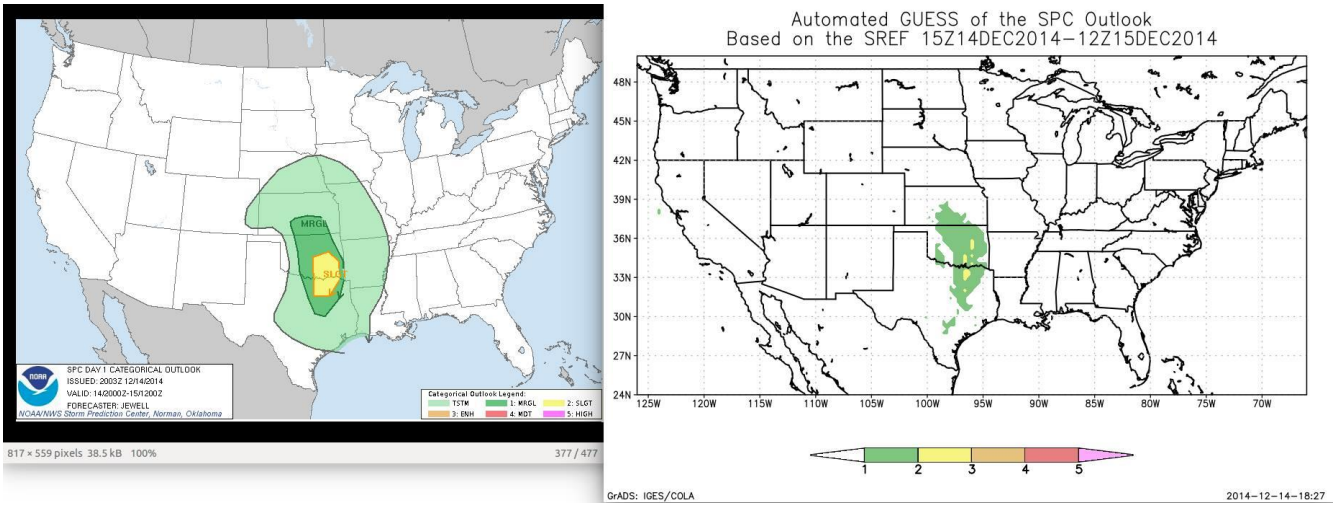

Figure1: Example of an SPC outlook vs the output generated by the SREF algorithm.

The algorithm has the advantage of searching through a large portion of the cape/shear spectrum to look for a favorable environment, rather than just relying a single combination. One size does not fit all! In order to come up with the actual numbers for each ingredient, I re-analyzed all EF2+ tornadoes for the WFO Tallahassee and Norman CWAs from 1979-2011 using gridded reanalysis data. I chose Norman in addition to Tallahassee because their climatological environments are very different from each other. Tallahassee gets a lot of low cape/high shear cases, but Norman gets a lot of high cape/low shear cases. By plotting them together, I get a better representation of the full cape/shear spectrum upon which to draw my subjective line. The figures below show some of the scatterplots. The purple line represents my choice of thresholds, which was drawn to try to walk the fine line between missing events and having too many false alarms.

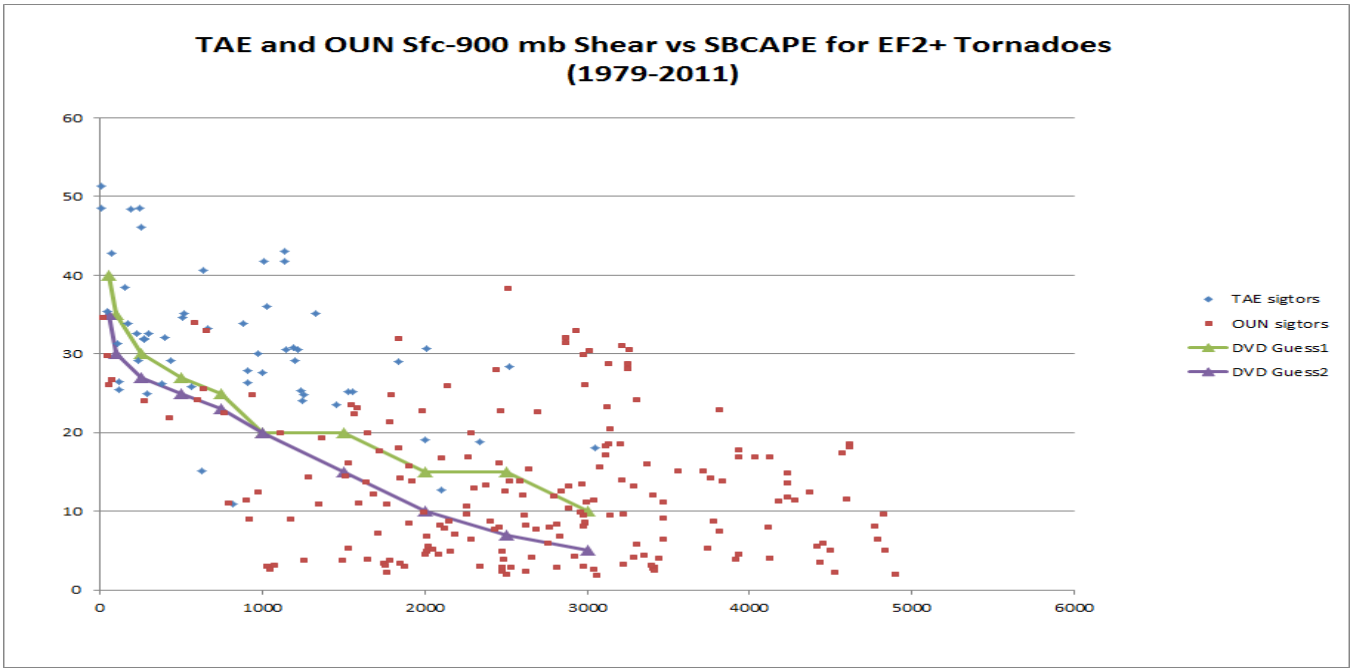

Figure 2: A climatology of Sfc-900 mb shear vs SBCAPE for EF2+ tornadoes for the WFO Tallahassee and Norman forecast areas.

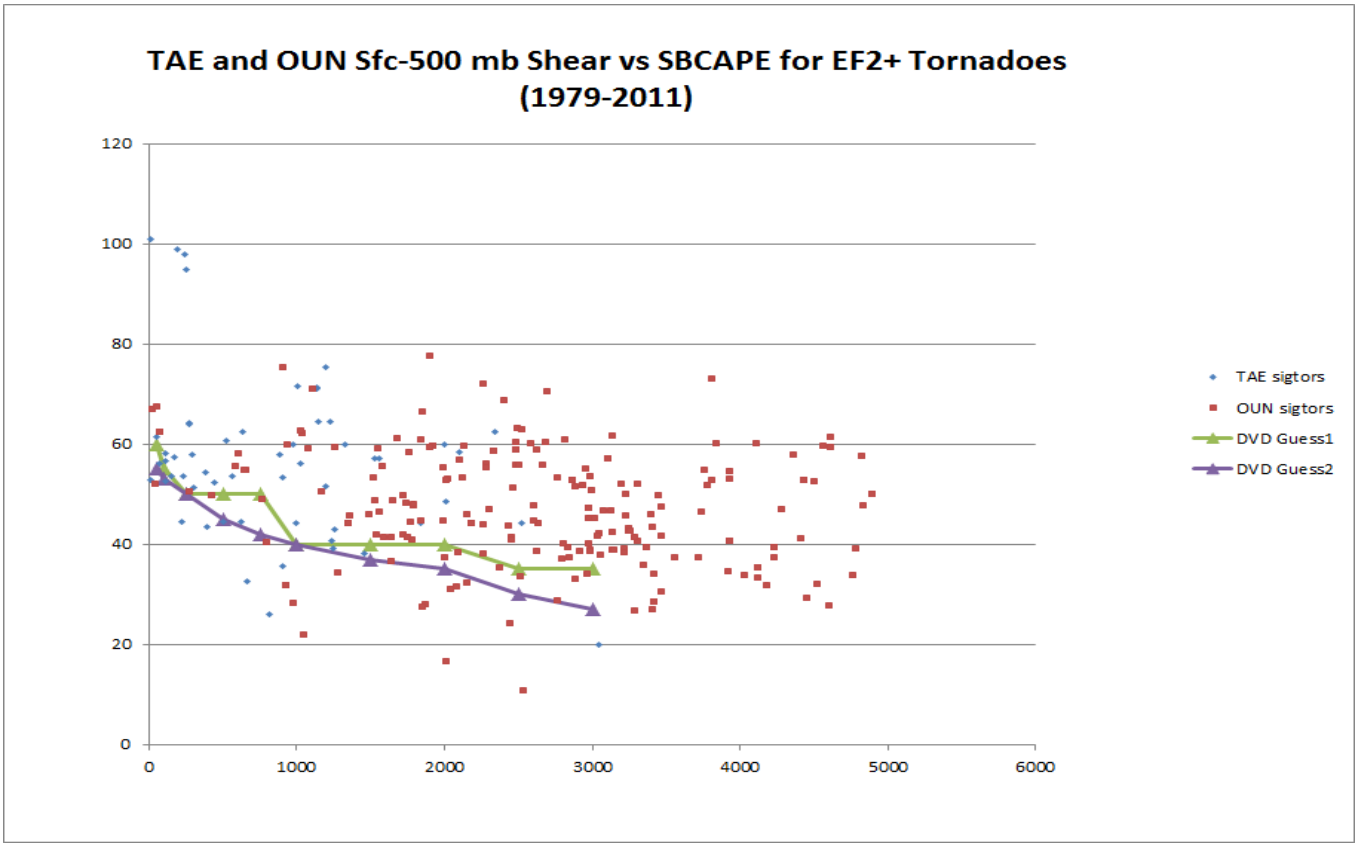

Figure 3: Same as figure 2 except Sfc-500 mb shear on the y-axis.

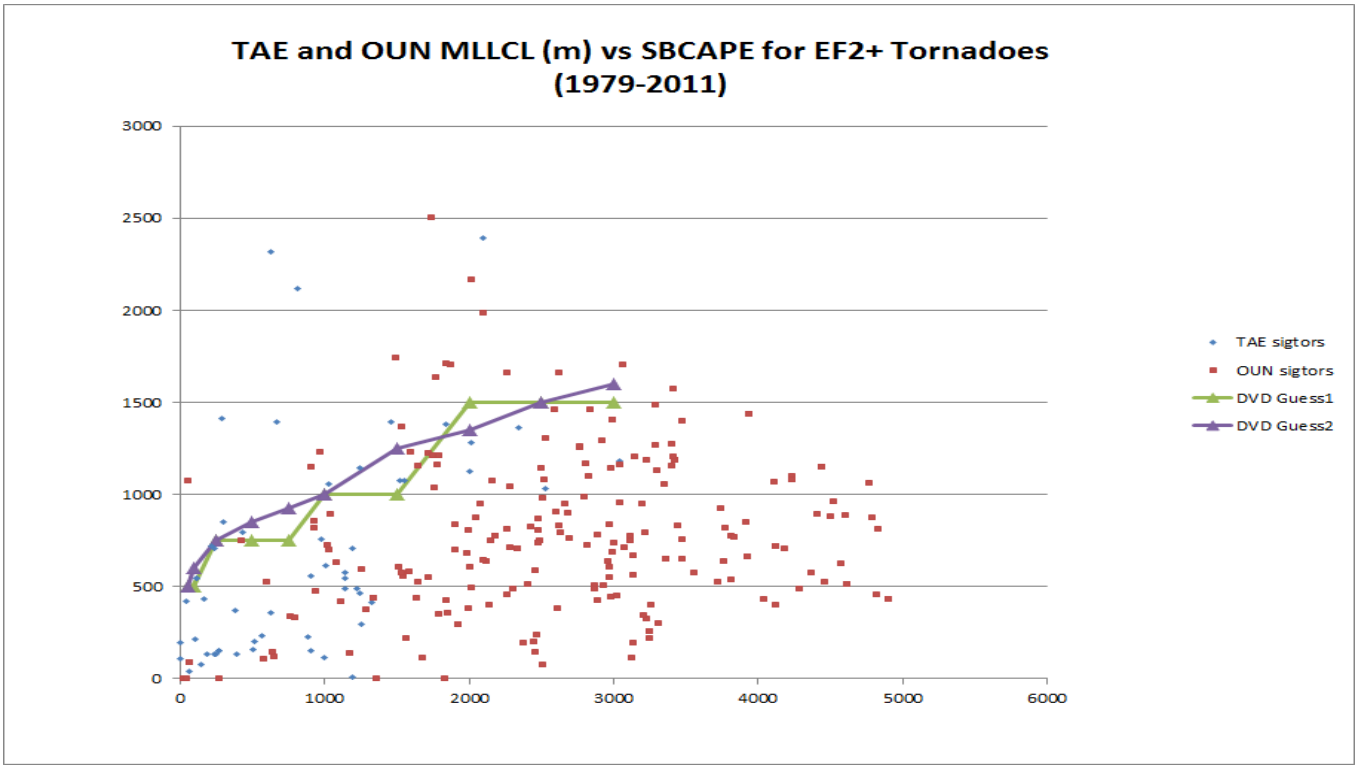

Figure 4: Same as figure 2 except MLLCL on the y-axis.