UDC 551.501.81:621.396.969

A Display of Radar Echo Maximum Intensity in Use at the National Severe Storms Laboratory

WALTER L. WATTS and DALE SIRMANS
National Severe Storms Laboratory, NOAA, Norman, Okla.

ABSTRACT—A digital display of the location and intensity of the most intense radar echo in a selected sector is provided by a digital comparator with shift register storage of digital video signals from the National Severe Storms Laboratory WSR–57 radar. The display provides the radar operator with immediate access to important weather information.

A numerical display that shows data on the maximum radar echo intensity has been designed and built at the National Severe Storms Laboratory (NSSL) and is now used routinely as part of the NSSL WSR–57 radar system (Sirmans et al. 1970). Display parameters include the maximum echo intensity class in a selected sector of the plan-position indicator (PPI) scope, the azimuth and range of the location where the maximum class is first encountered during scanning from the selected starting azimuth, and the number of occurrences of the maximum intensity in the selected sector. The device is an important aid to NSSL observational programs in which the deployment of sensors is partially controlled in real time on the basis of radar information. It could also be an aid to National Weather Service (NWS) operations when digital equipment becomes available at NWS radar stations (Kessler and Wilson 1970, Wilk and Gray 1970).

Figure 1 is a photograph of the display unit and figure 2 is a diagram indicating principal components of the unit and their connections. The digital comparator shown in figure 2 compares incoming digital video (DV) signals with the digit stored in the intensity shift register (SR). This display is unchanging as long as the SR value is not equaled or exceeded. As signals equal to the SR value are received during a sector scan, the number-of-occurrences counter (NOC) advances. A DV signal exceeding that in the intensity SR causes the stored value to be replaced by the larger value, and the NOC is simultaneously reset to unity and the spatial coordinates (range and azimuth) are stored and displayed. The display unit uses azimuth data from the digital shift encoder and other information from the NSSL digital recorder, including DV, write pulses, 2° angle marks, 1-n.mi. marks, and counter resets.

When used in a continuous recording mode, the display lights are reset to zero at the start of each sector scan. By use of selector switches, the display unit can be used to monitor the maximum intensity value over any selected azimuth sector or the entire PPI scope. In this mode, it continuously displays the maximum echo intensity encountered since the chosen starting time, and thus alerts the radar operator automatically to the first occurrence of strong echoes. The unit can also be used to give a quick and accurate indication of the areal coverage (number of counts) of any selected intensity level.

Figure 3 shows the NSSL WSR–57 PPI display at 1845 CST, Apr. 15, 1970, a day with a vigorous trough at 500 mb over the Great Basin and associated strong southwesterly flow over Oklahoma. Figure 4 shows the number of values in the maximum intensity class recorded during 20-s PPI scans over a 30-min period. Levels 6 and 7 here correspond to equivalent reflectivity factor values (Z_E) of 8×10^4 and 5×10^5 $mm^6 \cdot m^{-3}$ respectively, or rainfall rates of about 1.7 and 5.2 in./hr (Wilk and Kessler 1970). Figure 5 is a time plot of the displayed coordinates of maximum intensity. The small-size numerals indicate the number of oscillations of the maxima between discrete locations indicated by the arrows. The locations are separated by 2° and 1 n. mi., the basic grid mesh of the present NSSL digital radar data system. The larger size numerals in figure 5 show the number of times the maximum intensity was recorded at the indicated locations.

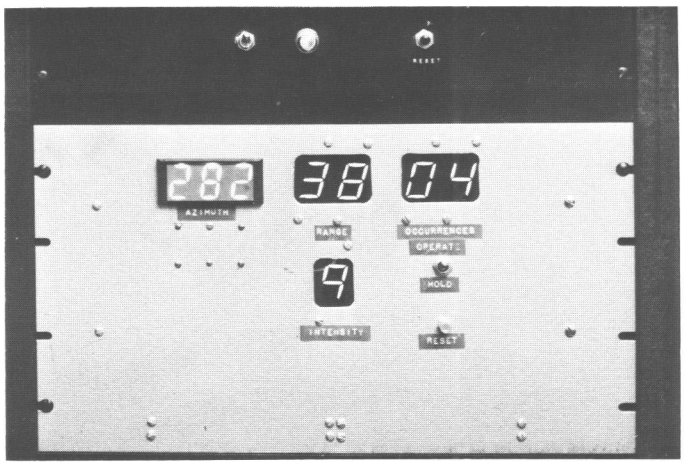

FIGURE 1.—Display of radar echo maximum intensity and location of first occurrence in a selected sector.

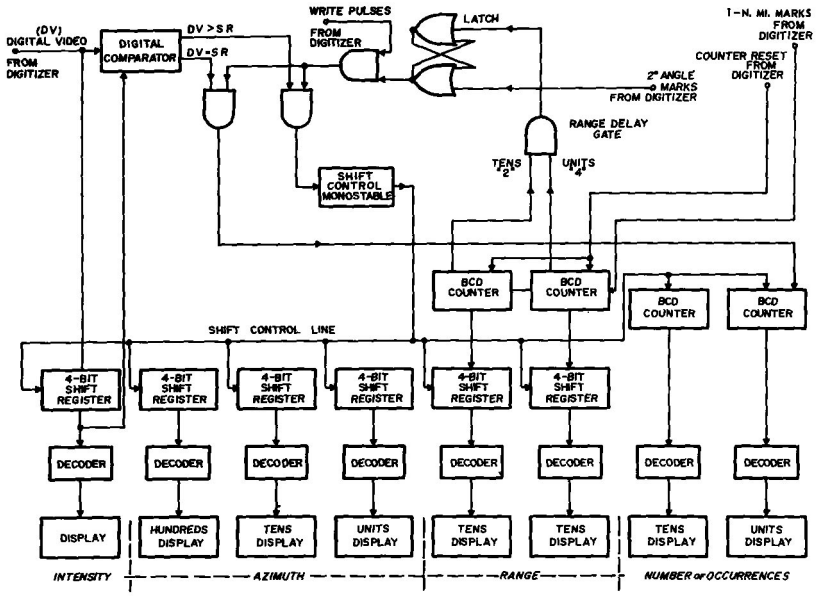

FIGURE 2.—Block diagram of the maximum echo display

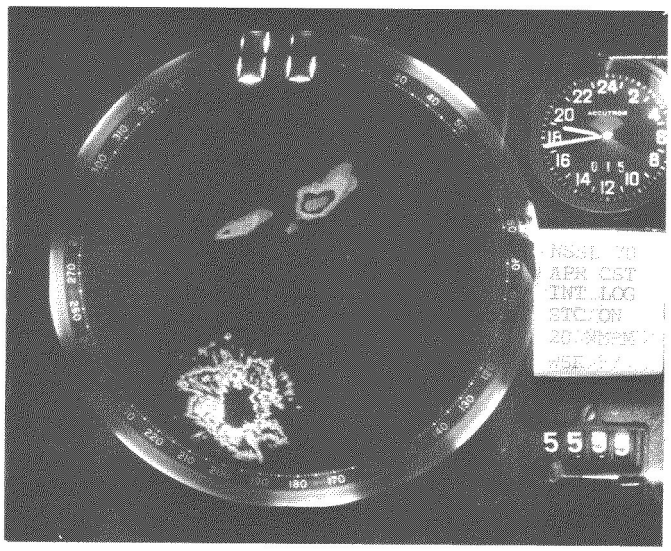

FIGURE 3.—WSR-57 PPI display, National Severe Storms Laboratory, at 1845 CST, Apr. 15, 1970, showing the only storm echoes apparent in Oklahoma on that day. The fourth level in this display corresponds in this case to radar reflectivity factors between 4×10^4 and 5×10^5 $mm^6 \cdot m^{-3}$. The main storm moved from 269° at 25 kt and attained heights up to 42,000 ft.

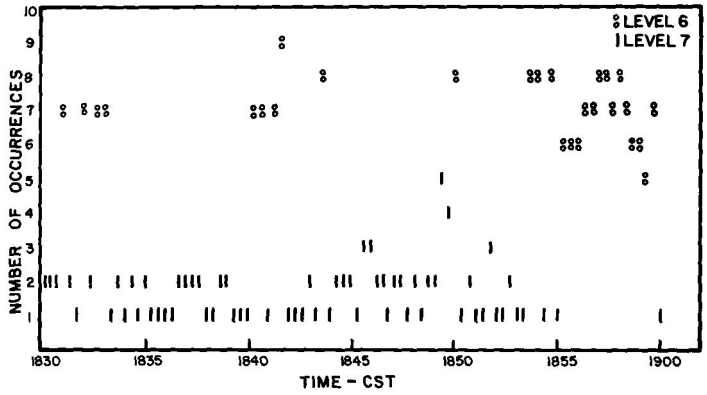

FIGURE 4.—Number of values in the maximum intensity class recorded over a 30-min period for the case shown in figure 3. The maximum intensity varied irregularly between levels 6 and 7.

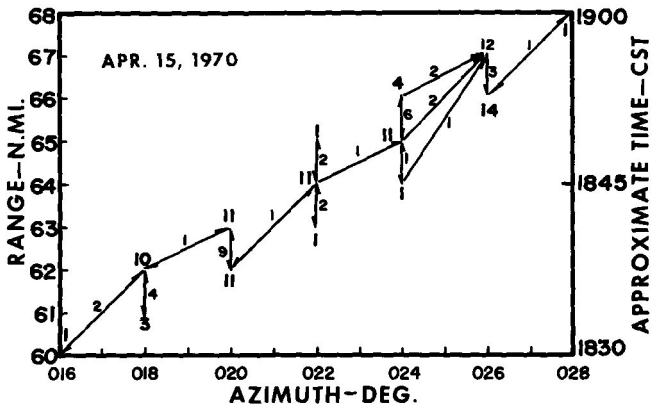

FIGURE 5.—Location of maximum intensity class first encountered during clockwise azimuthal scanning, in relation to time, for the case illustrated in figures 3 and 4.

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[Received March 15, 1971; revised June 1, 1971]