ANNUAL SUMMARY

Air-Stagnation Cases in the Eastern United States during 1983

J. KORSHOVER AND J. K. ANGELL

Air Resources Laboratory, ERL, NOAA, Rockville, MD 20852

(Manuscript received 31 May 1984)

ABSTRACT

The number and location of stagnation days within the eastern United States, as estimated mainly from a surface geostrophic-wind criterion, are presented by month and for the year 1983 as a whole. The distribution of stagnation days in 1983 was quite typical of the 40-year mean, with the number of such days falling halfway between the relatively high number observed in 1981 and the relatively low number observed in 1982. A diagram shows the variation of "grid-point days" of stagnation with latitude and longitude for 1981–1983.

1. Introduction

This is the third in a series of annual reviews of air-stagnation cases in the United States east of 100°W. Presented are maps showing, by month and for the year 1983 as a whole, the number of stagnation days in this region, as well as the average number of stagnation days during the interval 1936–75. For comparison, a table gives the number of "grid-point days" of stagnation by month for 1981–1983 and a diagram is presented showing the number of such days as a function of latitude and longitude for the three years.

2. Procedures

The method used to delineate areas of stagnation basically involves determining those areas where, for at least four days, the surface geostrophic wind (as determined from the Daily Weather Maps of the National Weather Service) is less than 8 m s^{-1}. Areas of stagnation, so obtained, were eliminated if fronts crossed through the region, there was a trace or more of precipitation or the wind at 500 mb exceeded 13 m s^{-1}. More details concerning the method used for evaluation of stagnation cases may be obtained from the earlier papers in this series (Korshover and Angell, 1982, 1983).

3. Discussion

Table 1 give the dates of stagnation cases in 1983, and Figs. 1–7 show by month the number and location of stagnation days in 1983 (solid lines) in comparison with the average number and location of stagnation days based on the interval 1936–75 (dashed lines). There were no stagnation cases, as defined here, in January, February, March, May and December of 1983.

Stagnation between 26 April and 3 May occurred in the usual location in extreme southeastern United States (Fig. 1) as a polar-continental high, moving southeastward to the west of a rapidly developing East Coast low, became nearly stationary off the southeast coast of the United States. There was a diffluent westerly flow at 500 mb over the stagnation region owing to the juxtaposition of a weak trough east of Florida and southwesterly flow over New England.

Stagnation during 9–17 and 19–22 June occurred in middle Atlantic states, or slightly north of the usual location (Fig. 2). The first episode was associated with a polar-continental high which, moving slowly eastward behind a weak cold front, became almost stationary in the eastern United States. At 500 mb a strong high developed over the East Coast in the form of an "omega block," and the area of stagnation would have extended farther north except for scattered light precipitation in New England. Following the passage of another weak cold front, a similar situation developing during 19–22 June; the area of stagnation in this case was limited by rainfall to the south and a front to the north. During the latter episode, a strong 500 mb high extended over most of the country.

Stagnation during 7–10 and 26–30 July occurred in the Upper Mississippi Valley and middle Atlantic states, or slightly west and east of the usual location (Fig. 3). The first episode was associated with a slowly

TABLE 1. Cases of stagnation in eastern United States during 1983.

Period	Duration (days)
26 April–3 May	8
9–17 June	9
19–22 June	4
7–10 July	4
26–30 July	5
13–20 August	8
25–28 August	4
1–4 September	4
27 September–4 October	8
15–18 October	4
26 October–2 November	8
6–9 November	4

moving polar-maritime high (from the Pacific Ocean) which became almost stationary in the eastern part of the country. At 500 mb there was a high over the central part of the country and a trough over both coasts. This episode ended as a "backdoor" cold front moved south along the East Coast. The second episode was associated with a slowly-moving polar-continental high which crossed over the Great Lakes and then the middle Atlantic states.

Stagnation during 13–20 and 25–28 August occurred along the Appalachian Mountains and in the South, and was centered southwest of the usual location (Fig. 4). The first episode was characterized by weak pressure gradients throughout the United States, but scattered rain limited the area of stagnation. At 500 mb almost the entire country was covered by a high, the main belt of westerlies located far north in Canada. The second episode was similar in nature.

Stagnation during 1–4 September and between 27 September and 4 October occurred in the Ohio and Lower Mississippi Valleys, slightly west of the usual location and with an unusually large number of stagnation days in Louisiana (Fig. 5). The first episode was associated with small pressure gradients through-

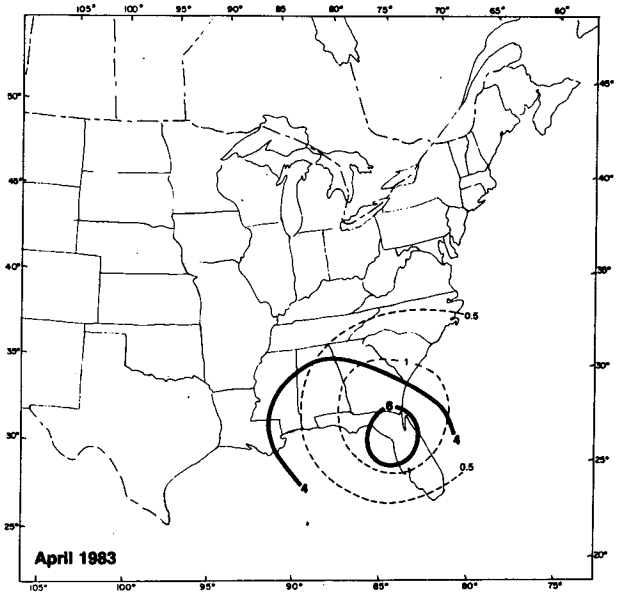

FIG. 1. Number of stagnation days in April 1983 (solid lines) in comparison with the April average of stagnation days during the interval 1936–75 (dashed lines).

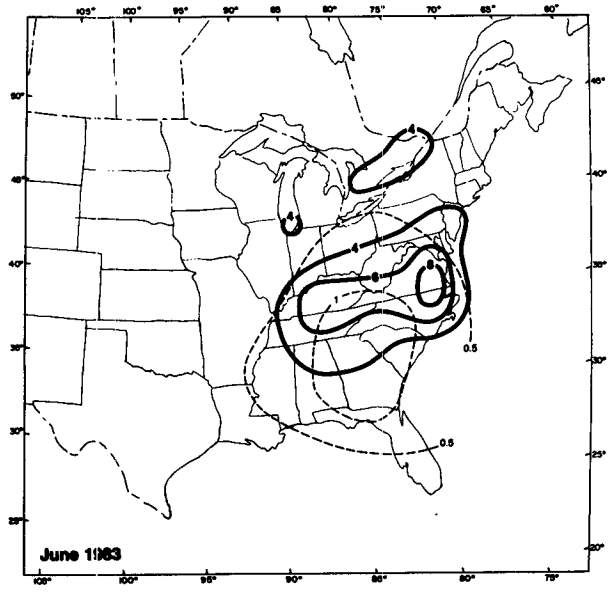

FIG. 2. As in Fig. 1, but for June.

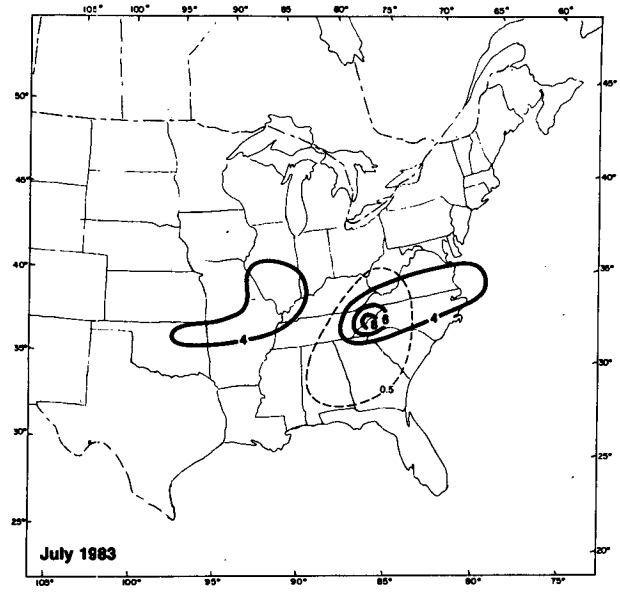

FIG. 3. As in Fig. 1, but for July.

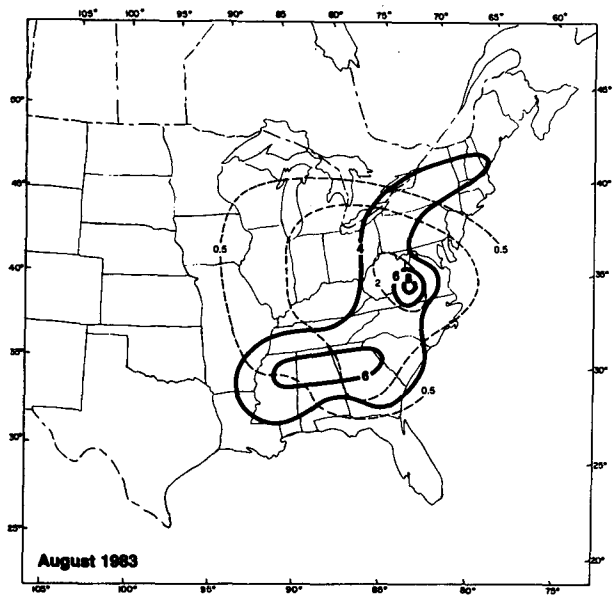

FIG. 4. As in Fig. 1, but for August.

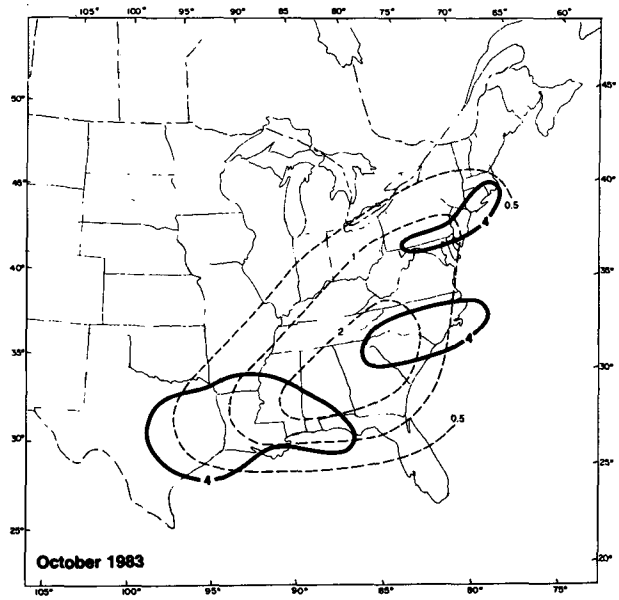

FIG. 6. As in Fig. 1, but for October.

out the eastern United States as a weak low moved up the East Coast. This episode was unusual in that the stagnation was found under a trough at 500 mb rather than a ridge, the trough being so weak that the 500 mb wind speed criterion for stagnation was met. The second, and longer episode was associated with the slow eastward movement of an extensive polar-maritime high with a central pressure of nearly 1040 mb. At 500 mb this episode was characterized by a low over southeastern United States and a high over northeastern United States, an anomalous pattern not unlike that of 9–17 June. This episode was also unusual with respect to recent years in that a tropical storm was associated with it; tropical storm "Dean" crossed the Delaware Coast on 30 September, a time of exceedingly weak pressure gradients in Louisiana and surrounding states.

Stagnation during 15–18 October occurred in the New York area, while the longer episode between 26 October and 2 November occurred in the South and

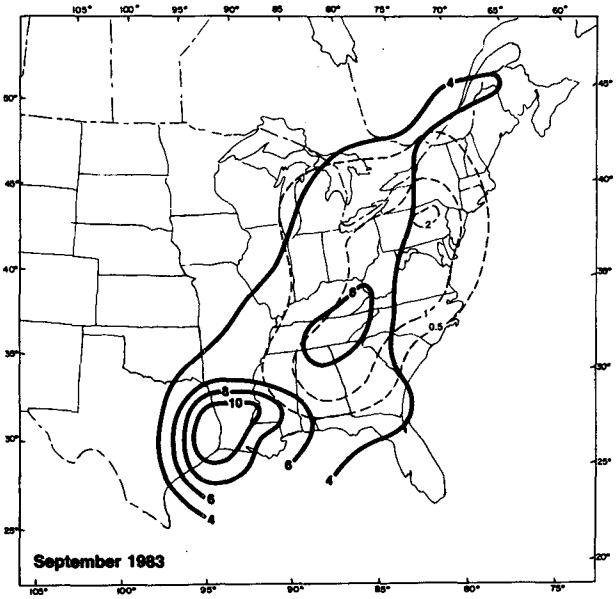

FIG. 5. As in Fig. 1, but for September.

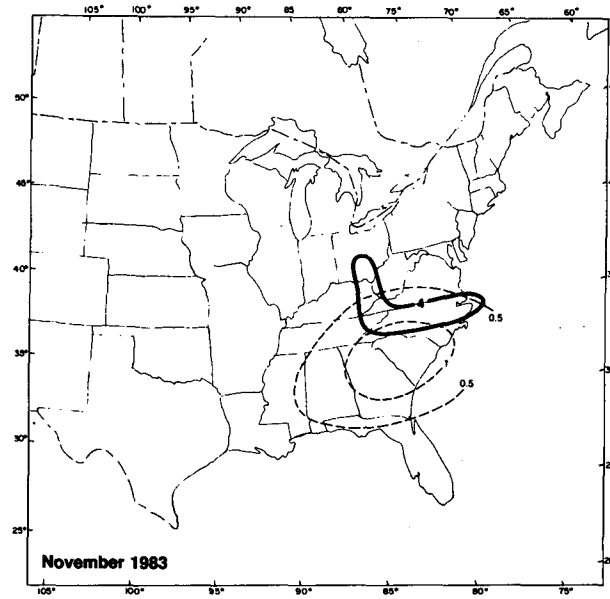

FIG. 7. As in Fig. 1, but for November.

in the middle Atlantic states (Fig. 6). The latter episode was associated with the slow southeastward movement of an extensive polar-maritime high beneath a weak northwesterly flow which extended from coast to coast at 500 mb.

The stagnation during 6–9 November was located basically in the middle Atlantic states, slightly north of the usual location (Fig. 7). This stagnation was associated with the southeastward movement of a polar-continental high across these States as a deep low moved northeastward across the Maritime Provinces of Canada. This was another case when stagnation occurred beneath a weak 500 mb trough. This episode, and the stagnation year, came to an abrupt end as a powerful storm developed over the East Coast on 10 November.

4. Summary

Figure 8 shows that the pattern of stagnation in eastern United States during 1983 (solid lines) was fairly typical of the 40 year mean (dashed lines), though in 1983 the region of maximum stagnation at the Tennessee–North Carolina border was 3 deg latitude north of the mean location in central Georgia; the stagnation pattern was slightly more elongated in the northeast–southwest direction than usual, and there were a smaller number of stagnation days in South Carolina relative to North Carolina than usual.

Of interest is the difference in the extent of stagnation for the three years for which this annual stagnation summary has been prepared. Table 2 presents by month and year the number of "grid-point days" of stagnation obtained by summing over the eastern United States the number of days of stagnation at 2° lat–2° long grid points during the

TABLE 2. Number of "grid-point days" of stagnation by month, and for years 1981–83 as a whole, obtained by summing the number of days of stagnation at 2° lat–2° long grid points.

Month	1981	1982	1983
January	0	0	0
February	0	0	0
March	0	0	0
April	22	0	58
May	89	100	0
June	40	42	127
July	45	0	80
August	412	104	136
September	222	114	317
October	180	151	119
November	104	70	28
December	0	0	0
Total	1114	581	865

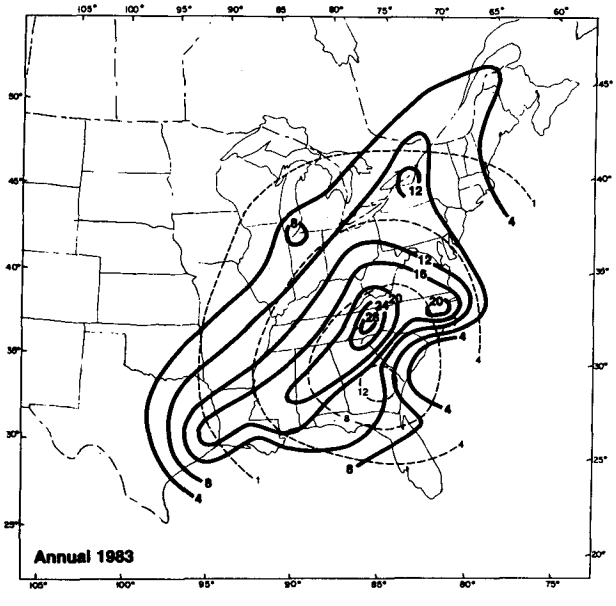

FIG. 8. Number of stagnation days in 1983 (solid lines) in comparison with the annual average of stagnation days during the interval 1936–75 (dashed lines).

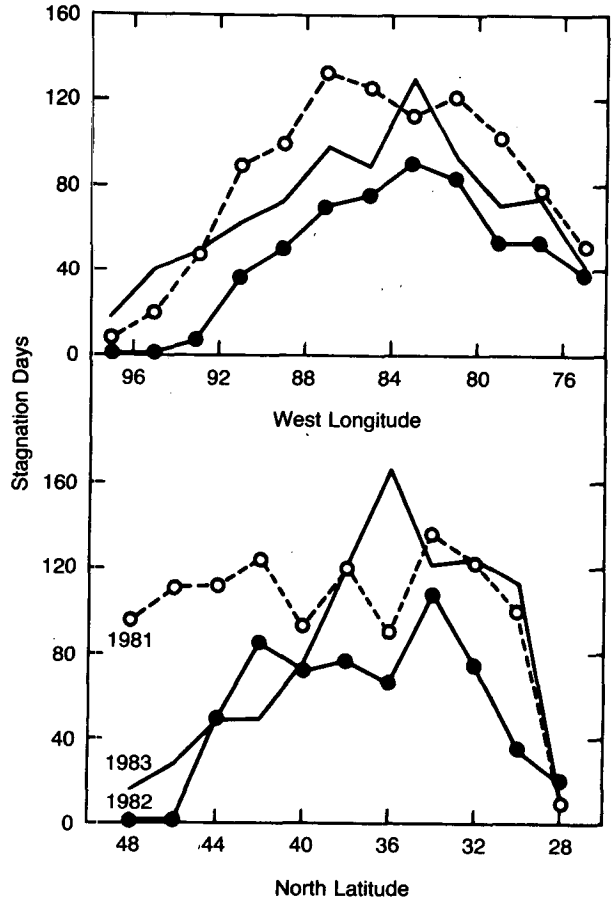

FIG. 9. Variation of "grid-point days" of stagnation with lat (bottom) and long (top) during 1981 (dashed lines), 1982 (solid lines with dots) and 1983 (solid lines). Longitudinal values are not presented east of 75°W because of the small latitude range of the data.

three years. In the eastern United States the year of greatest stagnation is indicated to be 1981, with nearly twice the stagnation days of 1982. The number of stagnation days in 1983 is approximately halfway between 1981 and 1982. The month of maximum stagnation in 1981 is indicated to have been August (the highest monthly value in the Table), October in 1982 and September in 1983 (second highest monthly value in the Table). The extent of stagnation has been similar in October during all three years, but in September the extent of stagnation has varied by nearly a factor of 3 and in August by a factor of 4.

Figure 9 shows the variation of "grid-point days" of stagnation with latitude and longitude for each of the three years. The greater number of these days in 1981 as compared to 1983 is due wholly to the greater number of stagnation days north of 40° in the earlier year, whereas the progressive increase in stagnation days from 1982 to 1983 to 1981 has been fairly uniform with respect to longitude.

REFERENCES

Korshover, J., and J. K. Angell, 1982: A review of air-stagnation cases in the eastern United States during 1981—Annual summary. *Mon. Wea. Rev.*, **110,** 1515–1518.

——, and ——, 1983: Air-stagnation cases in the eastern United States during 1982. *Mon. Wea. Rev.*, **111,** 1679–1684.