CRH SSD
MARCH 1987

CENTRAL REGION TECHNICAL ATTACHMENT 87-7

USE OF RADAP II WITH ICRAD AT WSMO GARDEN CITY, KANSAS

Samuel M. Gardner
National Weather Service Meteorological Observatory
Garden City, Kansas

RADAP stands for RAdar DAta Processor. RADAP II is the second version of the RADAP program, which used to be called D/RADEX. ICRAD stands for Interactive Color Radar Display. The ICRAD is an enhancement tool used with RADAP II.

RADAP II consists of a NOVA series Data General computer which has a 2.5 MB or 10 MB hard disk drive and two eight inch floppy drives. The hard disk drive contains the operation programs while the eight inch floppy drives are used to archive the raw radar data collected during each automated radar observation.

The data that are collected in each automated radar observation are obtained at a one-half degree elevation angle scan from 25 NMI to 240 NMI range. The data are collected from 11 NMI out to 25 NMI at an elevation of two and one-half degrees. The two scans are merged into one called "ZTR" for Zero Tilt Reflectivity. This is done to minimize ground clutter within 25 NMI of the site. A set of elevation scans beginning at two degrees elevation, and at 2^{o} increments, is taken until either a 22^{o} elevation angle is reached or no echoes are observed, whichever comes first.

Once the volume scan has been performed and the data processed, a long list of products become available. Listed below are some of the more important products:

1. Reflectivity maps of ZTR for the ranges of 40, 60, 120, and 240 NMI.

2. VIL (Vertically Integrated Liquid) maps for 120 NMI range. The VIL value is a cumulative sum of weighted reflectivity values for a cell from the one-half degree elevation scan to the echo top. Large VIL values are associated with greater probabilities of severe weather.

3. Severe Weather Probabilities (SWP) map. This product uses a large amount of information to create theoretical probabilities that a given storm will produce severe weather. Some of the information that it uses is the value of the VIL and the size of the storm.

4. Maps displaying height of echo tops. These tops are usually within 3000 to 5000 ft of what is seen on the RHI scope directly.

5. Storm structures, which use the Lemon technique to detect possible severe storms. For a given storm, the storm structure product displays the location of the low echoes, mid-level echoes, the VIP levels two and five, the max echo top, and the location of towns near the storm within a 31 x 31 NMI grid. When displayed, this product gives the radar operator a very good picture of what is going on and if a severe weather statement or a warning is needed.

6. Several rainfall accumulation maps, which are representative of the real world as long as no AP (Anomalous Propagation) is present within the rainfall area.

ICRAD is an enhancement to RADAP II. ICRAD consists of the following:

1. Northstar Horizon microprocessor with one 5 1/4 floppy and one 15 MB hard disk drive.

2. SCION SC-5060 color graphics generator for six bit planes of 512 x 480 pixels.

3. AYDIN 8830 LP long persistence phosphorous color monitor.

4. A 80 column RS232C KCRT.

The old saying that "a picture is worth a thousand words," is very true in this case. Normally, RADAP II products are printed on a TI 810 printer, which means that the operator must use an overlay to be able to see where the storms are in relation to the station. With ICRAD, the operator has a color display with a map background and product displayed on the background. The map background, depending on the scale, has all or most of the following:

1. County lines.

2. Either county names or towns within the county.

3. Rivers and streams, etc.

How do we use all this data? First, we are about seven to eight minutes behind in real time. The RADAP II starts the observation on the hour and every ten minutes thereafter. It may take up to six or seven minutes to take a complete volume observation. By the time the data are ready to be used, it is six to seven minutes old, but the amount of data is very large. Because of the completeness of the observation, and with proper use of all RADAP II products, the radar operator should be able to tell what the storms are doing. During severe weather, the VIL map has been found to be most useful in following storm development and decay. If during each ten minute observation segment, the VIL value for a storm increases and reaches a value of 40 KG/sq. mi., then it is time to put that on your list of storms that could produce severe weather. Of course, you need to consider the storm structure display

and also the severe weather probability display. The last bit of information that is needed is the height of the VIP level five in the storm. A height of 27,000 ft or greater combined with the appropriate storm structure yields a high probability of a severe storm. Of course, you must do a little forecasting as to what you should see on the next observation and try to keep ahead of what is going on with the storm system. The critical value of the VIL changes from spring, to summer, to fall. Lower values are used in the spring and fall and a higher value in the summer. During the summer, a VIL value of at least 50 to 55 KG/sq. mi., is needed to set off severe weather and this depends also on which side of the dryline the storm is located.

Using the archived data and the playback mode, a storm system can be played back in real time on fast mode. When in the playback mode, a person is able to spend as much time on each observation as is needed and the amount of data that is available is the same as in real time. Therefore, ICRAD provides the opportunity to do research and training.

In concluding, I would like to point out that RADAP II with ICRAD is not the final answer to the severe storm problem. As for RADAP II, there are a few things that should be changed to make the program more effective. Several new products can be obtained from the data now available from RADAP II, such as:

1. A four panel display programmable by the user as to which four products are to be displayed.

2. Quadrant movement for the system, rather than the movement for the entire system.

3. A display that shows the path of the 50 dbz or higher echoes. This would be useful in hail research.

On the bright side, during the past two years WSMO Garden City has had outstanding results by using RADAP II and ICRAD. Not only have we improved on picking out the storms which will reach the severe stage, but we have also cut down on false alarms.

Aside from producing paper overlays, the entire radar observation routine could be done from the ICRAD. To make the most of RADAP II and ICRAD in severe weather, there should be at least two people on duty and RADAP II should be allowed to take the maximum number of volume observations. While the max echo tops are too high in most cases, compared to manually derived tops, they are sufficiently close to be useful. I believe that RADAP II and ICRAD are the best tools that we have for severe storm detection until NEXRAD is operational.