HURRICANE ABLE, 1952

R. B. ROSS

WBAN Analysis Center, U. S. Weather Bureau, Washington, D. C

INTRODUCTION

The Miami Weather Bureau Office issued its first advisory for storm Able on August 25, 1952. Navy aerial reconnaissance had reported squally conditions with a poorly defined center located at 20° N. latitude and 59° W. longitude (about 420 miles east-northeast of San Juan, Puerto Rico). The storm, moving toward the west-northwest, developed hurricane force winds in squalls on August 27. Movement continued in this direction until the storm reached a point east-southeast of Jacksonville, Fla., August 30. Then as recurvature took place, the storm became a fully developed hurricane. It then moved toward the north and crossed the South Carolina coastline August 31. After moving inland this storm maintained its identity as a closed circulation as it continued up through the Atlantic Seaboard States into Maine where it finally dissipated. Hurricane tracks dating back to the beginning of the 19th century indicate that the path taken by this storm (fig. 1) was unusual. Tropical storm tracks, as reproduced by Tannehill [1], show one storm, in August 1893, with a track almost identical to the path taken by storm Able and only two other tracks with some similarity. Storm Able took a toll of two lives and left considerable damage in its wake as a result of heavy precipitation and high winds.

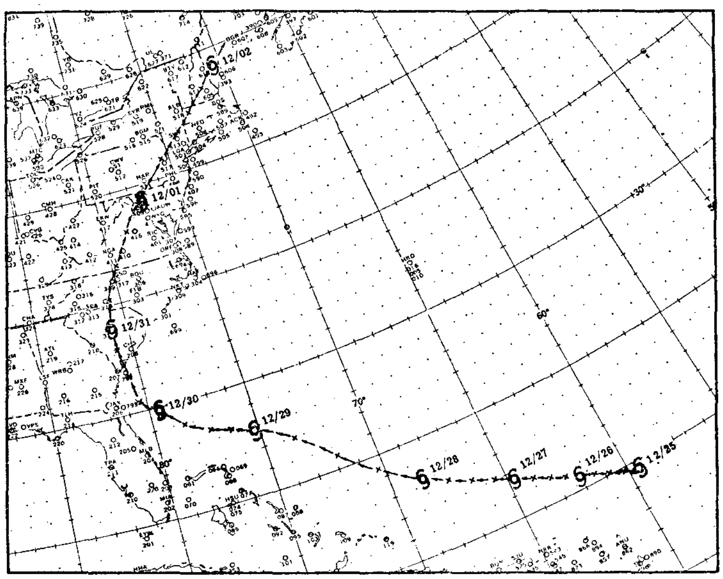

FIGURE 1.—Track of tropical storm Able. Hurricane symbols indicate 24-hour positions. Intervening 6-hour positions are indicated by an "X". Plotted number groups indicate time and date (GMT/Date) of positions.

EARLY DEVELOPMENT AND MOVEMENT

Storm Able originated from a development on a wave in the easterlies. When discovered on August 25, organization of the storm circulation was incomplete. Development was slow and until August 29 the southern semi-circle of the storm remained open with observed winds of not over 25 knots. The first winds of hurricane force, observed by aerial reconnaissance, were reported in squalls located in the northern semi-circle of the storm on August 27. On August 30, 1952, storm Able slowed down in its forward movement. Intensification with the formation of a definite eye took place and indications of recurvature were noted. The storm at this point was located about 130 miles east-southeast of Jacksonville, Fla. (fig. 2). Following recurvature the hurricane moved toward the north and crossed the South Carolina coast at Beaufort.

An interesting feature of storm Able, after recurvature took place, was the report of an apparent double eye structure. In a post-flight summary August 30, Navy reconnaissance reported a principal eye of 38 miles diameter and a secondary eye located just a few miles to

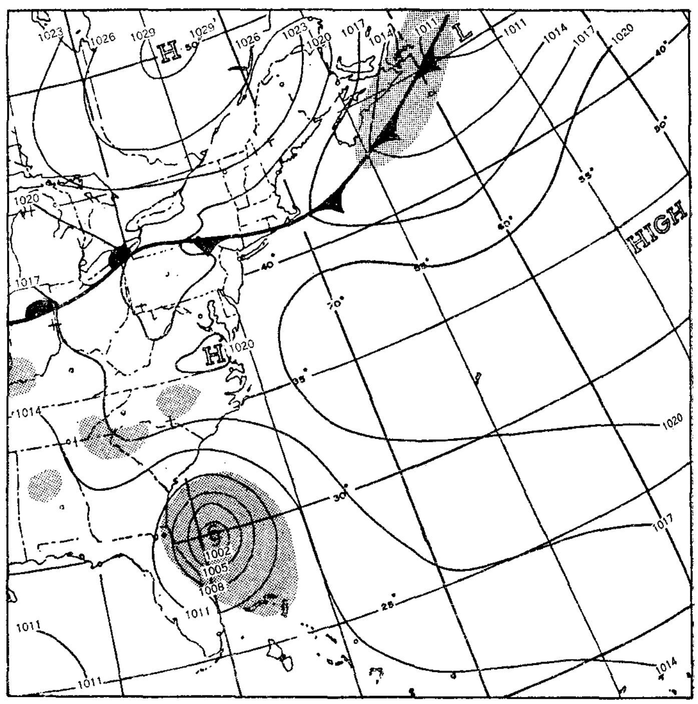

FIGURE 2.—Surface weather map for 1230 GMT, August 30, 1952. Shading indicates areas of active precipitation.

the southwest of the principal eye. Again, on August 31 a post-flight summary verified the existence of a secondary eye in the same relative position. This same summary reported maximum winds of 110 knots, the highest winds encountered during the existence of the storm.

RECURVATURE AND STEERING

At the time recurvature was indicated, the determination of the exact path that the storm might take posed a difficult problem. However, there were certain significant features in the synoptic situation which indicated that the storm might move with a more northerly component.

On August 30 a wave developed on a cold front just to the south of Newfoundland. Rapid cyclogenesis, associated with a strong surge of cold air aloft in the area, caused this wave to develop into a storm of major proportions within 24 hours (figs. 2 and 3). Although the entire wave structure is not shown in the figures, some idea of the intensity of the development is portrayed. With the intensification of this surface wave, a deepening and an apparent retrogression of the associated stationary trough aloft took place (figs. 4, 5, and 6). The upper air ridge located to the west of the trough, as shown in this sequence of 400-mb. charts, was displaced to the south and west, perhaps limiting the sharpness of the recurvature of the storm.

Another feature that may have influenced the path taken by storm Able, was a trough located over the Mississippi River region (see Boyce et al. [2]). In view of the weak circulation aloft in the immediate vicinity of storm Able, however, evidence that the steering was influenced by this trough to the west is not conclusive. Still another feature favorable (see [2]) for recurvature of the storm was the southward trend of the maximum westerlies at 600 mb. at this time as shown in figure 7.

Warm tongue steering of tropical cyclones has been suggested by Simpson [3]. The difference in height between the 700- and 500-mb. pressure surfaces appears to give the best results. Simpson says:

> "The analysis of temperature fields for this intermediate layer reveals that a tongue of warmer, lighter air is associated with the moving tropical cyclone and extends from 800 to 1200 miles in advance of the storm. The major axis of this tongue of warm air is parallel to the instantaneous direction of storm movement. Experience in testing this effect has shown that a good lag correlation exists between the present orientation of the warm tongue and the future path of the storm. In 139 synoptic cases analyzed the 24-hour movement given by this simple steering principle differed seriously from the observed movement in only four instances, and on many occasions important changes in direction were indicated as much as 48-hr. in advance."

To examine the warm tongue steering effect, thickness charts for the layer between 500 and 700 mb. for 0300 GMT on August 30, 31, and September 1, 1952, were constructed (figs. 8, 9, and 10). The path that the storm might follow is not definitely indicated by the first of these figures. The following two figures, however, clearly show that the major axis of the warm tongue was almost identical to the track taken by the storm (fig. 1).

Forecasters commonly make use of the high level wind flow to determine the future direction of motion of hurricanes. After reading a draft of this article, Mr. Grady Norton, Meteorologist in Charge of the Miami Weather Bureau Office, wrote, ". . . we thought this was a very good example of high-level wind 'steering'." Pointing out that wind steering is never used for longer than 30-hour periods, he further stated that their warnings for this hurricane were based on the winds at the 30,000- and 35,000-foot levels, where the hurricane circulation was absent. Figure 11 is a reproduction of a copy, furnished by Mr. Norton, of the 35,000-foot winds aloft working chart made at the Miami office at the time. Comparison of figures 1 and 11 reveals that the streamline through the hurricane is close to the path of the storm up to the time it passed inland about 24 hours later.

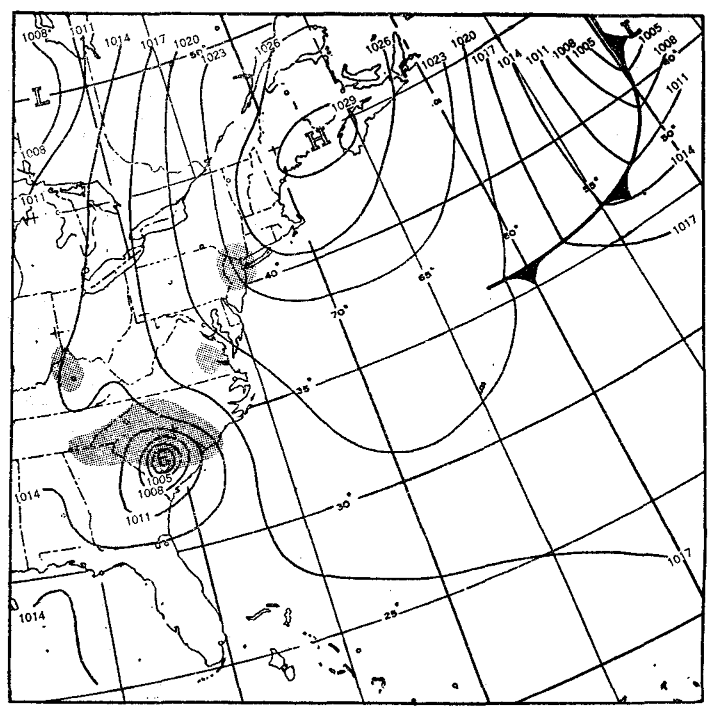

Figure 3.—Surface weather map for 1230 GMT, August 31, 1952.

THE STORM INLAND

On August 31, 1952 Navy reconnaissance reported the northwest edge of the storm's eye over the coastline at 0255 GMT. By 0345 GMT the eye of the storm had moved inland. A vertical cross section (fig. 12) was constructed using 0300 GMT, August 31, 1952 radiosonde data (very close to the time storm Able crossed the coastline). The stations used were Jacksonville, Fla., Charleston, S. C., and Greensboro, N. C. Unfortunately the Charleston sounding ended just short of the 500-mb. level so details of the structure above that level are missing. The eye of the storm passed close to, but not over, Charleston, so the central structure is not known. Arakawa [4] shows in detail the vertical structure of a mature typhoon. The data available to him consisted of a large number of radiosonde and wind observations from a network of closely spaced stations with one radiosonde flight near the core of the typhoon. According to Arakawa there is descending motion within the core and ascending motion just outside the core of the storm. The vertical cross section constructed for storm Able, although it does not show the central structure, shows cooling in the vicinity of Charleston which may be attributed to the vertical motion near the eye of the storm and to the heavy precipitation in advance of the eye. The lapse rate and the dew point curves for Charleston at 0300 GMT on the 31st are very similar to the findings of Jordan [5] on the low level structure of the typhoon.

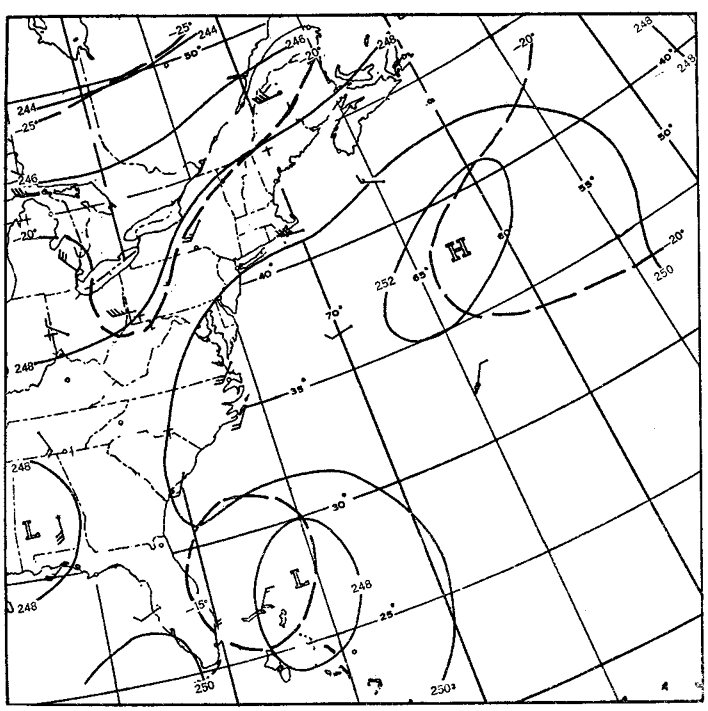

FIGURE 4.—400-mb. chart for 1500 GMT, August 29, 1952. Contours (solid lines) at 200-foot intervals are labeled in hundreds of geopotential feet. Isotherms (dashed lines) are at intervals of 5° C. Barbs on wind shafts are for wind speeds in knots; full barb for every 10 knots and half barb for 5 knots.

The following is quoted from the preliminary report on storm Able by Mr. Grady Norton:

> "Beaufort was in the western edge of the calm center with unofficial pressure of 29.09 inches (985 mb.) and strongest wind 80 to 90 m. p. h.

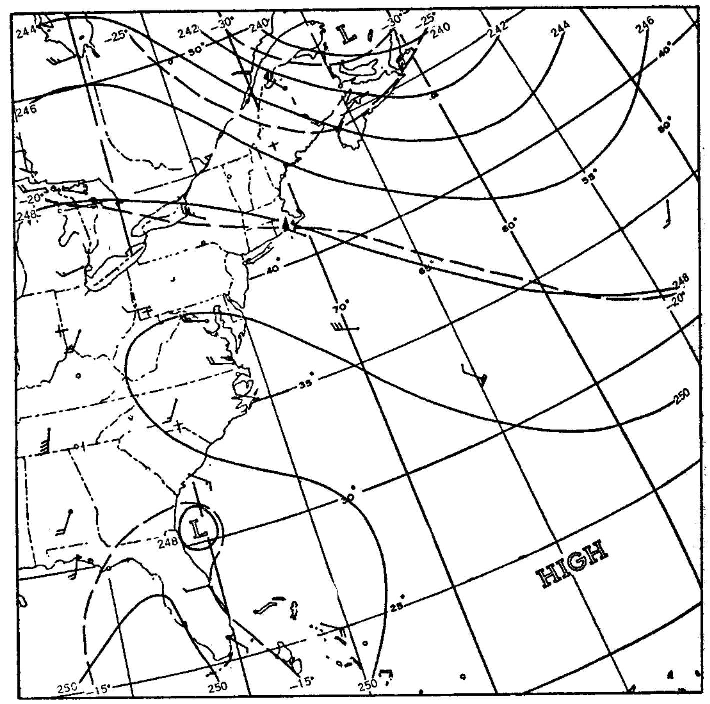

FIGURE 5.—400-mb. chart for 1500 GMT, August 30, 1952.

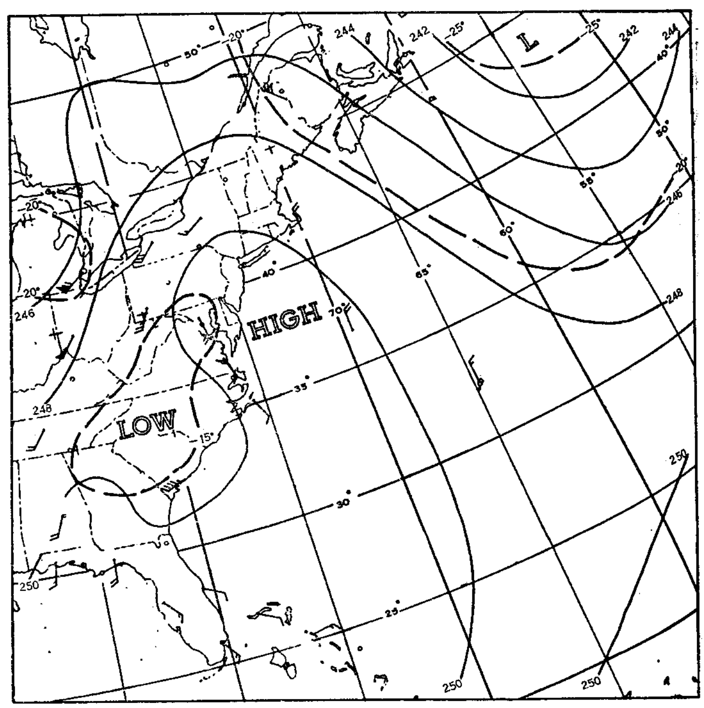

FIGURE 6.—400-mb. chart for 1500 GMT, August 31, 1952.

from WSW after the lull, which lasted about 10 minutes from 10:20 to 10:30 p. m. The strongest wind would be expected on the right or eastern side of the eye, but this was over the marsh and swamplands between Beaufort and Charleston where no measurements were obtainable. At Charleston, about 50 miles east of the center, the wind reached 63 m. p. h., while at Savannah, about 30 miles west, the highest gusts were only 35 m. p. h.

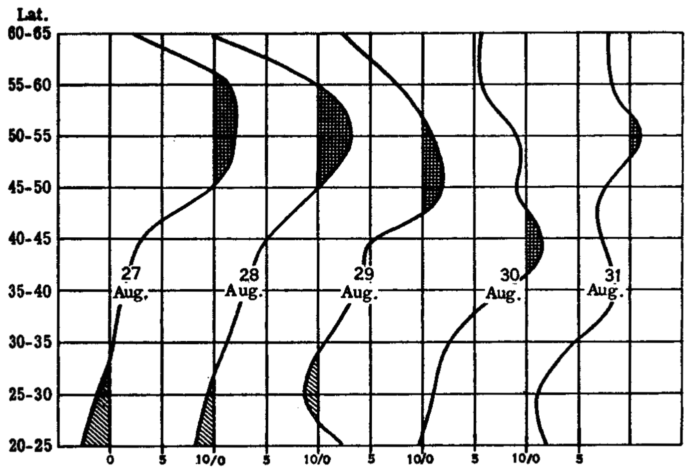

Figure 7.—Zonal wind profile curves at the 600-mb. level for the zone between 20° W. and 135° W. longitude. Curves derived by computing westerly component of the average wind for intervals of 5° of latitude. Magnitude of the westerlies is in degrees of latitude per day.

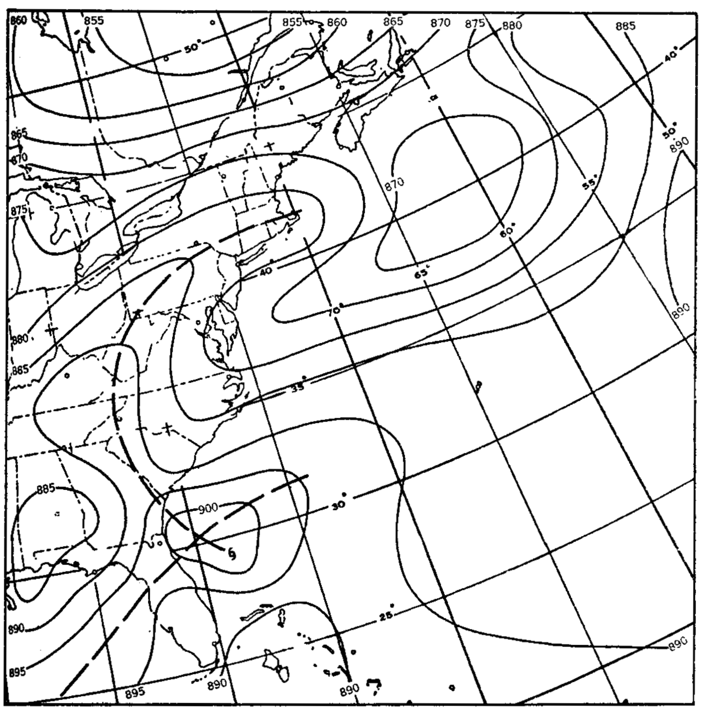

Figure 8.—Height difference chart between 700 and 500 mb. for 0300 GMT, August 30, 1952. Isopleths of mean virtual temperature (solid lines) are labeled in terms of height difference for 50-foot intervals. Axis of warm tongue indicated by heavy dashed line.

"Damage was estimated at about $2,200,000 in South Carolina, divided roughly $500,000 to property, $200,000 to communications, and $1,500,000 to crops. The crop damage was most-

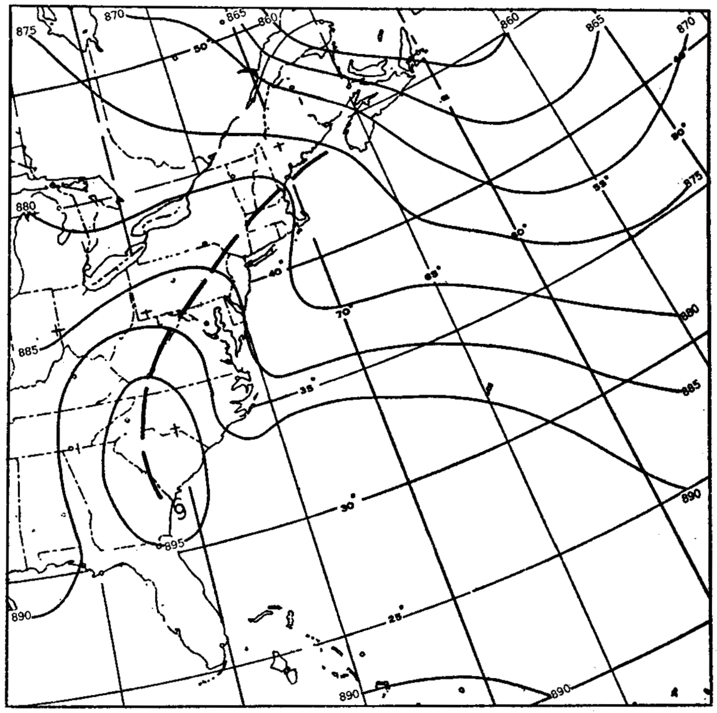

Figure 9.—Height difference chart between 700 and 500 mb. for 0300 GMT, August 31, 1952.

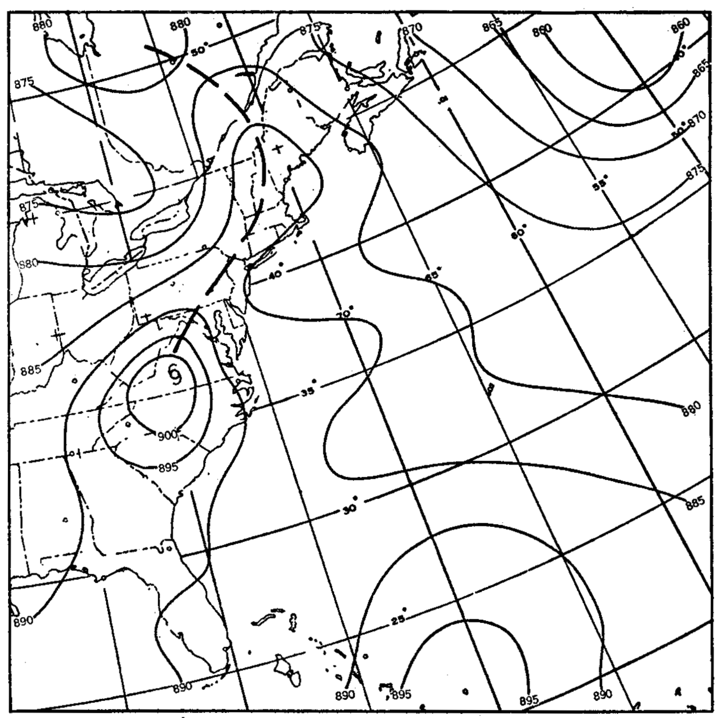

Figure 10.—Height difference chart between 700 and 500 mb. 0300 GMT, September 1, 1952.

ly to open cotton blown on the ground and damaged. Most of it was salvaged but beating by wind and rain in dirt lowered grade and price.

"In North Carolina, damage was given as 'minor' or 'light'. Highest winds over a rather widespread area of the State ranged around 40 m. p. h. and did little damage. A small tornado occurred in connection with the passage of the weakened hurricane in Stokes county and damaged a number of farm buildings. Torrential rains caused some flooding of lowlands, and a number of highways were flooded for a short time, and a few small bridges and embankments were washed out. The total actual damage probably did not exceed $50,000.

"Two persons lost their lives in the hurricane in South Carolina, one man was killed when he tried to remove a live wire that had fallen on his automobile, while another was killed when his car was

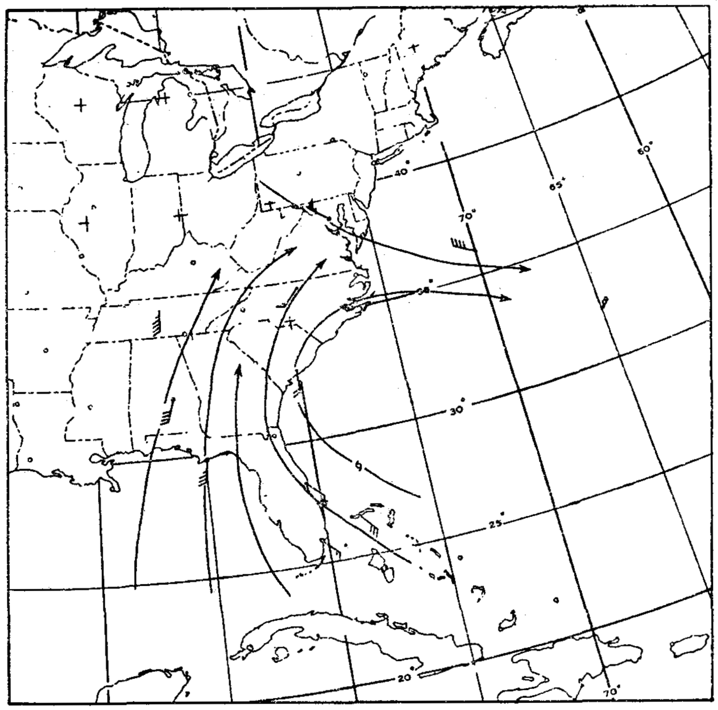

FIGURE 11.—Winds and streamlines at 35,000 feet, 0300 GMT, August 30, 1952. The hurricane symbol shows the surface position of the storm at this time.

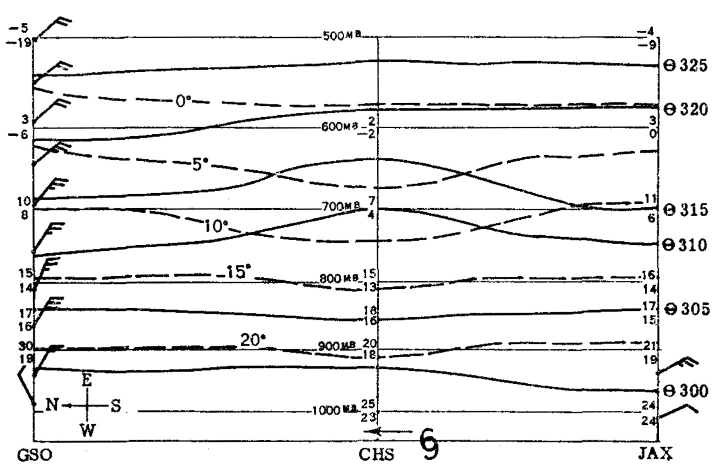

FIGURE 12.—Vertical cross section through hurricane Able for 0300 GMT, August 31, 1952. Temperature (dashed lines) is in ° C., potential temperature (solid lines) in ° A. Temperature and temperature of dew point in ° C. is shown at significant levels. Barbs on wind shafts are for wind speeds in knots; full barb for every 10 knots and half barb for 5 knots.

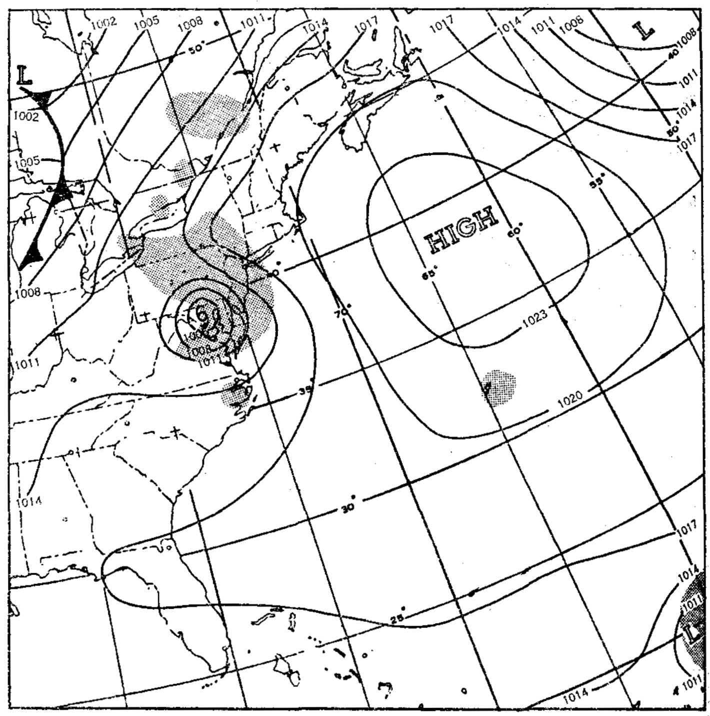

FIGURE 13.—Surface weather map for 1230 GMT, September 1, 1952.

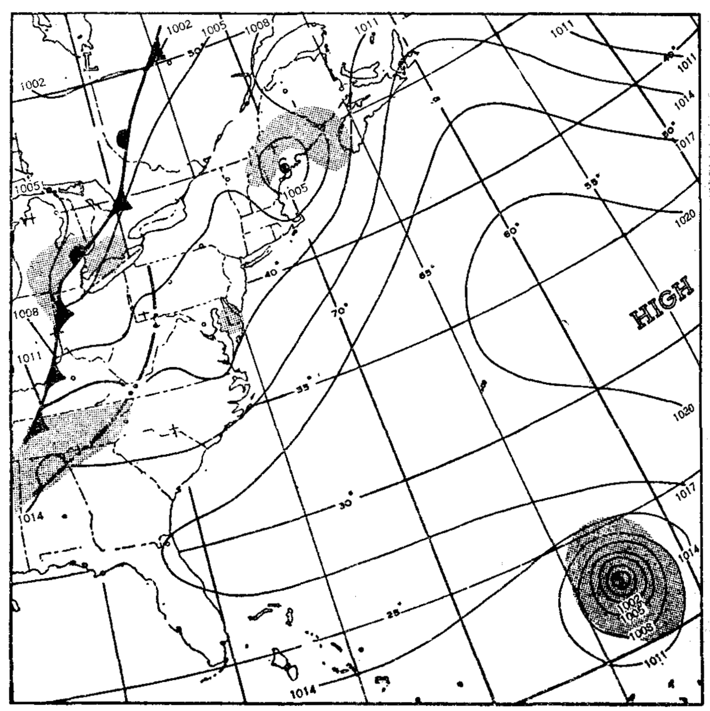

FIGURE 14.—Surface weather map for 1230 GMT, September 2, 1952.

wrecked in the blinding rain when it struck a tree that had fallen on the highway."

The storm center as shown in figure 3 was located just to the northeast of Columbia, S. C., at 1230 GMT, August 31, 1952; 24 hours later the center had moved to Frederick, Md., northwest of Washington, D. C. (fig. 13). The storm in the Washington, D. C., area was attended by winds 35 to 40 m. p. h., with occasional gusts up to 50 m. p. h. The peak gust reported at Washington National Airport was 60 m. p. h. A small tornado did considerable damage to dwellings at Franconia, Va., in Fairfax County. A tornado, which may have been the same one also struck with destructive force at Potomac, Md. Rainfall was heavy, ranging from 2 to over 3 inches. Property damage done in the area was estimated to be in excess of $500,000, caused primarily by flooding and the destructive force of the tornado. Falling trees and branches disrupted power and telephone facilities. There were no reports of personal injuries.

After leaving the Washington area the storm moved up into the New England States and was centered just to the northwest of Portland, Maine, at 1230 GMT, September 2, 1952 (fig. 14). It was in this area that the storm finally lost its closed circulation and dissipated. Pennsylvania, New York, and the New England States experienced winds of 30 to 40 m. p. h., with gusts to 50 m. p. h., with passage of the storm. Rainfall was moderate to heavy, resulting in some flooding in localized sections. Some unofficial rainfall amounts are shown in table 1 for stations affected by the storm.

Table 1.—*Some unofficial rainfall amounts associated with storm Able*

Station	Amount in inches	Station	Amount in inches
Jacksonville, Fla	1.69	Baltimore, Md	4.27
Savannah, Ga	1.16	Frederick, Md	3.70
Charleston, S. C	2.01	Harrisburg, Pa	3.60
Myrtle Beach, S. C	4.75	Allentown, Pa	5.08
Florence, S. C	3.83	Teterboro, N. J	2.07
Columbia, S. C	1.69	New York, N. Y	1.20
Charlotte, N. C	3.76	Albany, N. Y	2.47
Fort Bragg, N. C	6.33	Pittsfield, Mass	2.77
Raleigh, N. C	3.66	Chicoppee Falls, Mass	1.47
Greensboro, N. C	2.67	Summerset, Vt	3.27
Roanoke, Va	2.61	Montpelier, Vt	2.82
Lynchburg, Va	2.52	Mt. Washington, N. H	2.10
Gordonsville, Va	2.55	Portland, Maine	1.15
Martinsburg, W. Va	3.72	Rumford, Maine	2.37
Washington, D. C	3.47		

Storm Able, although never really developing into a large storm over the ocean maintained its circulation and identity as a tropical storm over a long land trajectory. Two important features can account for this. First, since the trajectory remained east of the Appalachian Mountains, the storm's circulation was not distorted appreciably by the terrain. Secondly, and of perhaps greater importance, the general circulation over the eastern seaboard, prior to and during the time the storm was inland, was characterized by southerly flow bringing warm moist tropical air into the area. The dew point temperatures ranged in the seventies as far north as New York City. This tropical maritime air supplied the energy required by the storm to maintain itself.

It is interesting to note that the second hurricane of the season, storm Baker, developed in the same region in which storm Able originated. This fully developed hurricane is shown inthe southeastern corner of figure 14. Initially,storm Baker followed very closely the track taken by Able but recurved farther to the east and moved to the north-northeast well off the Atlantic coastline.

ACKNOWLEDGMENTS

The writer is indebted to Mr. Grady Norton and Mr. Joseph Vederman for their helpful suggestions and review of the manuscript.

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