P8.6 # FLORIDA SEVERE STORM INDICATORS

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I. INTRODUCTION

A detailed analysis of National Weather Service Tampa Bay Area, Ruskin, Florida WSR-88D radar and sounding data for severe weather events from 1994 through 2000 provided many important correlations for severe weather recognition. The severe weather events were stratified into hail, damaging wind, tornado, and waterspout categories. Data were collected for every volume scan, representing 5 to 6 minute intervals, starting one hour prior to the event. Among the trend analyses produced were maximum reflectivity, maximum reflectivity height, mesocyclone base height, mesocylone rotational velocity, and mesocyclone maximum shear.

The analyses showed two distinct pulse features occurring prior to severe hail events in the spring season. The analyses also showed radar data trends that can be used to predict a developing tornado.

II. DATA

Severe weather event radar data were collected from National Weather Service (NWS) Tampa Bay Area, Ruskin, Florida WSR-88D radar archives. Atmospheric soundings were collected from NWS Ruskin, FL, 1200 UTC radiosonde data.

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III. DISCUSSION

The seasons are broken down as cool (Dec.-Apr.), Spring (May-Jun.), Summer (Jul.-Sep.), and fall (Oct.-Nov.). During the cool season, convection is usually generated by synoptic scale systems with supporting upper level dynamics. These are more supportive during winters when a strong El Niño is present. In spring, the upper level dynamics generally decrease, but cool pockets at mid and upper levels decrease lapse rates and allow for significant pulse thunderstorm growth if the LFC is reached, usually by forcing of mesoscale boundaries such as sea breezes, lake breezes, and outflow boundaries. Surface troughs can also act as low level lifting mechanisms during this season, but occur less often. In summer, the main source for convection is the combination of colliding low level mesoscale boundaries and high CAPE values due to afternoon temps routinely above 90F (32C) and dew points near 75F (24C). Occasionally, tropical systems are a source of high wind/tornado events. The fall is usually similar to the cool season, but the dynamics tend to be a bit weaker while the instability tends to be higher due to higher surface dew points.

Review of the sounding data show that severe events do not occur until the precipitable water reaches 1.2" or greater. For hail events, the avg 400 to 500 mb temperature is less than -15C. For winter events, shear is typically 35 to 50 kts near the surface increasing with height. This profile helps create a strong updraft necessary to support hail.

Spring severe hail events show two distinct 20 to 25 minute pulse features, evident in the average height of maximum DBZ (Fig. 1). It is the second pulse that generally produces the severe weather.

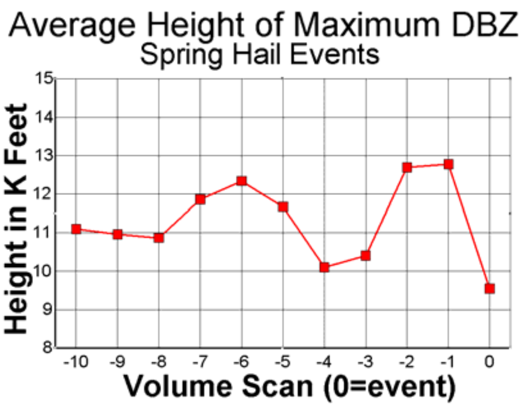

Fig. 1. Spring hail average height of maximum reflectivity.

In addition, the peak height of maximum DBZ usually reaches 25K feet five to six minutes prior to the severe weather event (Fig. 2).

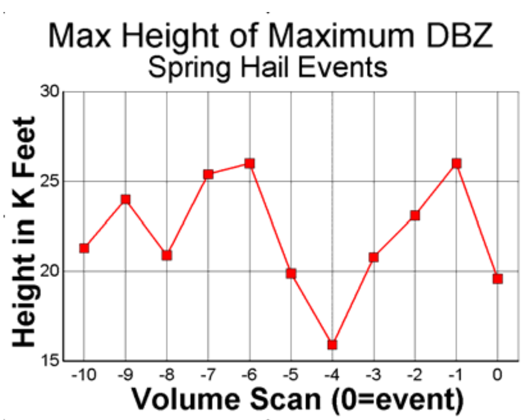

Fig. 2. Spring hail maximum height of maximum reflectivity.

Similar double pulse trends are seen during severe wind events in the summer months (Fig 3.).

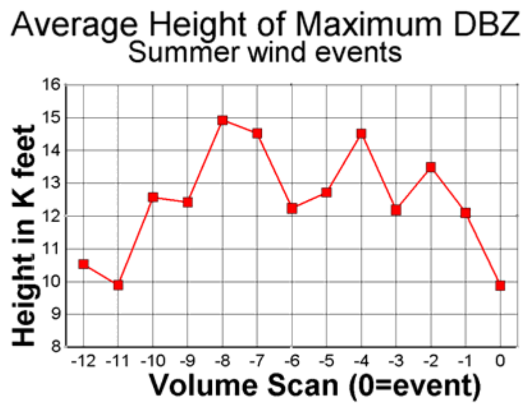

Fig. 3. Summer wind average height of maximum reflectivity.

The analysis showed that on average the base of a mesocyclone drops 15 minutes prior to a tornado touchdown. In the graph (Fig. 4) the base height of the mesocyclone drops rapidly from T-4 to T-3.

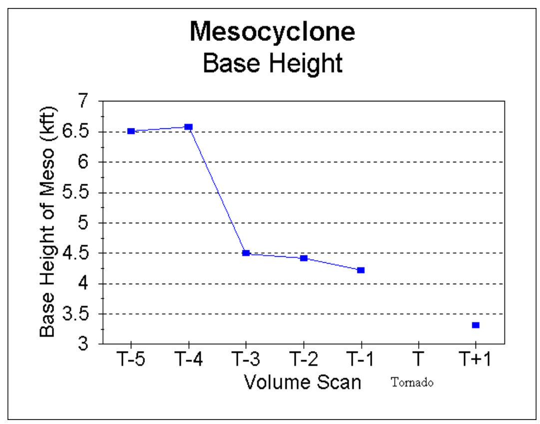

Fig. 4. Mesocyclone base height.

Also, prior to tornado touchdown, maximum low level rotational velocity and shear increase steadily, peaking at time of touchdown (Figs. 5 and 6). The steady increase begins at T-3.

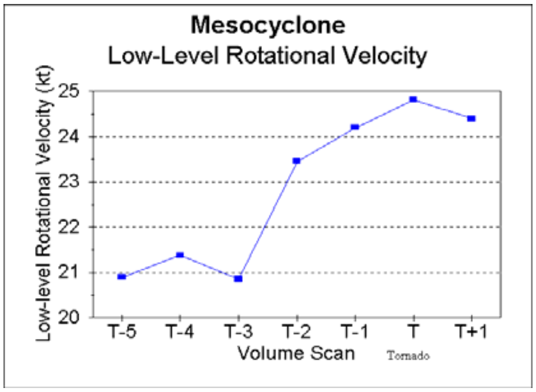

Fig. 5. Mesocyclone low level rotational velocity.

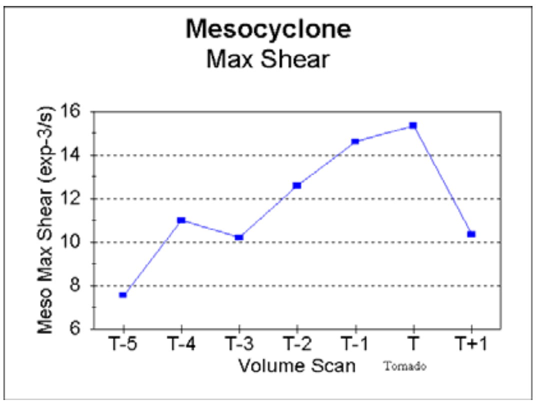

Fig. 6. Mesocyclone maximum shear.

Meanwhile the maximum rotational velocity through the volume of the storm peaks 5 to 6 minutes before touchdown (Fig. 7).

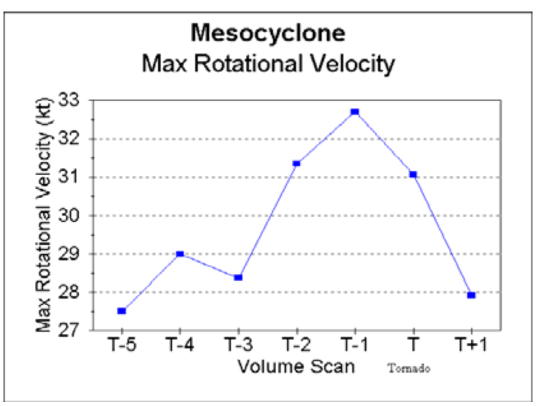

Fig. 7. Mesocyclone low level rotational velocity.

IV. CONCLUSION

This detailed analysis of National Weather Service Tampa Bay Area, Ruskin, Florida WSR-88D radar and sounding data for severe weather events from 1994 through 2000 has provided many important correlations for severe weather recognition. The analysis showed distinct double pulse features for severe weather events in the spring and summer. Also, the analysis shows that for a developing mesocyclone the base drops, low level velocity and shear increase steadily, and max rotational velocity peaks prior to a touchdown. These results are consistent with those using similar techniques: Grant and Prentice, 1996 and Turnage et. Al. (2000). These correlations may be used by forecasters to help alert them to the possibility of a severe weather event and thus increasing the lead time in the issuance of severe weather warnings.

V. REFERENCES

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Turnage, T.J., R.R. Lee, E.D. Mitchell, 2000: WSR-88D mesocyclone characteristics of selected thunderstorms during the southwest Georgia tornado outbreak on 13-14 February 2000. *Preprints, 20th Conf. on Severe Local Storms*, Orlando, FL, Amer. Met. Soc.