Radar Analysis Using GR2Analyst

Examining severe weather signatures through radar analysis using the software GR2Analyst was the topic of discussion for the November meeting of the West Central Florida chapter. Andy Johnson—FOX 13 (WTVT, Tampa) meteorologist, chapter president, and presenter—explained the difference between Level II and Level III data used in radar analysis. Level II data consists of reflectivity, radial velocity and spectrum width data produced by the National Weather Service's (NWS) WSR-88D radars containing data from all scans. The Level II products are produced in 256 color-coded data levels at the highest spatial resolution of the radar. Range resolution is 1 km for reflectivity and 0.25 km for velocity and spectrum width and azimuthal resolution is 1° for reflectivity, velocity, and spectrum width. On the other hand, Level III data have just 16 color-coded data levels from the lowest four scans, at most, although the output algorithms can consider data collected at all scans. Level II data are the input to the Radar Product Generator (RPG) while Level III data are the output of the RPG meteorological algorithms or displays of the data. At least 41 Level III products are routinely available. Johnson focused on the Level II data in his presentation because of the ability to visualize WSR-88D data more clearly in three dimensions and with more resolution than with Level III data.

Of the different products that GR2Analyst (Gibson Ridge Software's GRLevel2 Analyst Edition) uses, only three are actually directly measured: reflectivity, mean radial velocity, and spectrum width. Derived products are echo tops, vertically integrated liquid, VIL density, probability of severe hail, maximum expected hail size, and normalized rotation. Johnson explained that radial velocity data can be used to determine velocity couplets, which are an indication of rotation associated with a mesocyclone or tornado. At long distances from the radar, information about variability in velocity can be gleaned from the spectrum width product even if low-level rotation detection is not possible. The GR2Analyst program allows the user to adjust rotational values to determine weaker or low-topped tornadic and mesocyclonic rotations within tropical cyclones.

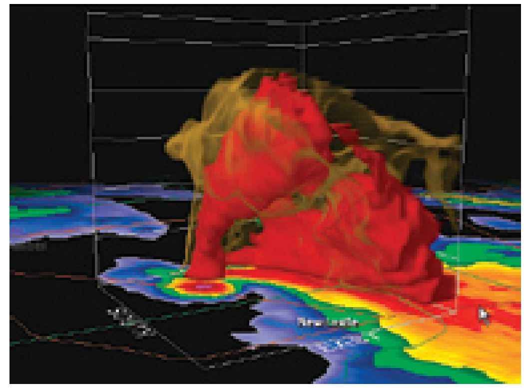

Fig. 1. The 3 May 1999 Moore tornado (taken from www.grlevelx.com/gr2analyst).

Johnson then presented the 3 May 1999 Moore, Oklahoma, tornado using GR2Analyst. He noted that the Moore tornado was close to the radar site in Norman. A three-dimensional representation of the tornado (Fig. 1) shows reflectivity, with values greater than 50 dbZ in red. He noted that the GR2Analyst can be used to clearly see the vertical dimension of this storm and the condensation funnel of the tornado. Johnson said that one can look at both two- and three-dimensional displays in GR2Analyst. He then showed

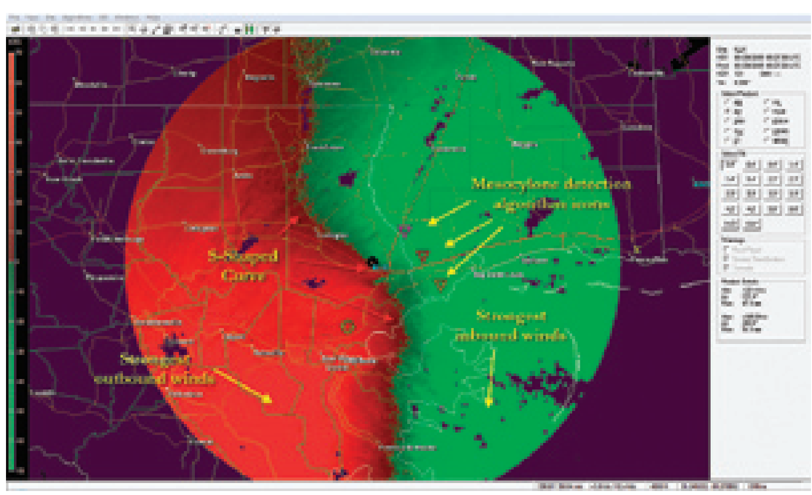

Fig. 2. Level II radial wind velocity taken from the Slidell radar at 0927 UTC 29 August 2005 during Hurricane Katrina showing the locations of maximum velocity and mesocyclone detection algorithm icons. (Image: Gibson Ridge Software)

a two-dimensional display of a hook echo and explained that reflectivity data can be analyzed for hook echoes. He noted that one needs to look for persistent cells and that the basic criteria (as described in the literature) for tornadoes is the 50 db*Z* reflectivity level.

With the meeting in the computer lab in the Geography Department at the University of South Florida, members were able to take advantage of the facilities to experience hands-on data from the National Climatic Data Center that Johnson had prepared (Fig. 2). Specifically the members loaded and analyzed level II data from Slidell for 29 August 2005 related to Hurricane Katrina. The software allows the user to easily pan and zoom the data. It also has the application of a smoothing function. He noted that for research purposes it is often best to analyze the data in the unsmoothed view. Members then clicked on the cross-section tool to identify the highest levels of reflectivity. Johnson noted the rotation around Katrina's clear eye as it was coming ashore and pointed out a possible outer eye wall, suggesting an eye wall replacement was occurring at landfall. Johnson concluded by showing the base velocity product for Katrina. He pointed out a distinct S-shaped curve that is typically seen with hurricanes—along the S-curve there is no motion toward or away from the radar. Mesocyclone detection algorithm (MDA) icons are very helpful in determining the precise location and amount of rotation in mesocyclone and potential tornadoes. Figure 3 shows the location of the S-curve, areas of strongest radial velocity and locations of MDA icons. The user can adjust the rotation threshold and count. By adjusting the rotation threshold to values lower than the default, the operator can locate mesocyclones and even weak tornadoes occurring in hurricanes. The ability to overlay street-level map data allows the user to pinpoint the location of potential severe weather.

More information on GR2Analyst is available at www.grlevelx.com/gr2analyst.

—Jennifer M. Collins,
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and Andy Johnson