ANALYSIS OF AN F0 TORNADO
USING THE WEATHER EVENT SIMULATOR (WES)

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Introduction:

This WES case provided an opportunity to examine a tornadic storm in southeast Idaho which produced an F0 tornado in close proximity to the Pocatello WFO on April 28, 2003 at 2300Z (5PM). This tornado was on the ground for approximately 8 minutes, with a path 2 ½ miles long and 300 feet wide. Severe thunderstorms moved through eastern Idaho during the mid-afternoon and evening hours producing three tornadoes (all F0) and numerous accounts of nickel to golf ball sized hail. These storms developed in an environment characterized by moderate instability and shear; however local flow interaction induced by terrain likely played an important role. On average, the state of Idaho receives three tornadoes per year, usually in the category of an F0 or an F1. An F2 rarely gets reported and an F3 has never been reported in eastern Idaho. The evolution of this storm into a tornadic supercell was quickly determined on examination of the 3-dimensional structure with multiple elevations of the basic reflectivity (Z) product. The evolution of the mesocyclone was observed from multiple elevations of the storm relative velocity (SRM) products.

Synoptic and Mesoscale Features:

A deep upper level closed low was located just off of the northwest California coast with southwesterly flow over eastern Idaho at all levels. The GFS and Eta showed a 100 to 110kt jetstreak through central California with southeast Idaho falling under the left front or left exit region of the jet between 21Z and 00Z indicating divergence aloft and large scale upward motion. A surface low pressure center was located over northern Utah with a surface trough extending into south central Idaho. Dewpoints were around 40F with afternoon temperatures in the upper 50's. Two upstream soundings from SLC (Salt Lake City, UT) and LKN (Elko, NV) at 12Z Apr 28 indicated LI/CAPES of – 1.6 to –3.7C and 250 to 486J/Kg respectively. In addition these soundings showed moderate to high 0-3km Storm Relative Helicities of 105 to 257 m2/s2. The 12Z Eta forecast sounding for Pocatello (PIH) at 21Z also indicated that unstable air to the southwest would advect into the area with a predicted LI/CAPE values of –5C and 1261J/Kg. The predicted afternoon 0-3km storm relative helicity was somewhat limited at 169 m2/s2. This storm developed and moved along the southeast edge of the Snake River Plain (SRP) where localized low-level shear would have been generated by the interaction of southwest flow in the SRP and southerly flow exiting smaller valleys into the SRP. This likely enhanced the boundary layer shear and thus mesocyclone and tornado development.

Discussion:

Convection developed along the surface trough over south central Idaho around 21Z. An earlier report of a possible tornado altered the focus from a wind/hail event to tornadic potential. Figure 1a (0.5 deg base reflectivity) shows a large thunderstorm cell with a well-defined pendant on the southern (inflow) flank. Slight cyclonic curvature of the pendant suggests possible rotation, and a supercell structure. The suspicion is confirmed by examining higher elevation scans. Figure 1b (2.4

deg base reflectivity) shows a single pixel of weak reflectivity just to the east of the maximum reflectivity. This is the center of the intense updraft, which is "bounded" by higher reflectivities (BWER). The presence of a strong rotation is revealed in the two SRM slices. Figure 1c (1.5 deg SRM) shows a well-defined inbound/outbound velocity couplet. The outbound maximum is closest to the RDA, which suggests convergent rotation in the lower levels. In the center of the couplet is a data dropout, which is probably due to the absence of scatterers in the updraft core. Figure 1d (2.4 deg SRM) shows a more balanced couplet with the maxima equidistant from the RDA. This would indicate pure rotation. Higher elevations (not shown) displayed divergent rotation. This is a typical 3-dimensional structure of a mesocyclone. Both vertical and time continuity were met with the mesocyclone signature, and became the basis for a tornado warning. The initial sighting of the tornado was 15 minutes later, and was clearly visible from the WFO. Typically, the 0.5 degree SRM is highly contaminated, and often unreliable for determining rotation. Experience has shown that it is a better practice to examine velocity patterns at higher elevations, where mesocyclones are most likely to develop.

Figure 1a, 1b, 1c, 1d