COMPARISONS BETWEEN THE STORMS OF NOVEMBER 20–22, 1952, AND NOVEMBER 25–27, 1950

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At 1830 GMT, November 19, 1952, a low-pressure center was developing just south of Chattanooga, Tenn., on an eastward moving cold front. The center deepened and apparently joined another center which formed southwest of Hatteras, N. C. The development and movement of the synoptic features during the following several days were similar to those of the storm of November 25–27, 1950, [1, 2]. Although other storms evolving similarly are relatively rare, some have been described in the literature, e. g. the storm of November 8–10, 1913 [3], and that of October 22–25, 1923 [4]. It is of interest to compare the cyclones of November 1952, and 1950, examining the similarities and differences, because attendant weather conditions were sometimes extreme and destructive and because the cyclones presented forecasters with challenging problems.

During the 1952 storm there were heavy rains and high winds over the Atlantic Coastal States. Snow accompanied by low temperatures occurred along the Appalachian Mountains especially near the inception of the storm. The total precipitation for the period November 19–22, 1952, for some selected stations is shown in table 1. Knoxville, Tenn., received 18.2 inches of wet snow within a 24-hour period establishing a new record for any 24-hour period within the past 69 years. During the 1950 storm heavy snow accompanied by record minimum temperatures blanketed large areas of the eastern United States, and very strong winds, some exceeding hurricane force, occurred over certain Atlantic Coastal States (see [1] and [2] for more detailed description).

TABLE 1.—*Total precipitation at selected stations for the period November 19–22, 1952*

Station	Total (in.)	Station	Total (in.)
Connecticut		*Pennsylvania*	
Hartford	2.7	Harrisburg	4.7
		Pittsburgh	2.0
Kentucky		*Tennessee*	
Lexington	2.5	Knoxville	3.5
Maryland		*Virginia*	
Baltimore	6.1	Norfolk	3.6
		Richmond	4.5
New York		Roanoke	2.0
Albany	1.8		
New York (City Office)	1.7	*District of Columbia*	
North Carolina		Washington (Airport)	4.6
Hatteras	9.4		
Raleigh	3.3		

In comparing any two storms it would be desirable to use a quantitative measure of their strength rather than rely upon the usual subjective opinions. One such measure would be the minimum central pressure attained compared to the mean central pressure of a large group of Lows in the same latitude zone. Statistics relating to that subject have been prepared by James [5] who has proposed that the term "intensity" be used to describe the central pressure of a Low or High. James has published frequency tables of mean central pressure (4½ years data) and variance of North American Lows and Highs. He suggested that $\pm$ one standard deviation (σ) from the mean is normal; for Lows, between $-\sigma$ and -2σ is intense, and $<-2\sigma$ is very intense; for Highs, between $+\sigma$ and $+2\sigma$ is intense, and $>+2\sigma$ is very intense. Using James' data the Low of 1952, when at its minimum (997 mb.), would be classed intense while the High (1038 mb.) to the northeast would also be intense. The Low of 1950 (980 mb.) and the High (1049 mb.) would both be classed very intense. These measures of intensity confirm the subjective impression that the 1950 storm exceeded the 1952 storm in strength.

Figures 1 and 2 show the similarities of synoptic pattern existing at sea level in the early stages of the storms. The north-south cold front, the Low over the Carolinas, and the ridge over eastern Canada are significant features common to both. Not only were the patterns analogous but the geographical positions were also very similar. In the 1952 case the transition from tropical to polar air along the Atlantic Coast was very gradual, consequently no warm front is shown.

The 500-mb. charts preceding the storm development are shown in figures 3 and 4. The patterns are dissimilar east of 85° W. longitude, but to the west the presence of cold air southwest of the Low center and strong north winds west of the center are important features in common which are discussed further below.

The tracks of the two storms, at sea-level and 500-mb. are shown in figures 5 and 6. Retrogression and reformation west of the Appalachian Mountains are noted in each case. After the 500-mb. Low in the 1952 storm became fully developed, its track followed that of 1950 more closely than the track of the sea-level center followed its 1950 counterpart.

The sea-level patterns of the storms when near maturity are shown in figures 7 and 8. Except for details,

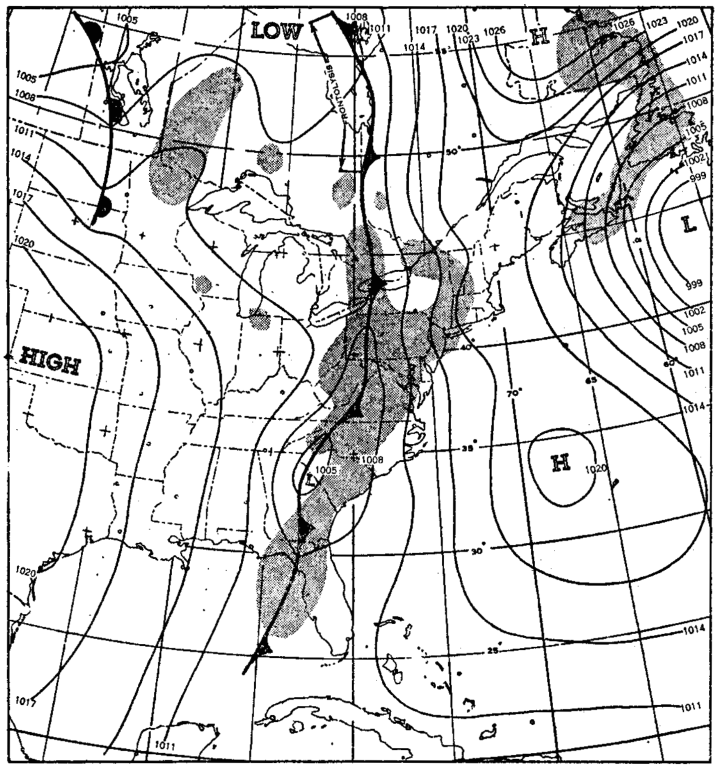

FIGURE 1.—Surface weather chart for 0630 GMT, November 20, 1952. Shading indicates areas of active precipitation. Isobars are intervals of 3 mb.

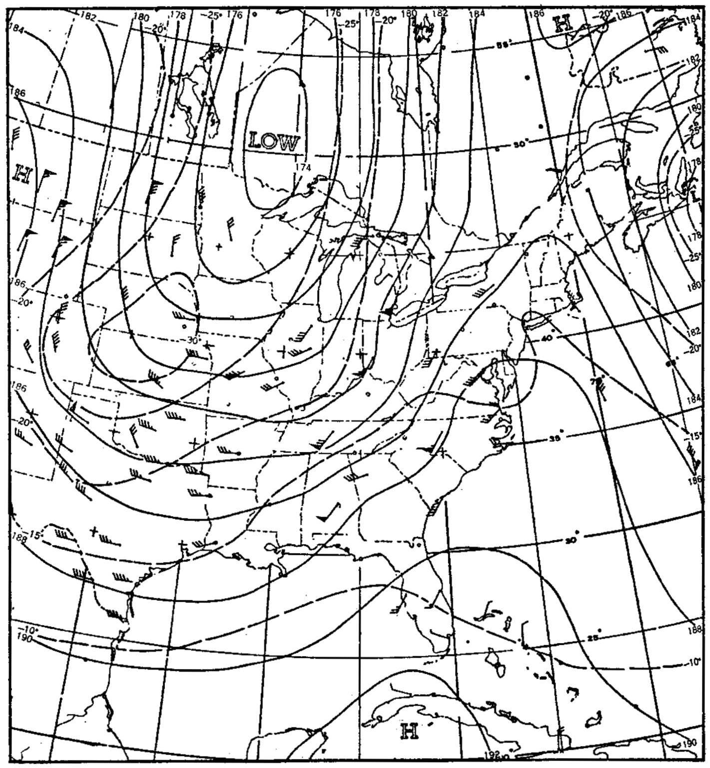

FIGURE 3.—500-mb. chart for 1500 GMT, November 19, 1952. Contours (solid lines) at 200-feet intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are drawn for intervals of 5° C. Barbs on wind shafts are for wind speeds in knots; full barb for every 10 knots and half barb for 5 knots.

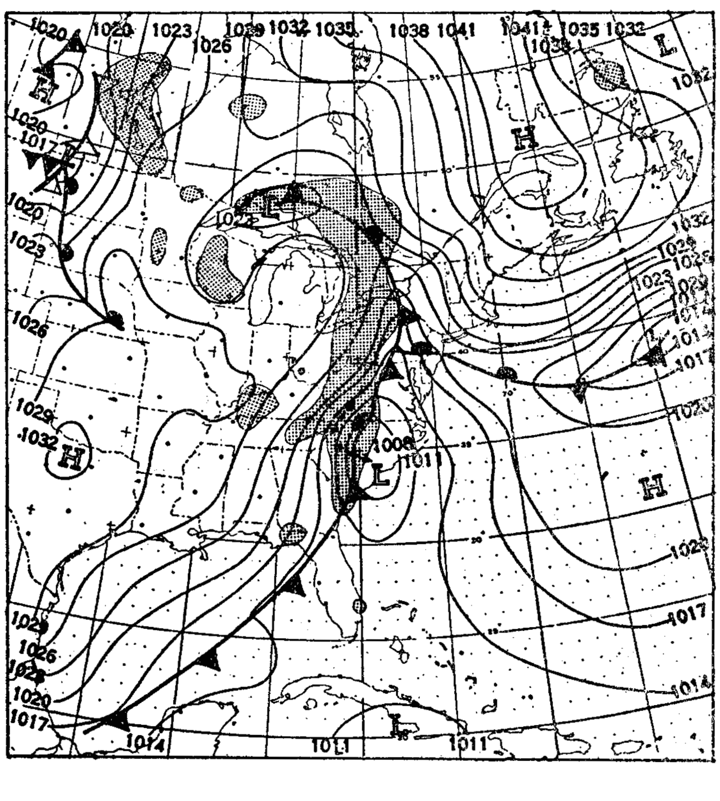

FIGURE 2.—Surface weather chart for 0030 GMT, November 25, 1950. Small squares connected by arrows indicate past positions of main Low at 12-hour intervals.

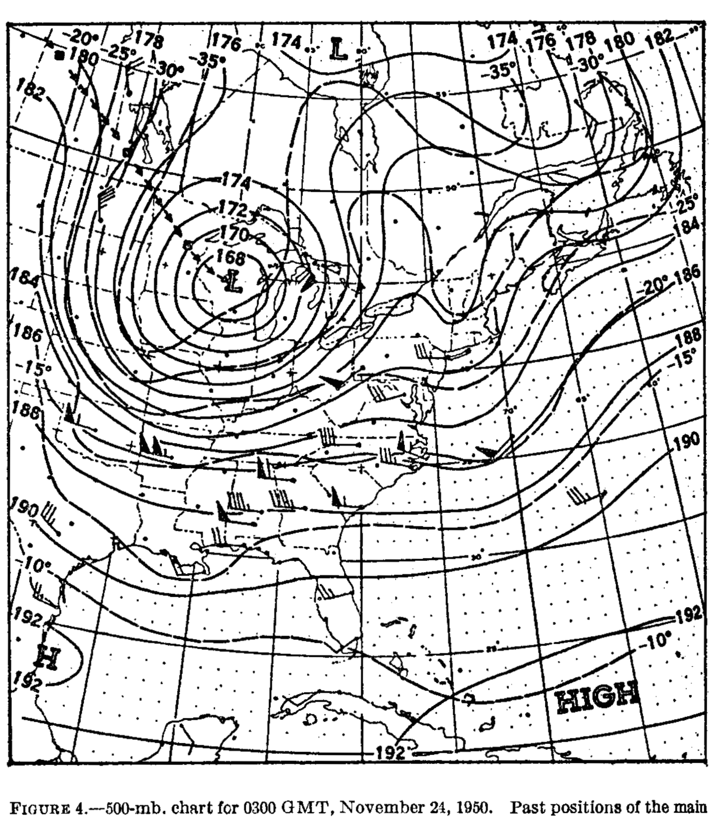

FIGURE 4.—500-mb. chart for 0300 GMT, November 24, 1950. Past positions of the main Low are at 12-hour intervals.

the only apparent difference is in intensity. Figures 9 and 10 show the 500-mb. patterns after the full development of the storms. Each was a mature "cold air drop" with the 1950 case obviously exhibiting greater intensity. Palmén [6] has discussed in detail the high-level cyclone of which the subject storms are examples.

In the large-scale features of the circulation as delineated by the 500-mb. charts, some similarities of blocking action over the Atlantic area are apparent between the periods preceding the storms of 1952 and 1950. Beginning about November 14, 1952, a branching of the main current of the westerlies appeared over Montana. The small trough and ridge just east of the branching current moved eastward, each developing, until on November 19 a typical block with a closed High north of a closed Low was established along 55°-60° W. longitude. The blocking apparently contributed to the deceleration of the northern portion of the large-scale trough over western United States; this, in turn, allowed the southern portion, which had been lagging behind, to advance to about the same longitude as the northern portion setting up the relatively narrow north-south trough shown in figure 3. A large-scale trough and ridge arrangement of that type indicates that cold air moving from the west would be shunted far southward instead of proceeding eastward.

During November, 1950, initial symptoms of a blocking situation indicated by the branching of the main current of the westerlies appeared about the 19th near 40° N., 55° W. and moved eastward while developing into a mature block near 40° W. by the 22d. The large-scale trough west of the block was not as narrow as in the 1952 case. Furthermore the distance between trough and block was 15°–20° of longitude greater in the 1950 case making any influences the block may have had on the trough less apparent.

One of the relations used in the WBAN Analysis Center for prognosticating 500-mb. contours is the correlation between height and temperature changes. It has been repeatedly observed that stations experiencing sizeable temperature changes often experience height changes of the same sign.[1] It can be seen from figure 3 that the coldest air was generally over Kansas and Nebraska and that cold advection was indicated to the north. Using the relation given above, sizeable temperature and height falls would have been expected over the lower Mississippi Valley and sizeable rises over the Dakotas, Minnesota, and Nebraska. For the 24-hour period beginning 1500 GMT, November 19, 1952, these indications were borne out when the 500-mb. height at Nashville, Tenn., fell 490 feet, at Atlanta, Ga., 520 feet, and at Lake Charles,

[1] This observation is supported by some unpublished data compiled by Sidney Teweles, U. S. Weather Bureau, who obtained high correlation between interdiurnal height and temperature changes at 500 mb. for several stations in different geographical locations in the United States.

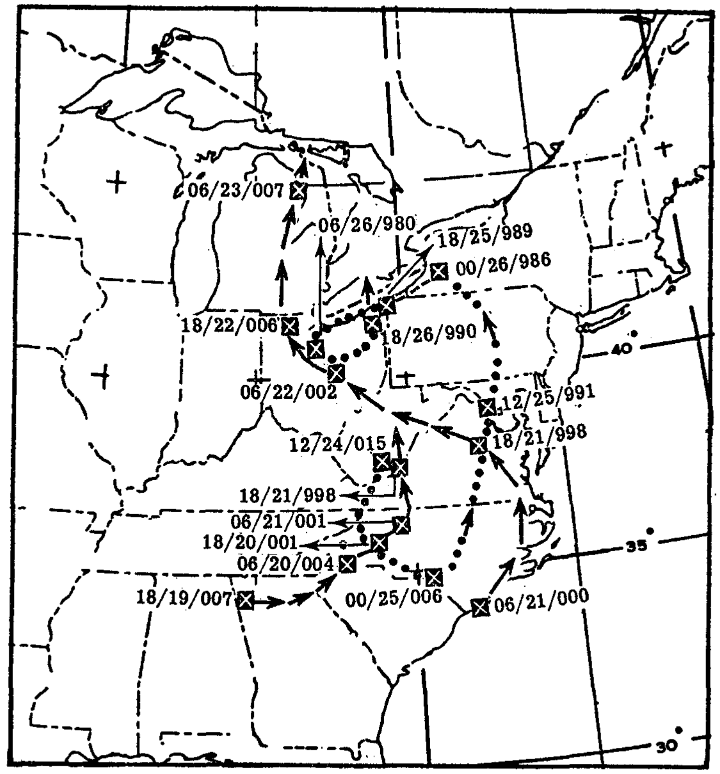

FIGURE 5.—Tracks of the surface Low centers. Dotted line indicates for 1950. Arrows indicate for 1952. Labeled GMT/DATE/PRESSURE (in millibars).

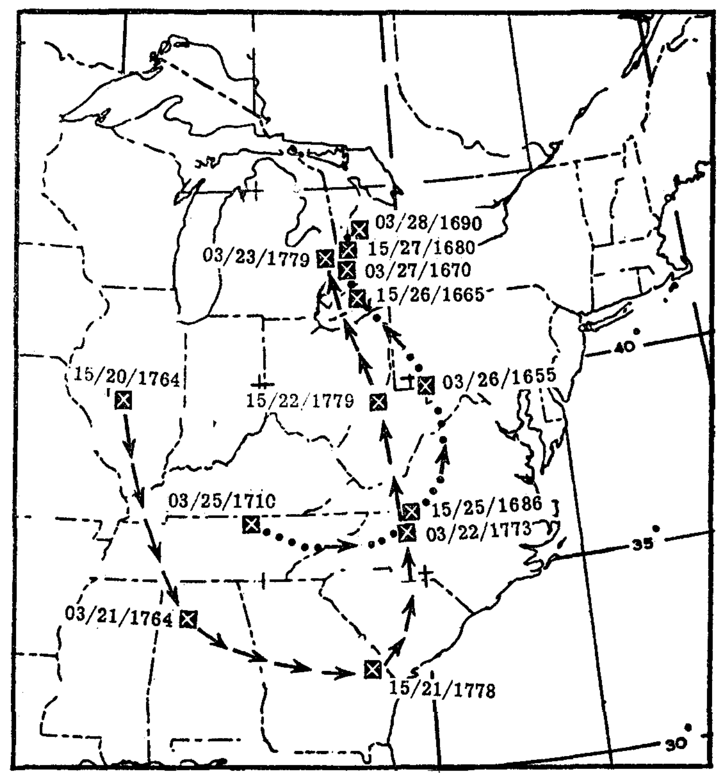

FIGURE 6.—Tracks of the 500-mb. Low centers. Dotted line indicates track for 1950. Arrows indicate for 1952. Labeled GMT/DATE/HEIGHT (in tens of feet).

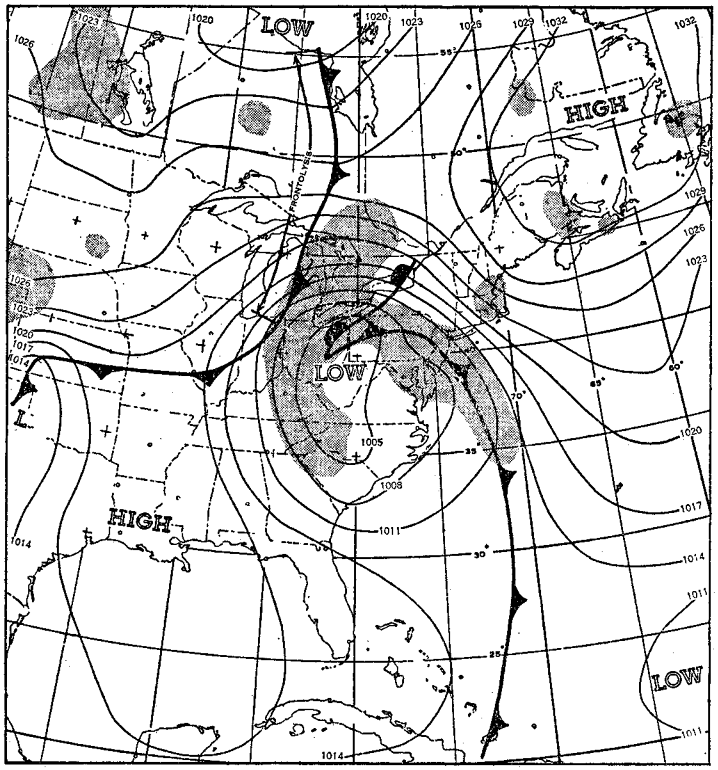

FIGURE 7.—Surface weather chart for 0630 GMT, November 22, 1952.

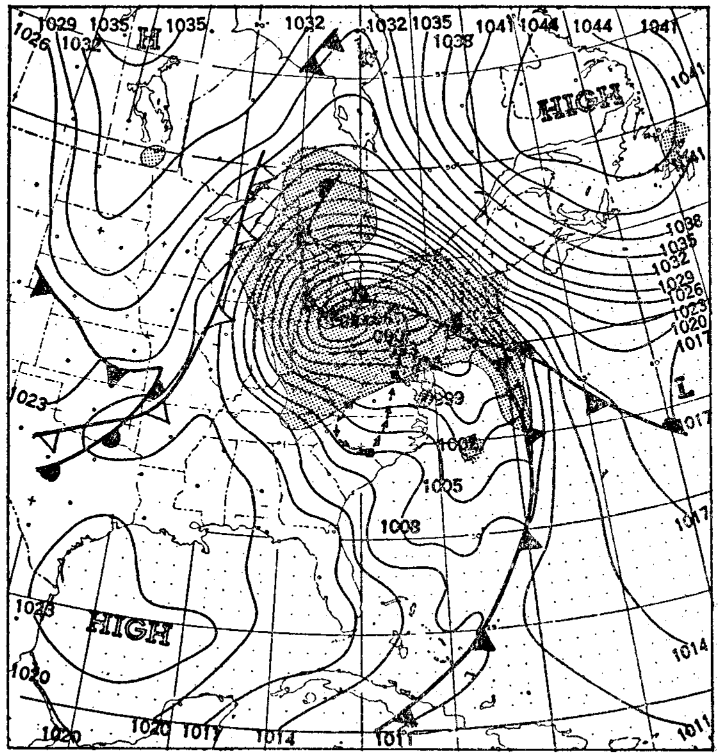

FIGURE 8.—Surface weather chart for 0030 GMT, November 26, 1950.

La., 730 feet while the temperature fell 5° C., 3° C. and 9° C., respectively. Concurrently, warming and height rises occurred west of the Low. For the same period as above, the 500-mb. temperature at St. Cloud, Minn., rose 9° C., at North Platte, Nebr., 13° C. and at Bismarck, N. Dak., 2° C., while the heights rose 490 feet, 510 feet, and 390 feet, respectively. In the 1950 situation cold air at 500 mb. located southwest of the Low (fig. 4) was also noted. During the 24-hour period beginning 0300 GMT, November 24, 1950, the 500-mb. height at Nashville fell 1,140 feet and at Atlanta 1,110 feet while the temperature fell 10° C. and 9° C., respectively. During the same period the height at St. Cloud rose 1,050 feet while the temperature rose 18° C.

Another feature common to the 500-mb. Lows of 1952 and 1950 was the presence of strong winds in the northerly current west of the center (figs. 3 and 4). For the 1950 Low, that feature has been discussed by Smith [1]. For the 1952 Low, figure 3 shows the 80-knot wind at Bismarck directed toward a region of approximately 50 percent less contour gradient. Using the arguments implied by the term "delta region" [7], a marked fall in 500-mb. heights in the southern part of the trough could be anticipated. The confirmation of that event was striking in the following 24 hours as indicated by the height falls given above.

Vederman [8] has published statistics showing the average changes in thickness of the standard layers over the centers of deepening Lows in eastern United States. His results indicated that the lower two-thirds by weight of the central column becomes thinner (denser) while the upper one-third becomes thicker (less dense). It is of interest to compare this feature of the Lows under discussion. During the 24-hour period ending 1500 GMT, November 21, 1952, when the maximum deepening (6 mb.) occurred, the thickness changes were in agreement with the average changes. Smith [1] has pointed out that during the 24-hour period ending 1500 GMT, November 25, 1950, when the maximum deepening (24 mb.) occurred in that more intense storm, the entire central column became thicker, however, during the 24-hour period ending 0300 GMT, November 26, 1950, when the Low deepened 22 mb., the thickness changes were compatible with the average. It may be said, then, that the cases under discussion generally confirm the average changes.

In discussing the storms of 1952 and 1950 the question arises whether a trend for intensification could have been seen near its inception. One interesting technique which would have shown this to a rather significant degree is the comparison of 3-hour sea-level pressure tendencies with 24-hour tendencies according to the rule of Scherhag [7]. The rule states that 3-hour tendencies increased 5 times are comparable to 24-hour tendencies and can be used as trend indicators. In an unpublished study, C. L. Bristor of the U. S. Weather Bureau, Washington, has applied this technique with the following results. The zero 24-hour isallobar at 0630 GMT, November 21, 1952, lay approximately along a line from Hartford, Conn., to Binghamton, N. Y., to Atlanta, separating an extensive

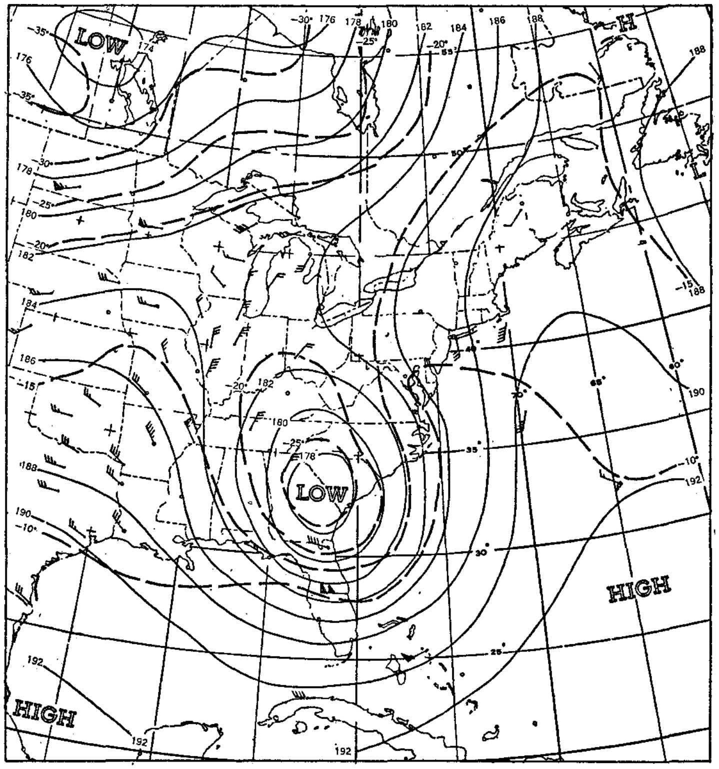

FIGURE 9.—500-mb. chart for 1500 GMT, November 21, 1952.

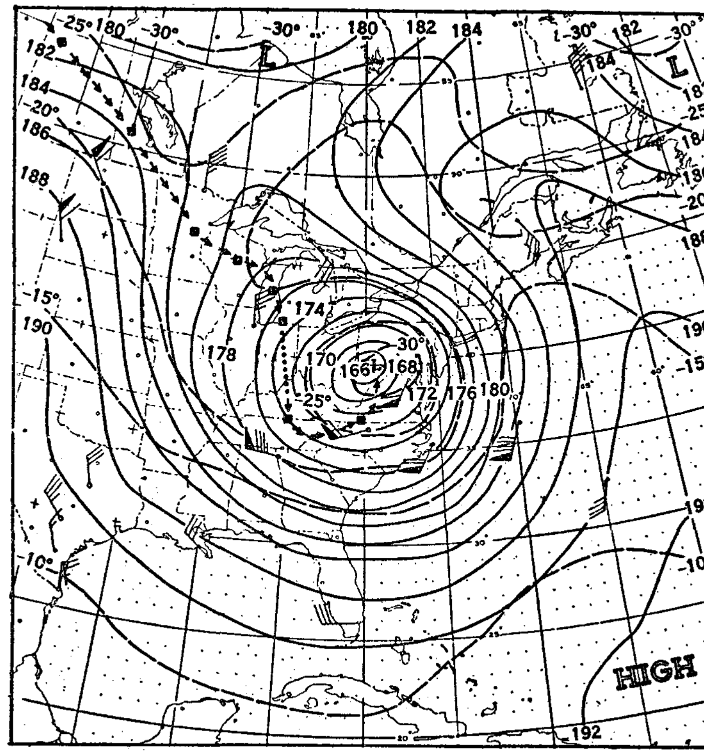

FIGURE 10.—500-mb. chart for 0300 GMT, November 26, 1950.

fall center (value ~ — 7 mb.) near Hatteras, from a rise area through the Mississippi Valley. The 3-hour pressure changes (normal diurnal removed) for the period ending at the same time converted to 24-hour changes according to the rule above showed that the zero isallobar moved southward to the Virginia border, and westward to a line from Dayton, Ohio, to Birmingham, Ala. This indicated a trend for concentration of the center of the fall area over North Carolina and the spreading of a portion of it northwestward over West Virginia and Ohio. The central value of the fall area was shown to have decreased to −13 mb. over southeastern North Carolina confirming a clear trend toward intensification.

Concerning the 1950 storm, the following indications were obtained. The 24-hour pressure change for 0330 GMT, November 24, 1950, showed a +5-mb. isallobar along a line from near Columbus, Ohio, to Chattanooga, Tenn., with a −5-mb. center over Lake Huron. The 3-hour changes expressed in fifths of millibars for the period ending at the same time showed that the +5-mb. isallobar had not moved eastward appreciably even though other prognostic techniques would have suggested such movement, and that a −5-mb. center had formed near Knoxville, Tenn. The trend was evident, then, for intensification in that case also.

This report has compared the storms of November 1952 and 1950 and has pointed out several features which may be of use in anticipating the development and movement of future retrograde storms over the eastern United States. As shown by these storms, however, the detailed differences between analogous situations can make very significant differences in the accompanying weather events.

REFERENCES

1. C. D. Smith, Jr., "The Destructive Storm of November 25–27, 1950," *Monthly Weather Review*, vol. 78, No. 11, November 1950, pp. 204–209.
2. C. L. Bristor, "The Great Storm of November, 1950," *Weatherwise*, vol. 4, No. 1, February 1951, pp. 10–16.
3. C. P. Mook, "The Famous Storm of November, 1913," *Weatherwise*, vol. 2, No. 6, December 1949, pp. 126–128.
4. J. Bjerknes and M. A. Giblett, "An Analysis of a Retrograde Depression in the Eastern United States of America," *Monthly Weather Review*, vol. 52, No. 11, November 1924, pp. 521–527.
5. R. W. James, "The Latitude Dependence of Intensity in Cyclones and Anticyclones," *Journal of Meteorology*, vol. 9, No. 4, August 1952, pp. 243–251.
6. E. Palmén, "The Aerology of Extratropical Disturbances," *Compendium of Meteorology*, American Meteorological Society, Boston, 1951, pp. 599–620.
7. R. Scherhag, *Neue Methoden der Wetteranalyse und Wetterprognose*, Springer, Berlin, 1948.
8. J. Vederman, "Changes in Vertical Mass Distribution over Rapidly Deepening Lows," *Bulletin of the American Meteorological Society*, vol. 30, No. 9, November 1949, pp. 303–309.

U. S. GOVERNMENT PRINTING OFFICE: 1953