11B.3

SEVERE WEATHER ASSOCIATED WITH WARM SEASON PRECIPITATION EPISODES

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1. INTRODUCTION

A recent radar-based climatology by Carbone et al. (2002) described coherent precipitation patterns that are continental in scale and have durations greater than the typical mesoscale convective systems. These patterns are referred to as warm season precipitation episodes. Tuttle and Carbone (2002, this preprint volume) analyzed a precipitation episode which lasted 50 h, covered 2800 km and consisted of two mesoscale convective systems. Carbone et al. (2002) suggest there is an intrinsic predictability of warm season precipitation based on the time-space coherence of the precipitation episodes. An important remaining issue is to identify the mechanisms leading to the warm season precipitation episodes. As part of several ongoing efforts to investigate the details revealed by this climatology, we are studying the radar data to identify the individual convective systems. One aspect of this study involves looking at characteristics of any severe weather associated with the convective systems. Towards this end, we plan to incorporate severe weather reports in the context of the time–distance (known as Hovmoller) representations of precipitation episodes. Here we show a case example which provided the motivation to examine many more severe events and their association with precipitation episodes revealed by the Carbone et al.(2002) climatology.

2. DATA

The primary data set used to develop the Carbone et al. climatology is WSR-88D national composite radar reflectivity (NOWrad) data provided by the WSI corporation. The processing technique is described in Carbone et al. (2002). They used the maximum reflectivity in a vertical column over a ~ 2 km latitude/longitude grid available every 15 minutes and then averaged over ~4 km wide longitudinal bands covering from 30-48 °N latitude. Data were processed for longitudes from 115°W to 78 °W and covering a period from May through September 1996-2001. They displayed their analyses on time – distance plots (referred to as Hovmoller diagrams). Unfortunately, we do not yet have the severe weather report data in digital form to combine with the Hovmoller diagrams of precipitation.

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We have done a cursory examination of the plots of severe weather available from the Storm Prediction Center's web site. These data are preliminary for the years 2000 and 2001, but include details about each report. For the previous years, the data are plotted for each 24 h period by severe weather type.

3. A CASE EXAMPLE

Our general approach was to note the number and type of severe weather reports for each day. We do not expect to see too much in the way of coherent patterns when plotting individual severe reports against the very large scale episodes revealed by the Hovmoller diagrams from the climatology. The possible exception would be derecho events (Johns and Hirt, 1987) because of their typical long-duration and large distance traveled. They are driven by day time density currents in the boundary layer, one of the mechanisms suggested by Carbone et al (2002), for the long-lived precipitation episodes.

Of particular interest was a derecho event which had 307 preliminary wind reports. The Hovmoller plot of rainfall rates, derived from the radar data, for the period from July 6 (00 UTC)–July 10 (00 UTC) 2001 (Fig. 1) shows 3 major "streaks" of precipitation extending from about 100- 81 °W Longitude. The lowest precipittation rate apparent on Fig. 1 corresponds to ~ 5 dBZ reflectivity level. This pattern reflects the development and movement of convective systems within large-scale northwesterly flow over the upper midwest. Stronger intensity rainfall rates for the same period as that of Fig. 1, are shown in Fig. 2. The derecho event occurred on July 8-9 represented by the plot of severe wind reports (Fig. 3). There is a correspondence with a "streak" of higher rainfall rates apparent in Figure 2. Note there is also a "spreading out" with time, of both the location of severe reports and the bands of higher rainfall rates. The shorter secondary streak of wind reports beginning at about 1600 UTC and 86 °W also had a corresponding region of higher rainfall rates apparent in Fig.2.

It is possible that information from a Hovmoller plot of rainfall rate obtained in near real time could be useful for specialized forecasting needs such as those associated with the upcoming BAMEX experiment for which there is an emphasis on studying bow echo and derecho events.

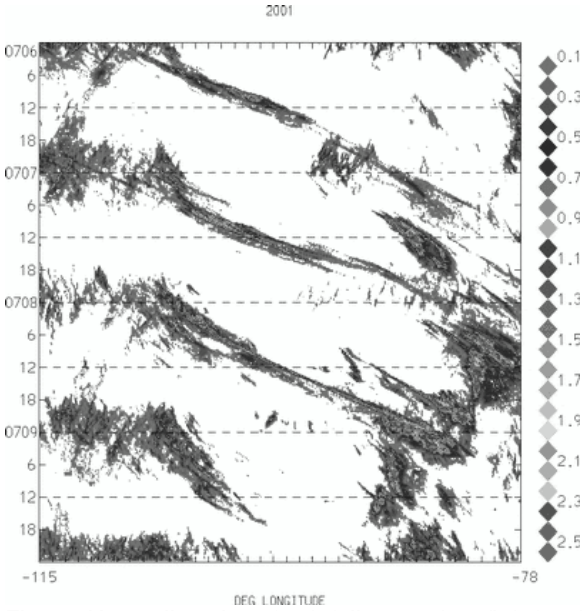

Fig. 1: Hovmoller plot of rainfall rates (mm/hr) for the period form 0000 UTC July 6 - 0000 UTC July 10 2001 from the Carbone et al (2002) climatology.

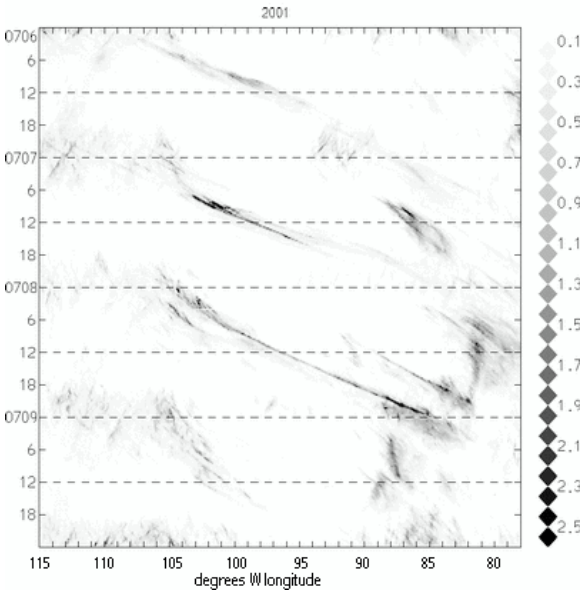

Fig. 2: As in Fig. 1, but with only stronger rain rates apparent due to the gray shading.

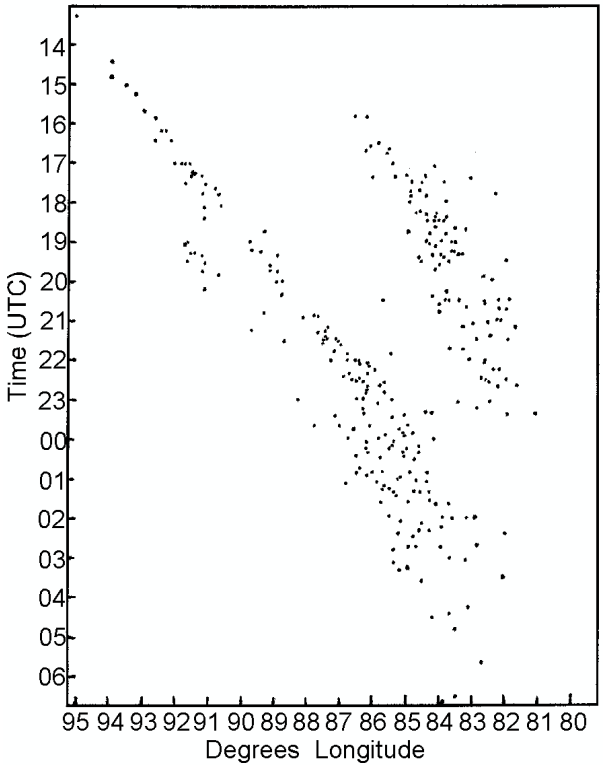

Fig. 3: Plot of preliminary severe wind reports for the period form 13 UTC July 8 - 06 UTC July 9 2001 for the region between 96 –80 ˚ W longitude.

4. ACKNOWLEGEMENTS

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5. REFERENCES

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