4. Immediately to the west of the northern portion of this line was a belt of diverging winds, characterized by brilliantly clear skies and exceedingly dry air, the driest on record at some stations. (Note surface wind-arrows on fig. 7.)

5. Kite observations indicated the presence of cold southwest-west wind at a moderate height overrunning the warm surface wind.

6. The northeastward movement of the tornadoes and lower clouds and the fall of hail on or to the east of tornado paths indicated a southwest to, at least, west-southwest wind not far aloft.

Surely this was an unusual set of conditions. With winds meeting at an angle of about 60° and at a rate of about 30 miles an hour, large volumes of air were sent upward and given a counterclockwise rotary motion by the thrusts of the southwest squalls routing under the rear portions of the slower north-northwestward-moving masses of warmer air. At a moderate height condensation took place in the moist, upthrust air, and as it ascended at a lesser rate of cooling, due to the liberation of latent heat of condensation, it probably was squeezed aloft at an increased rate by the cold wind it was probably encountering. Under such conditions intense vertical movement accompanied by a rotary motion of small dimensions makes a tornado.—*Charles F. Brooks.*

THE FOUR TORNADOES OF APRIL 20, 1920.

INTRODUCTORY NOTE.

The tornadoes of April 20, which were even more destructive than those of March 28, were apparently the result of a cold northerly wind overrunning the southerly surface wind. There was apparently no line of wind convergence, as in the case of March 28; but the striking feature is the formation, at approximately 60-mile intervals in a north-south line, of four tornadoes which swept along parallel paths from Mississippi into Alabama and Tennessee. The regular formation of these storms probably indicates the successive stages of the advancing cold air aloft: and the location of this front could be roughly determined by a line drawn through the synchronous positions of the tornadoes. According to newspaper accounts, which seem reliable, "loss of life * * * in Mississippi, Alabama, and Tennessee stood to-day [April 24] at 229 persons, with at least 700 injured, and a property loss of several million dollars."—EDITOR.

TORNADOES IN EASTERN MISSISSIPPI, APRIL 20, 1920.

By J. H. JAQUA, Observer.

[Meridian, Miss., May 21, 1920.]

Eastern Mississippi was visited on April 20, 1920, by the most destructive tornadoes of record in the area involved. A total of 130 persons were killed, 659 injured, and approximately 1,000 were rendered homeless. Incomplete statistics show that the property loss, exclusive of damage to crops, will approximate $1,500,000, which does not include damage done to standing timber.

METEOROLOGICAL CONDITIONS.

The morning weather map for April 20 shows the presence of an oval-shaped cyclone over the lower Mississippi Valley States (see fig. 1), the disturbance having made little eastward progress in 24 hours, but having materially changed its general shape. The pressure gradient over eastern Mississippi was about 0.1 inch to 75 miles. The barograph trace at Meridian shows that a slow fall in pressure had been in progress between midnight and 7 a. m. (See fig. 2 on plate facing p. 192.)

Temperatures ranged from 70° F. at Corinth to 75° F. at Meridian, or 10° F. in excess of the normal mean for the day. The northwest to southeast temperature gradient was probably not more than 5° F. in 120 miles. The trend of the isotherms was regular for the prevailing condition, and there was apparently a sharp wind-shift line, north and south through western Mississippi. (See fig. 1.)

The relative humidity was 86 per cent at 7 a. m., and had been practically stationary during the night, which was cloudy and sultry.

The conditions shown indicated the development of thunderstorms of convectional origin, and it was believed that the probability of the formation of tornadoes was not well decided. The most favorable feature that would warrant an assumption of the existence of incipient tornadic condition was the general atmospheric stress, which is frequently present under various arrangements of the isobars, but not as frequently productive of violent whirls. The rising humidity and abnormal surface temperatures prevailing in a season when the vertical temperature gradient is usually large indicated great

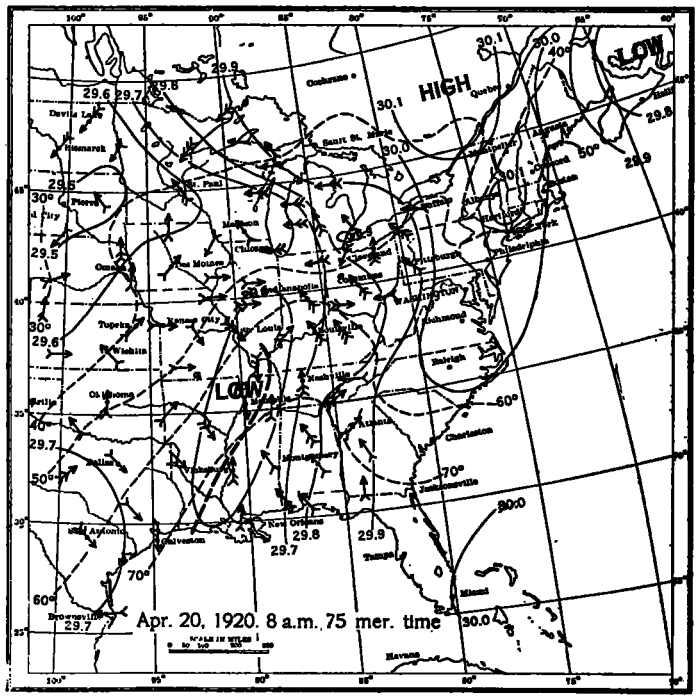

FIG. 1.—Weather map, April 20, 1920. (Barbs on wind arrows show wind force in Beaufort scale.) Wind-shift line heavy dashed.

convectional activity. That there existed probably a steep vertical gradient appears to have been demonstrated by the short funnel of the tornado at Meridian, as the cloud appeared to be a mass dragging over the surface. None of the tornadoes was spectacular in appearance, such as are frequently represented in photographs.

DISTRIBUTION AND POINTS OF ORIGIN.

Investigation made subsequent to the occurrence of the tornadoes discloses that four distinct storms were in progress between 7:30 a. m. and 11 a. m., their tracks being nearly parallel and practically the same width. Great damage was done in 14 counties out of 21 counties, which constitute a double tier extending northward from Jones and Wayne Counties to the Tennessee-Mississippi line. (See fig. 3.)

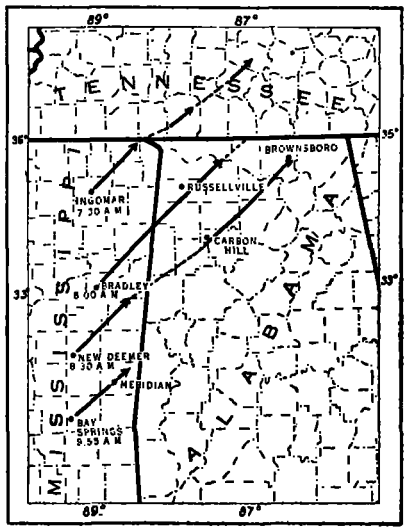

FIG. 3.—Tornadoes in Mississippi, Alabama and Tennessee, April 20, 1920.

Each tornado originated on, or slightly west, of the 89th meridian of west longitude and moved nearly due northeast at the rate of 50 to 60 miles per hour for a distance averaging 57 miles, except that the one originating in Oktibbeha County had a path of destruction which exceeded 80 miles and extended into the State of Alabama.

UNION COUNTY TORNADO.

The northernmost disturbance developed near Ingomar, in Union County, between 7 and 7:30 a. m., and moved northeastward across Tippah, Prentiss, and Alcorn Counties. The path of destruction ranged in width from one-eight to one-fourth mile. This tornado caused the death of 24 people and injured 167.

OKTIBBEHA COUNTY TORNADO.

The track of the next disturbance, which was over 80 miles long, lies about 66 miles south of the track of the northernmost tornado. It first became a destructive force about 8 a. m., near Bradley, in Oktibbeha County, from which point it crossed Clay and Monroe Counties into the State of Alabama. Reports state that in Clay and Oktibbeha Counties the devastated area is from 200 to 300 yards wide, but that in Monroe County it is one-fourth mile.

It was most destructive in Monroe County, where also the greatest number of fatalities occurred. There were 27 persons killed in that county, 150 injured, and about 500 left homeless. More than 110 dwellings were obliterated.

NESHOBA COUNTY TORNADO.

The third tornado originated about 8:30 a. m., in the southwestern portion of Neshoba County, and its path lies about 40 miles south of the Oktibbeha County storm.

It crossed Neshoba County and the southeastern corner of Winston County into Noxubee County, disappearing in Lowndes County. It was terribly destructive throughout its entire length, the width being one-fourth mile. The greatest loss of life occurred near New Deemer in Neshoba County, where 19 lives were lost in a lumber camp.

JASPER COUNTY TORNADO.

The southernmost and probably the most destructive of the series of four tornadoes developed near Bay Springs in Jasper County, about 9:55 a. m., and moved northeastward almost diagonally across Jasper and Lauderdale Counties.

The estimated damage to property in Jasper County is greater than in any other county traversed by the tornadoes of this day. Twenty-one persons were killed and 110 injured. The relief committee for that county reported that 156 families were affected by the storm, 20 of which had one or more members permanently injured, and 103 occupied buildings that were swept away or seriously damaged.

This tornado entered Lauderdale County at the southwest corner and began its work of destruction near Savoy; thence it continued northeastward to the Enterprise Road. The settlement at this point was the first important district to suffer devastation. It lay at the foot of a range of low hills, which the storm crossed, snapping off large trees like kindling wood and descending on the district with practically the suddenness of a flash of lightning. Not a house on this road for the distance of one-fourth mile was left standing. Most of them were so completely obliterated as to leave little evidence of their previous existence. From the Enterprise Road the storm crossed the broad plain below Hamiltons Lake, destroying most of the settlement at this point, where four people were killed. The tornado, when passing Hamiltons Lake, was about 6,150 feet southeast by south from the Weather Bureau Office at Meridian. Its least distance from the station was about 5,750 feet, at a point about 2,500 feet northeast of Hamiltons Lake. (See barograph trace, fig. 2 on plate facing p. 192.)

From the lowland the tornado passed up the foothills over the Mountain Road, crossing wooded hills and intervening vales, with no apparent loss of energy, to the Bonita district. In this section there was great destruction, but only one life was lost. About 25 houses were wrecked, including the Bonita public-school building and the Oak Grove Church building.

After moving about 1 mile beyond Bonita, the storm disappeared between Russell and Marion. The path of destruction averaged close to one-fourth mile in width, throughout the 5-mile course of the tornado off the city limits. The tornadic character of the damage was evident from the position of the fallen walls of houses and débris, wherever they were not carried away by the whirl, the walls being thrown outward.

In Lauderdale County, 15 people were killed, 81 injured, and over 100 families were left homeless. The total property loss, closely estimated by the relief committees, was $155,000. Owing to the unusual backward character of the spring season, the damage to crops was slight.

NOTES.

It is perhaps worth noting that the apparent north-to-south progress of the incipient tornadic condition from near Bradley to New Deemer, a distance of 50 miles, required nearly exactly the same time as for the Oktibbeha County storm to move from Bradley to Aberdeen, a distance of about 45 miles. In other words, when one tornado was passing Aberdeen, the next one to the southward was just becoming a destructive force.

The apparent southward progress of the condition was nearly twice the velocity of the forward movement of the tornadoes, except in the case of the southernmost storm, which developed rather slowly, as the first three had practically spent themselves before the last one was created.

At Mr. J. M. T. Hamilton's place, near Meridian, a drill-press weighing 150 pounds was carried about 150 feet; also a vise, weighing 100 pounds, was carried 150 feet away.

Near Bay Springs an automobile was blown several hundred yards; the spokes were torn from the wheels and tires from the rims. Three of the tires were found still inflated.

An automobile locked in a garage was undamaged, although the garage was blown to splinters.

Half a dozen glass jars of fruit were carried 100 yards by the winds and not damaged.

Legal documents from Bay Springs were found on the mountain, near Meridian, 50 miles from their point of origin.

Several photographs carried by the whirl from Jasper County have been found near Meridian.

The damage done to small towns and settlements lying within the path of the tornadoes was enormous. When the storms encountered heavily timbered sections, the paths of destruction suggest the swaths left by mowing machines. Large trees were snapped and wrung as if they had been limp rags, and the ruins present a spectacle of chaos that only fire could make more complete.

INTENSE DARKNESS.

At Meridian the cloud layers gradually thickened between 10:15 a. m. and 10:30 a. m., when it was very dark, with occasional flashes of vivid lightning. The darkness between 10:30 and 10:39 a. m. was as intense as would be common for a cloudy moonless night at 9:30 or later, and though lights were on in business houses (but no street lights were in operation), pedestrians could distinguish each other only with great difficulty. There were a great many excited people on the streets, and in many of the office buildings and department stores there was nearly a panic among the employees and others who were hurriedly leaving the buildings. The pall of darkness was so unnatural that it was extremely weird. People riding in automobiles state that steering was difficult even with lights on. At 10:31 a. m. the clouds in the southwestern horizon took on a greenish tinge, and at 10:36 a. m. the darkness was less intense for about three minutes. At 10:39 a. m., the darkness returned, the greenish tint being now of a yellowish green, pulsating in different degrees of intensity. The second period of darkness continued until about 10:55 a. m., and was, perhaps, more intense than the first period. The sky during the darkness was covered by a heavy curtain of clouds of stratus to nimbus structures, hanging nearly to the horizon, which was a narrow ring of light.

THE TORNADOES OF APRIL 20, 1920, IN ALABAMA.

By P. H. SMYTH, Meteorologist.

[Weather Bureau, Montgomery, Ala., June 3, 1920.]

METEOROLOGICAL CONDITIONS PRECEDING THE TORNADOES.

The disturbance in the Mississippi Valley (see Fig. 1) was attended in Alabama by southeasterly winds, generally less than 10 miles per hour, except along the coast, where they reached 22 miles per hour. A pronounced wind-shift line extended from southern Louisiana to Chicago, Ill. Morning temperatures were unseasonably high, the 7 a. m. isotherm of 70° F. extending as far inland as Nashville, Tenn., with temperatures as high as 76° F. recorded at Meridian, Miss., and Centerville, Ala., and a temperature of 74° F. at Montgomery, Ala., but somewhat lower temperatures prevailed on all sides of the area comprising these three stations.

Light rains had fallen within 24 hours at 18 stations in Alabama, mostly in northwestern and extreme western counties. Thunderstorms had occurred within 12 hours at Corinth and Vicksburg, Miss., and Birmingham, Ala. The sky over most of the State was overcast with clouds, exceptions being noted at Ozark, Milstead, and Selma, with partly cloudy weather, and Evergreen and Thomasville, with clear skies. At Montgomery the clouds were stratus, completely covering the sky and moving at 7 a. m. from the south; and these clouds continued throughout the day without breaking, shifting to the southwest late in the afternoon. Relative humidity at Montgomery at 7 a. m. was 80 per cent; at noon, 78 per cent.

METEOROLOGICAL CONDITIONS FOLLOWING 7 A. M. OF APRIL 20.

The storm that was centered between Memphis and Vicksburg at 7 a. m. of the 20th moved northeastward and was centered on the morning of the 21st over the lower Lake region, with increased intensity. It was attended in its passage by rainfall over nearly all except extreme southern Alabama, heavy rains (ranging from 1.25 inches at Riverton to 3.10 inches at Tuscaloosa) over much of northern Alabama, scattered thunderstorms in some central and northern counties, and the most destructive tornadoes of record for Alabama in the northwestern and north-central portions of the State. The sky remained overcast over nearly all the State during the 20th. Nevertheless, unseasonably high maximum temperatures were reported at most stations, ranging generally above 75° F. and reaching 85° F. or above at four stations, the highest being 87° F. at Auburn. Hail was reported from several points along the paths of the tornadoes, but from no other places in the State on the 20th.