THE WEATHER AND CIRCULATION OF JANUARY 1967

A Mild Month with Unusually High Zonal Index

WILLIAM R. WINKLER

Extended Forecast Division, Weather Bureau, ESSA, Washington, D.C.

1. MEAN CIRCULATION

The trend toward a high index circulation which began in December [1] continued through most of January. The monthly mean 700-mb. zonal wind speed, averaged between 35° N. and 55° N. in the western half of the Northern Hemisphere, rose from a below normal value of 9.6 meters per second in December to 11.4 m.p.s. in January, or 1.1 m.p.s. above normal. During the second half of the month this index averaged 12.6 m.p.s. Fast westerlies developed in mid-latitudes during the first two-thirds of the month and reached the highest values observed at 700 mb. since records began in 1942. After rising steadily from a daily speed of 9.7 m.p.s. on January 14, the zonal index reached an all-time record for a 5-day period of 16.7 m.p.s. in the period January 17–21, 1967. The previous record of 16.1 m.p.s. occurred in the period December 13–17, 1956. The daily index of 18.2 m.p.s. on January 20, 1967 was also a record, followed by 18.0 m.p.s. on January 19.

In agreement with the increased speed of the westerlies, 700-mb. heights in January rose in subtropical and temperate latitudes and fell sharply in high latitudes around the entire hemisphere, relative to their December values (fig. 1). In the January mean circulation most troughs and ridges were in their normal locations, but abnormally strong (figs. 2, 3). Heights were 250 ft. above normal in the expanded western Pacific subtropical ridge, and 510 ft. below normal in the polar vortex in the Soviet Arctic.

The exception to this general pattern was the blocking in the North Atlantic, where heights in the ridge were nearly 460 ft. above normal over Greenland and Iceland; this blocking pattern resulted in the deeper than normal eastern European trough downstream. Also, heights associated with the normal north-central Asian ridge were 180 ft. above normal in January, and the West African coastal trough was displaced some 15° of longitude westward (figs. 2, 3).

2. MONTHLY TEMPERATURE

The above normal temperatures in January over most areas (fig. 4) were associated with the strong westerly flow which brought in mild maritime air over most of the United States, where 700-mb. heights were also above normal. The warmth in the East was augmented by unusually strong southwesterly flow (fig. 3) and in the Great Plains by föhn warming associated with strong westerlies. Record high daily and monthly temperatures occurred during the last ten days of January in the eastern half of the Nation, another example of the "January thaw" quasi-singularity [2]. During this warm spell new record maximum temperatures for January occurred at Wichita, Kans. on the 22d (75° F.), Lansing, Mich. on the 24th (66° F.), and Baltimore, Md. on the 25th (75° F.); Syracuse, N.Y. equaled a previous January maximum on the 25th (70° F.). In the Far West, Reno, Nev. had a record high for January on the 15th (70° F.). Only in parts of the South and Southeast were temperatures below normal this month, and only slightly so.

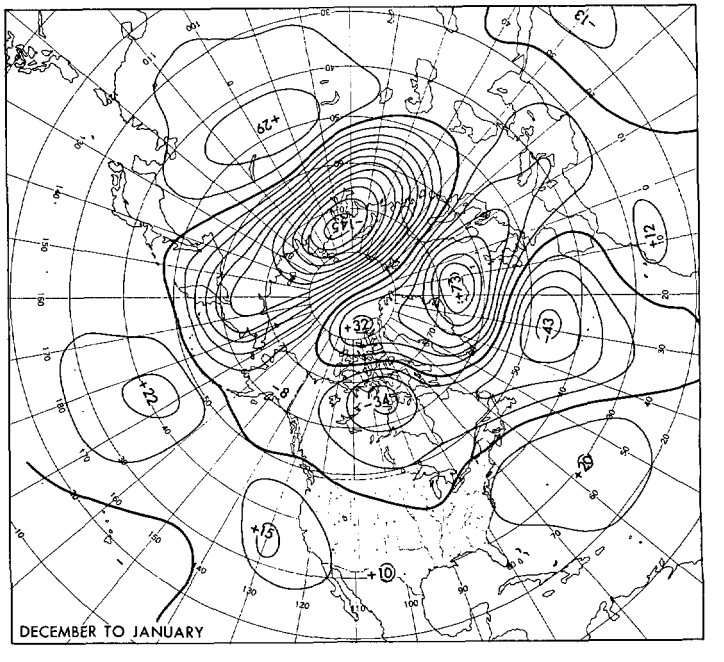


FIGURE 1.—Change in mean 700-mb. heights between December 1966 and January 1967.

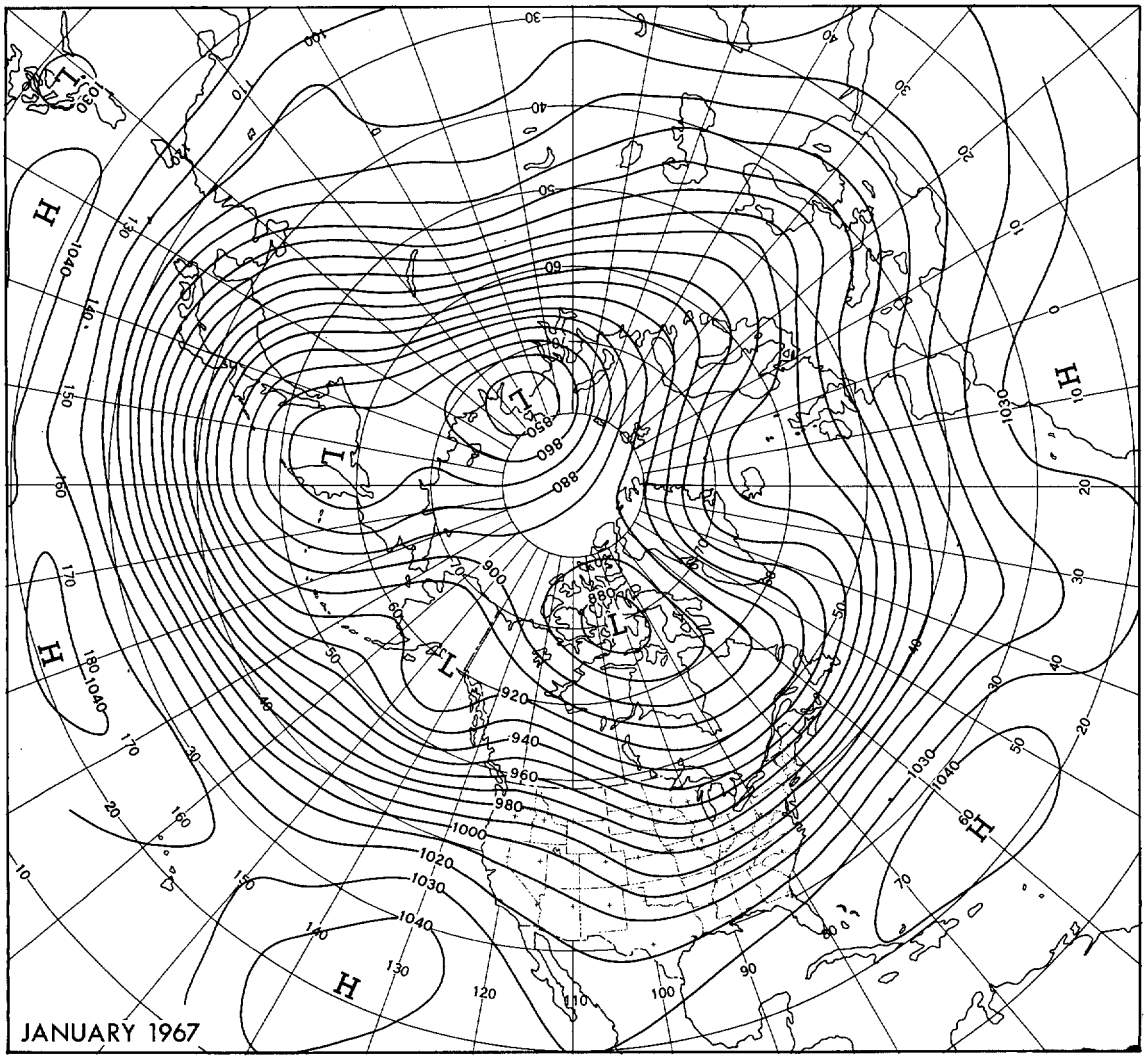


FIGURE 2.—Mean 700-mb. contours (tens of feet), January 1967.

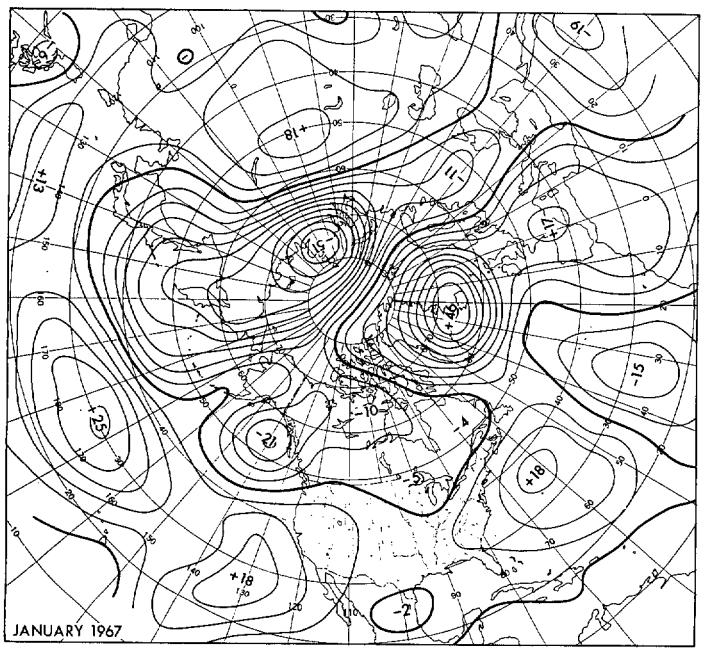


FIGURE 3.—Departure of mean 700-mb. heights from normal (tens of feet), January 1967.

3. MONTHLY PRECIPITATION

Much of the eastern third of the Nation and the South had below normal precipitation in January (fig. 5), while the Southern Plains and southern Plateau were dry for the fourth consecutive month. This was the twelfth consecutive month of below normal totals at Yuma, Ariz.

Although figure 3 shows that, in the mean, the eastern third of the country had flow with a southerly component, January was relatively dry over a broad area from the lower Mississippi Valley to the Northeast, since the positive anomalies there during the second half of the month (fig. 7) indicated subsidence and a lack of direct moisture source from the Gulf. Precipitation was heavy, however, from the Florida Panhandle to Cape Hatteras in the upglide flow ahead of the trough over the central United States.

Heavy precipitation in the Far West was related to the rapid deepening of a trough in the eastern Pacific early in the second half of January, from which numerous storms emanated (fig. 7). San Francisco and Stockton,

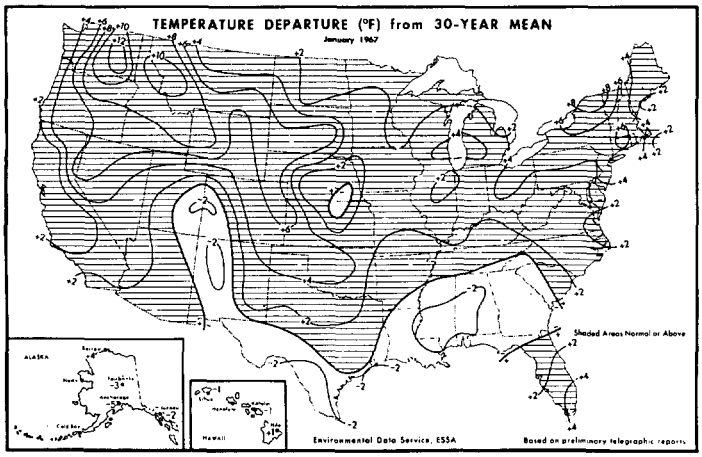


FIGURE 4.—Surface temperature departure from normal (°F.), January 1967 (from [4]).

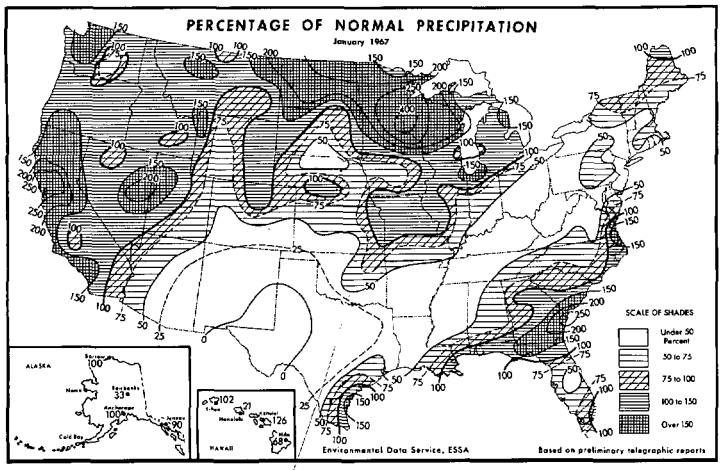


FIGURE 5.—Percentage of normal precipitation, January 1967 (from [4]).

Calif. had their wettest January on record, and Sacramento, its second wettest. Both San Francisco and Seattle, Wash. set all-time records for 24-hr. precipitation during this period.

In the northern Mississippi Valley and the western Great Lakes region heavy precipitation was related to the deeper than normal trough in central North America, particularly during the first half of January (fig. 6). Associated with this trough was one of the worst blizzards in history on the 26th, preceded by another on the 16th. These storms contributed to the record 26.1 in. of snow in January at St. Cloud, Minn.

Perhaps the most remarkable feature of the January precipitation pattern was the snowstorm which struck northern Mexico on the 9th, reported to be one of its worst snowstorms in history. It was associated with a deep upper-level cut-off Low in the southern part of the central North American mean trough (figs. 2, 3, 6). Monterrey, Mexico had more than 20 in. of snow in 8 hr., and some areas had drifts exceeding 3 ft.

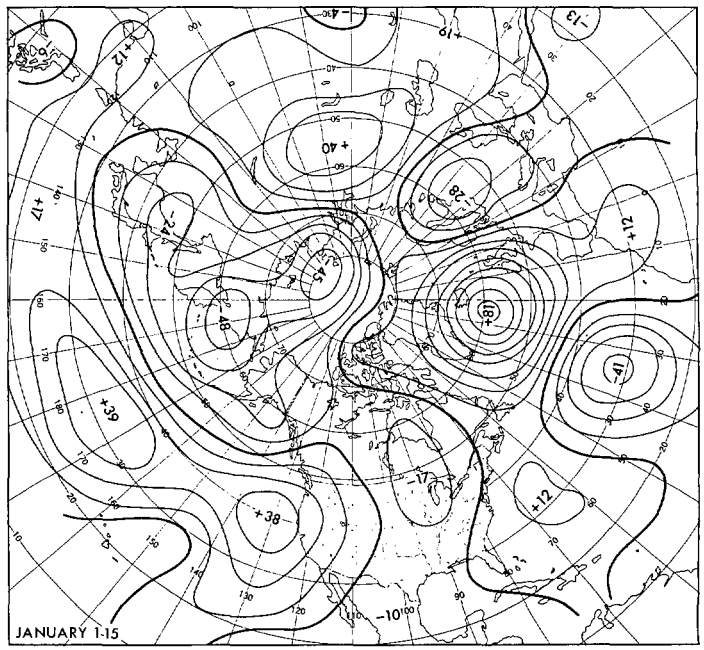


FIGURE 6.—Departure of mean 700-mb. heights from normal, first half of January 1967.

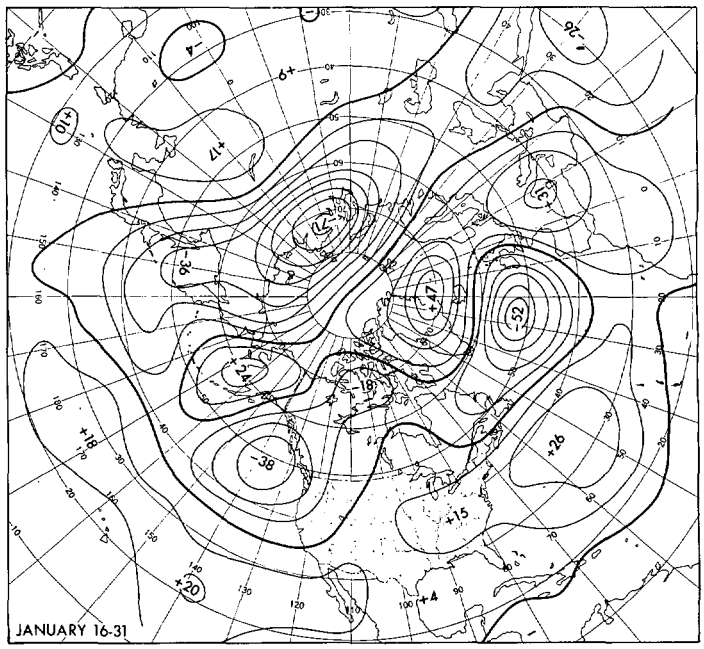


FIGURE 7.—Departure of mean 700-mb. heights from normal, second half of January 1967.

4. WEEKLY WEATHER AND CIRCULATION

JANUARY 2–8

As the New Year began, Concordia, Kans. had 10 in. of snow on the ground, its greatest January depth on record. A series of storms from the Canadian Rockies moved across the northern United States early in the week, followed by a northeastward-moving major storm which developed in Colorado. This storm resulted in below normal 700-mb. heights over most of the Nation,

and a deep trough in the Central United States (figs. 8A, 8B). It reached blizzard intensity in the northern Plains on the 6th and 7th; parts of Minnesota received 18 in. of snow, and dust storms occurred in Nebraska and Kansas with 40–60 m.p.h. winds.

Abnormal northerly flow brought dry weather and below normal temperatures to the central part of the country. In the East, heavy precipitation on the Atlantic coast south of Cape May, N.J. (fig. 8D) was associated with moist southerly flow and a coastal storm early in the week.

JANUARY 9–15

During the second week the eastern Pacific ridge amplified and moved eastward while another ridge amplified over the eastern Gulf of Mexico, resulting in above normal 700-mb. heights over all the country except the Northeast and Great Lakes (figs. 9A, 9B). Consequently, warmer Pacific maritime air gradually spread over much of the United States, resulting in above normal temperatures over most of the country except the Ohio Valley, the deep South, and near the southern Continental Divide (fig. 9C). Thus, while temperatures were below normal for the fifth consecutive week in Louisiana, parts of the Northern Rockies averaged 15° F. above normal. Yakima, Wash. and Reno, Nev. established high temperature records for the date on January 13 and 15, respectively. In contrast, Raleigh, N.C. had a record low on the 12th.

Heavy precipitation in the Northern Great Lakes region (fig. 9D) was associated with three rapidly moving cyclones which were reflected in the mean trough and negative height anomaly there (figs. 9A, 9B). In the Pacific Northwest onshore flow provided ample moisture for heavy precipitation, and in the deep South some amounts in excess of 2 in. for the week were produced largely by a frontal disturbance.

Abnormal southeasterly flow associated with an upper-level cut-off Low brought record snowfall to northern Mexico during the week and also resulted in more than 2 in. of precipitation and the second heaviest snowfall ever recorded in parts of southern Texas on the 9th. The strong northwesterly flow over a broad area from the far Southwest to the mid-Mississippi Valley was influential in preventing precipitation there.

JANUARY 16–22

The main Atlantic and Pacific high pressure ridges strengthened during the third week, while the North American trough moved eastward and deepened, particularly at high latitudes (figs. 10A, 10B). This was accompanied by increased westerly wind speeds associated with above normal 700-mb. heights over nearly the entire Nation except the northern border States. The West and the Central Plains were mild; in the Northern Rockies weekly temperatures again averaged 15° F. above normal. Much of the eastern half of the United States was colder than normal (fig. 10C) as polar air pushed deep into the Southeast behind disturbances moving rapidly across southern Canada in the strong westerlies.

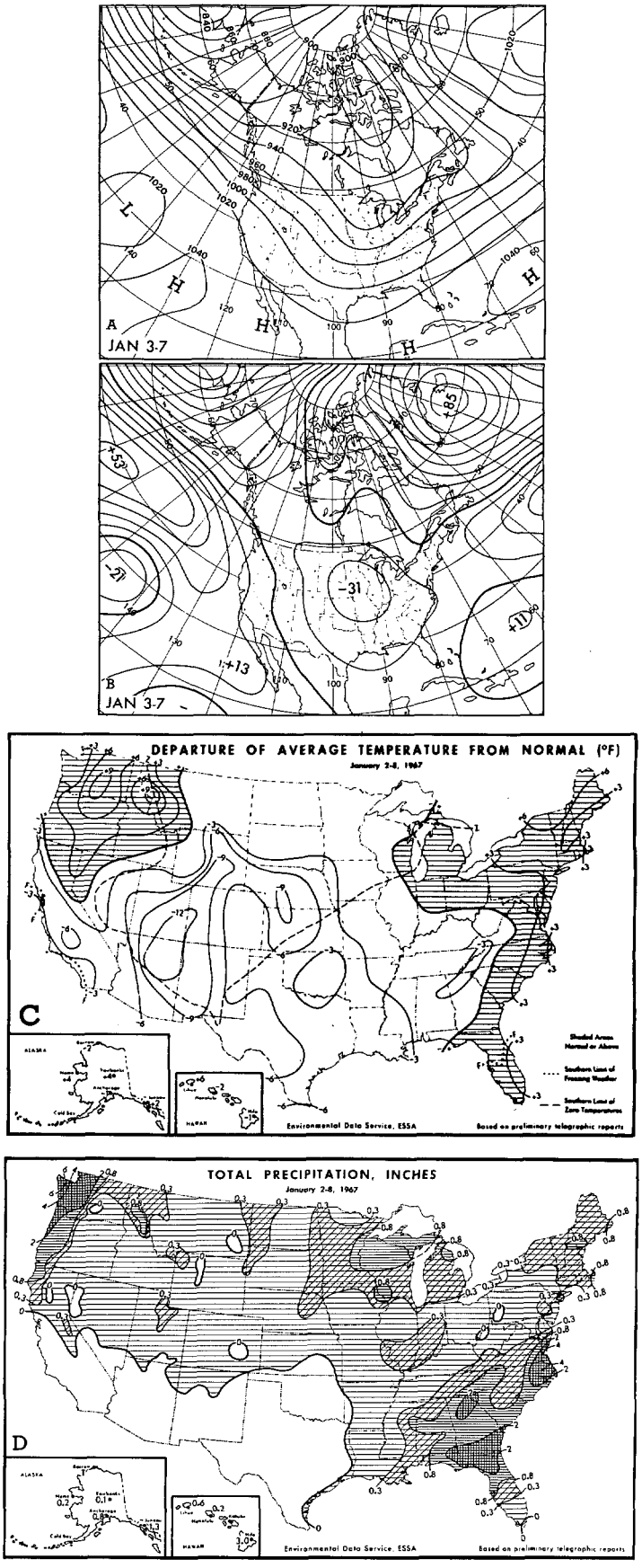
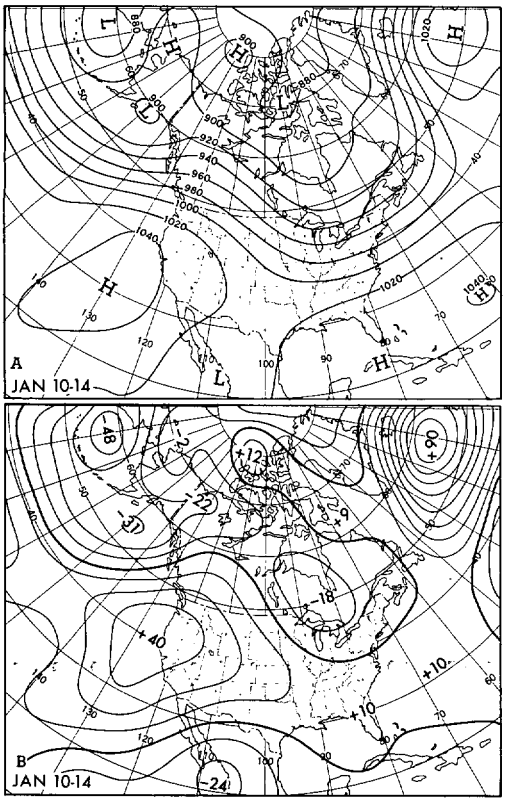
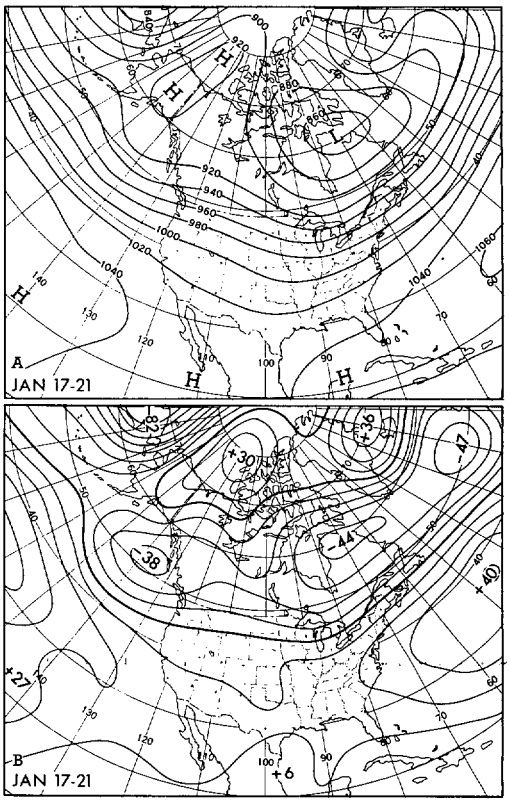
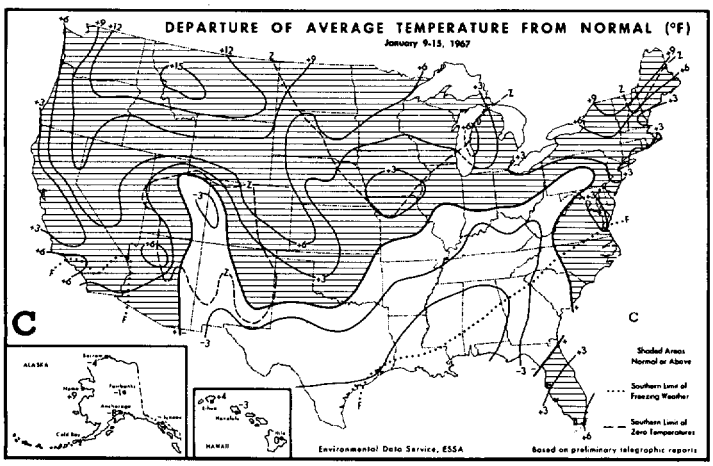
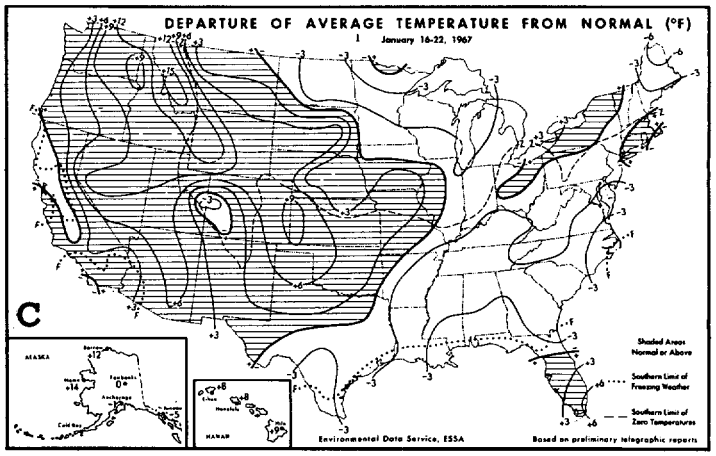


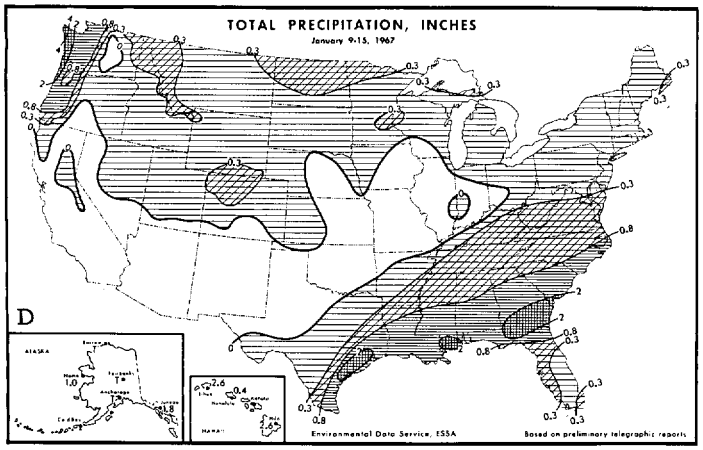
FIGURE 8.—(A) Mean 700-mb. contours and (B) 700-mb. height departures from normal (both in tens of feet) for January 3–7, 1967; (C) departure of average surface temperature from normal (°F.), and (D) total precipitation (in.) for week of January 2–8, 1967 (from [4]).











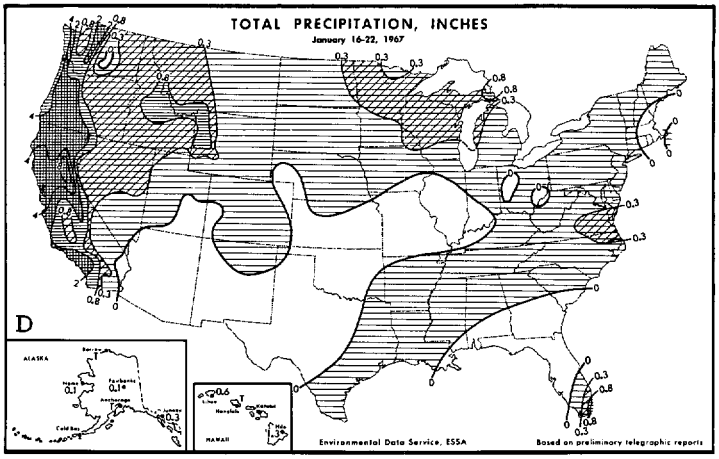
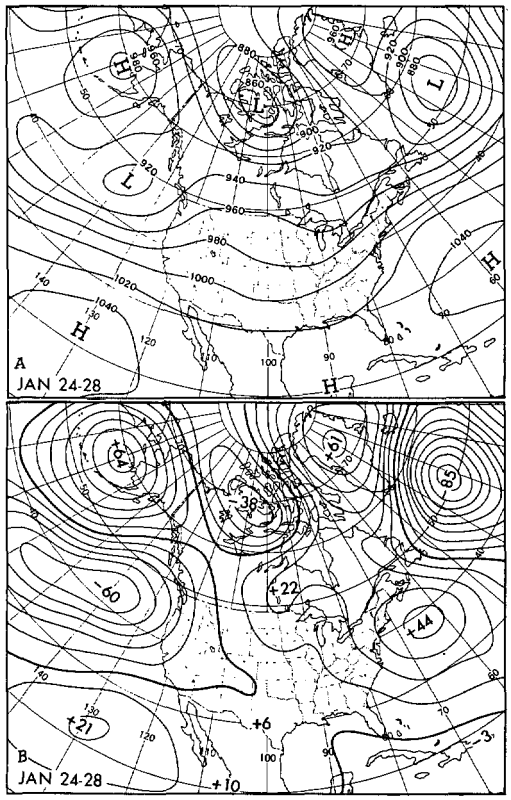
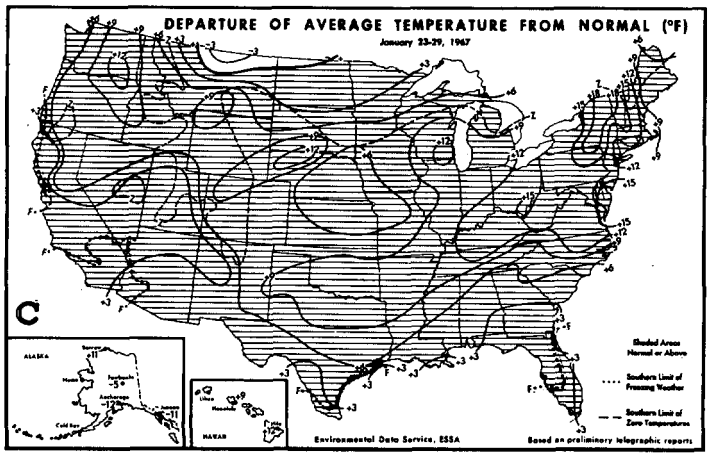


FIGURE 9.—Same as figure 8, (A) and (B) for January 10–14, 1967; (C) and (D) for January 9–15 (from [4]).

FIGURE 10.—Same as figure 8, (A) and (B) for January 17–21, 1967; (C) and (D) for January 16–22 (from [4]).





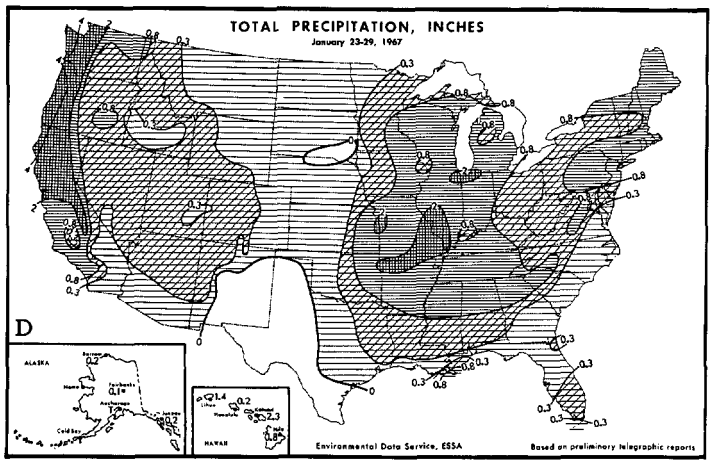


FIGURE 11.—Same as figure 8, (A) and (B) for January 24–28, 1967; (C) and (D) for January 16–22 (from [4]).

Precipitation was light to moderate over most of the country this week (fig. 10D), as might be expected in the absence of meridional flow in the high index circulation. A narrow zone from central Illinois to western Texas and most of the Southwest had no rainfall because of the absence of low-level disturbances. This was due to the dominance of a persistent Great Basin High. The Northern Plains and Great Lakes, however, received heavy precipitation from a blizzard which emerged from the Canadian Rockies on the 16th and produced winds of 62 m.p.h. at Jamestown, N. Dak. A severe oceanic storm brought heavy precipitation and high winds to the Pacific Coast on the 19th to the 21st. Record 24-hr. amounts of rain fell at Seattle, Wash. on the 19th, and at San Francisco, Calif. on the 21st. Winds at the height of this storm reached 93 m.p.h. at Cape Blanco, Oreg., and 61 m.p.h. at Seattle.

JANUARY 23–29

The most extreme weather of January occurred during the final ten days of the month. 700-mb. heights were again above normal over most of the country as the strong Hudson Bay vortex moved northwestward, and a major ridge developed off the east coast (figs. 11A, 11B). Strong westerlies continued to flow across the country, but were below their record values of the previous week, and brought unusually mild weather to much of the Nation. Parts of Montana and North Dakota were the only areas colder than normal (fig. 11C). Relatively mild Pacific air, augmented by föhn warming, brought above normal temperatures to most of the West, while southwesterly flow ahead of the Midwest trough (fig. 11A) accompanied warm conditions in the East. Numerous daily temperature records were established from North Carolina to Massachusetts and west to Illinois between January 22 and 25. Average daily temperature anomalies more than 30° F. above normal were frequent during this "January thaw" (table 1).

In contrast to this week's pleasant temperatures, fast moving waves in the westerlies interacted with the unusually warm air to spawn unpleasant weather in the form of severe storms in the Far West, Great Lakes, and Midwest. These disturbances in the westerlies also caused precipitation over much of the eastern half of the United States (fig. 11D).

A series of Pacific storms emanating from the deep and persistent 700-mb. Low in the eastern Gulf of Alaska, again deposited several inches of rain on much of the Pacific Coast for the third consecutive week. A storm born in Colorado on January 23 and which moved rapidly to the Great Lakes, was accompanied by widespread freezing rain and hail in the Midwest, thunderstorms in the South, and tornadoes near Kansas City, and St. Louis, Mo. Close behind this storm another from the same region became a severe blizzard in the southern Great Lakes area on January 26–27. Chicago was inundated by 23 in. of snow, its greatest snowfall on record

for both a single storm and in 24 hr. At the same time, three tornadoes related to the storm's fronts were sighted within 75 mi. of Peoria, Ill. and one at Itta Bena, Miss., on January 26. Several occurred in the Clinton, Okla. area on the 25th. As this fierce storm moved toward New England, it caused another tornado at Fulton, Del. on the 27th. Moist low-level southeasterly flow west of a High off the South Atlantic Coast brought seven to ten consecutive days of heavy fog to the central coast of the Gulf of Mexico, January 18–26.

5. THE JANUARY THAW

The quasi-singularity known as the "January thaw" has a long history in American weather folklore. Wahl [2] used about 62 yr. of January mean daily temperatures to show an apparent tendency for the period January 21–23 to be unusually warm in the eastern United States. Although it did not occur in 1966, this was true in January 1967 with large areas of the East having temperatures 20° F. or more above normal between January 22 and 25. The extremes of abnormal warmth during the thaw are listed in table 1, which shows those stations which had mean daily temperatures at least 30° F. above normal at the height of the thaw. The 5-day mean sea level map for January 19–23 (not shown) is remarkably similar, in the East, to Wahl's 40-yr. mean sea level map for January 20. Also, the January 26–30 sea level map shows a marked change in low-level circulation relative to that of January 19–23, somewhat as Wahl's post-thaw mean January 27 map changed from that of January 20.

Dickson [3] showed that conditions prevailing during the January thaw are those favorable for tornado formation in the Tennessee Valley. He found that more tornadoes occurred there on January 20–22 than in any other 3-day period of January, 1931–59. The thaw occurred a few days later this year than it often has previously, and the early reports of more than five tornadoes on January 24–26 in Missouri, Mississippi, Oklahoma, and southern Illinois occurred near the peak of the thaw in those areas.

TABLE 1.—*Stations reporting daily mean temperatures at least 30° F. above normal in January 1967*

Station	Degrees F. Above Normal	Date
Huron, S. Dak.	30	22
Valentine, Nebr.	30	22
Columbia, Mo.	31	23
St. Louis, Mo.	33, 30	23, 24
Evansville, Ind.	30	23
Indianapolis, Ind.	30, 31	23, 24
Columbus, Ohio	32, 31	23, 24
Cleveland, Ohio	33, 30	23, 24
Binghamton, N.Y.	31	25
Syracuse, N.Y.	33	25

REFERENCES

1. R. R. Dickson, "The Weather and Circulation of December 1966—A Transitional Month," *Monthly Weather Review*, vol. 96, No. 3, Mar. 1967, pp. 148–152.
2. E. Wahl, "The January Thaw in New England (An Example of a Weather Singularity)," *Bulletin of the American Meteorological Society*, vol. 33, No. 11, Nov. 1952, pp. 380–386.
3. R. R. Dickson, "Tornadoes of January 21, 1959—A Feature of a Weather Singularity?" *Monthly Weather Review*, vol. 87, No. 1, Jan. 1959, pp. 40–42.
4. Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin--National Summary*, vol. 54, Nos. 2–6, Jan. 9, 16, 23, 30, and Feb. 6, 1967.