

WEATHER AND CIRCULATION OF NOVEMBER 1977 Generally Mild With a Cold Ending

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1. Mean circulation

Mean 700 mb troughs and ridges at mid-latitudes during November were generally located west of their October positions while at high latitudes most circulation features progressed (Fig. 1 and Wagner, 1978). In the vicinity of North America, this brought a strong ridge to the western Atlantic and a moderately deep trough to mid-continent while the western ridge remained about stationary and weakened (Figs. 1 and 2). The short wavelength over western North America

apparently was a response to the fast westerly flow impinging upon the western mountains (Figs. 2 and 3) and this augmented flow was related to the marked strengthening of the east Pacific baroclinic zone this month (Fig. 4).

Relative motion between middle and high latitude wave features yielded an out-of-phase relationship between those features over the eastern Atlantic with associated strengthening of both the baroclinic field and the westerly flow (Figs. 1, 3 and 4). With weak

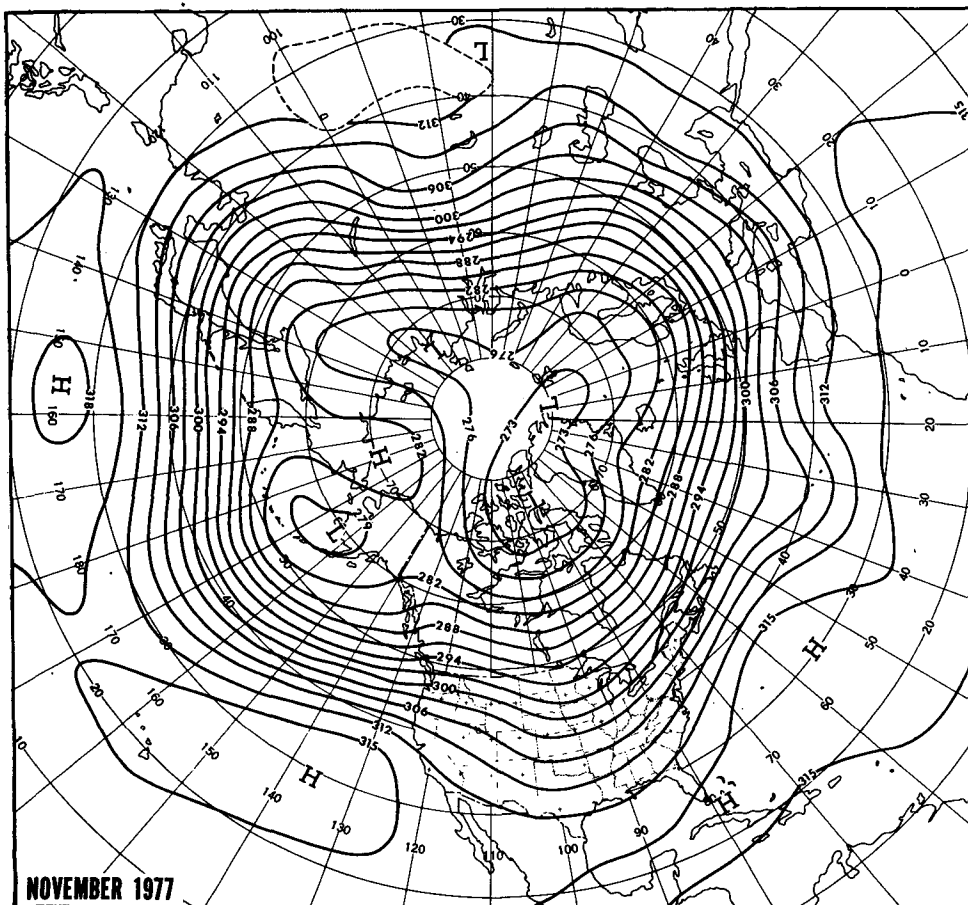


FIG. 1. Mean 700 mb contours (dam) for November 1977.

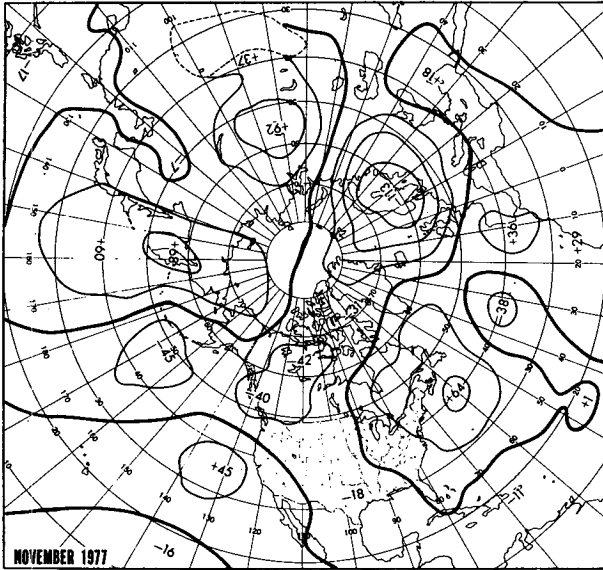


FIG. 2. Departure from normal of mean 700 mb height (m) for November 1977.

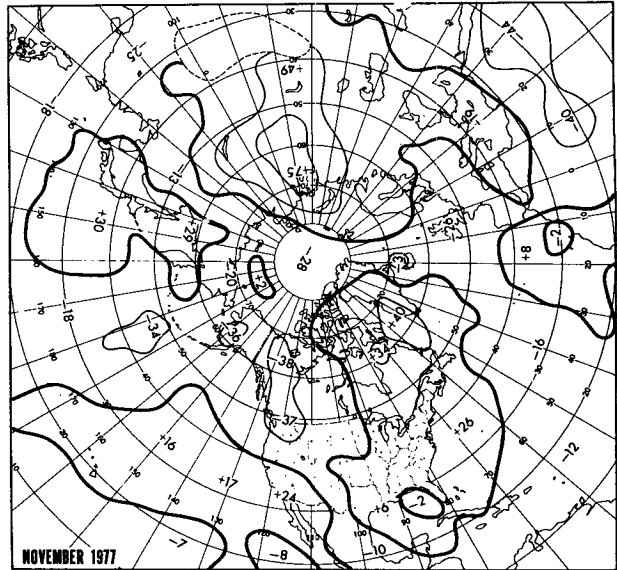


FIG. 4. Departure from normal of mean 1000-700 mb thickness (m) for November 1977.

baroclinic fields and diminished energy conversions over the western portions of both the Pacific and the Atlantic, the strongest winds were displaced to the eastern side of both oceans. Relative motion of wave features at different latitudes over central Asia replaced a previous out-of-phase arrangement with a full latitude ridge (Fig. 1), and the westerlies declined there at temperate latitudes.

2. Temperature

The extremely weak mean 700 mb ridge over western Canada, together with the fast westerly flow across the Pacific Northwest, acted to minimize cold air intrusion into the United States while enhancing the spread of warm air across the Southwest (Fig. 5). Stronger than normal southerly flow between the Great Plains trough and the western Atlantic ridge further contributed to the warm weather observed over the eastern third of the country.

A strong mean ridge west of Alaska brought cold air across Alaska and western Canada to the northwestern and north central United States (Figs. 4 and 5). To the south, a stronger than normal subtropical ridge near Hawaii accompanied above normal temperatures in that state.

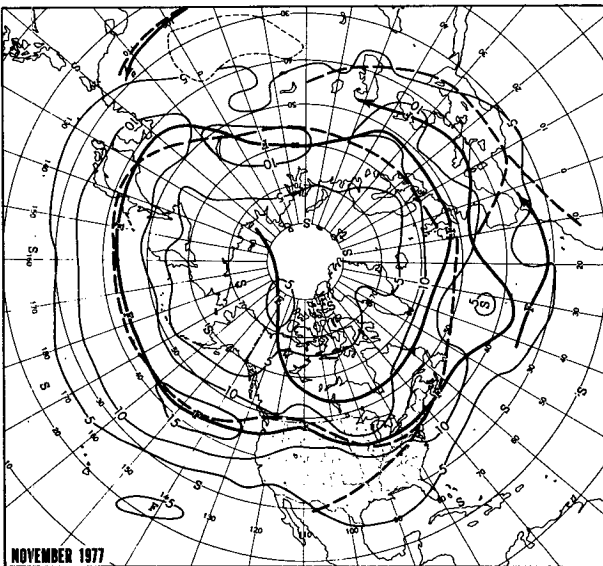


FIG. 3. Mean 700 mb geostrophic wind speed ($m s^{-1}$) for November 1977. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

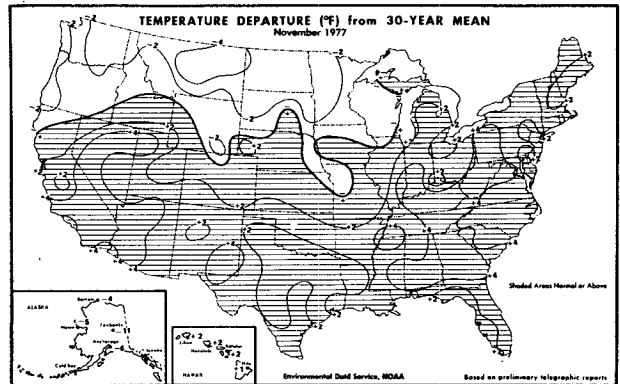


FIG. 5. Departure from normal of average surface air temperatures ($^{\circ}F$) for November 1977 (from National Oceanic & Atmospheric Administration and Statistical Reporting Service, 1977).

3. Precipitation

Storm systems or upper level vorticity maxima, moving with the fast westerlies across the Pacific Northwest, produced above normal precipitation totals over most of the northwestern and north central portions of the country (Fig. 6). To the east, above normal precipitation was general between the Great Plains trough and the strong western Atlantic ridge. It was the wettest November of record at Fargo, N.D. (4.58 inches) and the snowiest November at Salem, Ore. (6.1 inches) and Red Bluff, Calif. (2.0 inches). Bismarck, N.D., recorded 16.2 inches of snow, the greatest November total since 1908. The Southwest, south of both the fast westerlies and the travelling storms, was the only substantial area of subnormal precipitation in the contiguous United States.

Enhanced northerly flow over Alaska and a moderately strong subtropical ridge near Hawaii kept precipitation totals well below normal in both states.

4. Variability within the month

a. 31 October-6 November

A deep trough along the West Coast and a strong ridge over the western Atlantic brought warm air advection and above normal temperatures to most of the country this week (Fig. 7). While precipitation was widespread, greatest amounts were observed over the southeast in connection with a deep, slow moving trough south of the main westerly current. Heavy rains resulted in the loss of life from flash flooding in North Carolina and from the collapse of an earthen dam at Tocca in northeastern Georgia.

b. 7-13 November

Retrospection of wave features over the Pacific this week was accompanied by the building of a mean ridge over the western United States and the northward extension of the previously secluded trough over Louisiana

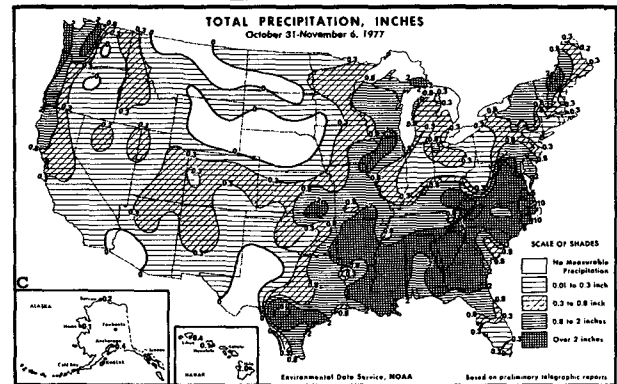
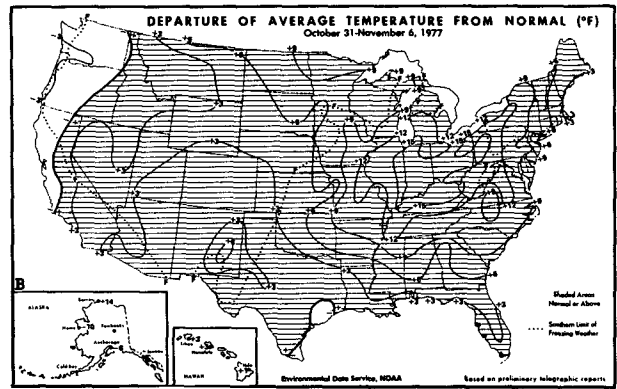
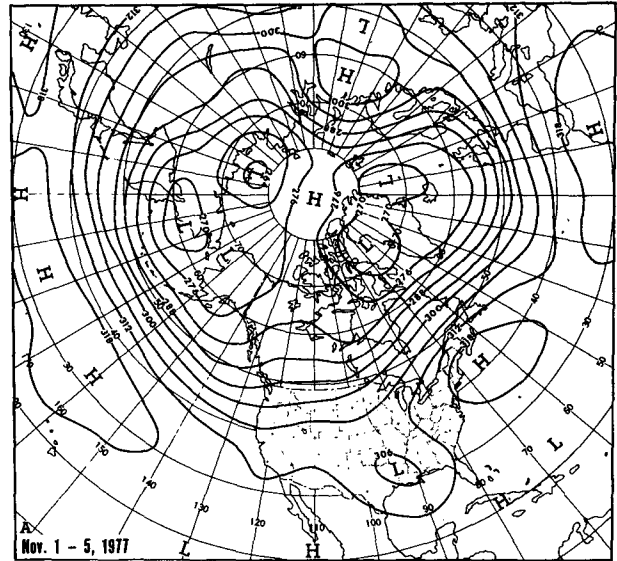


FIG. 7. (A) Mean 700 mb contours (dam) for 1-5 November 1977; (B) departure from normal of average surface air temperature (°F) and (C) total precipitation (inches) for week of 31 October-6 November 1977 (from National Oceanic & Atmospheric Administration and Statistical Reporting Service, 1977).

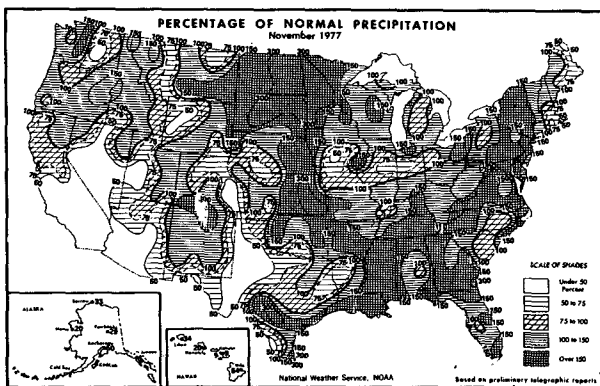
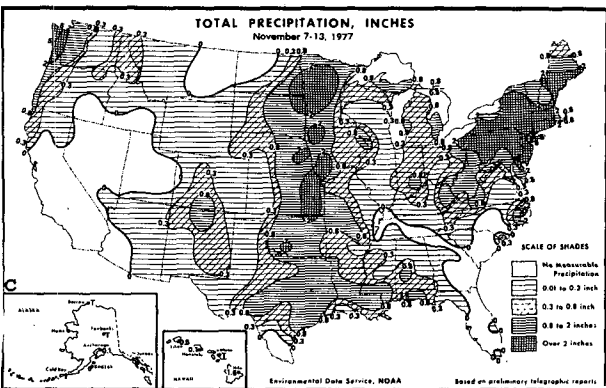
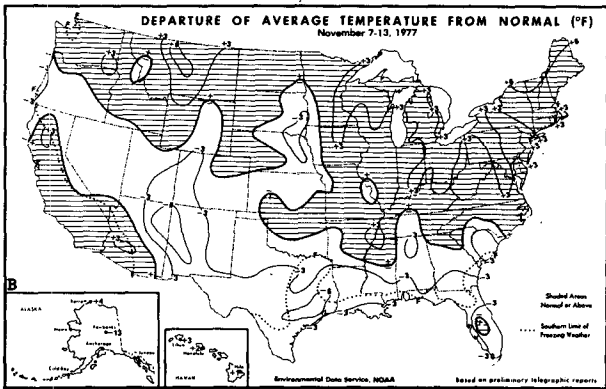
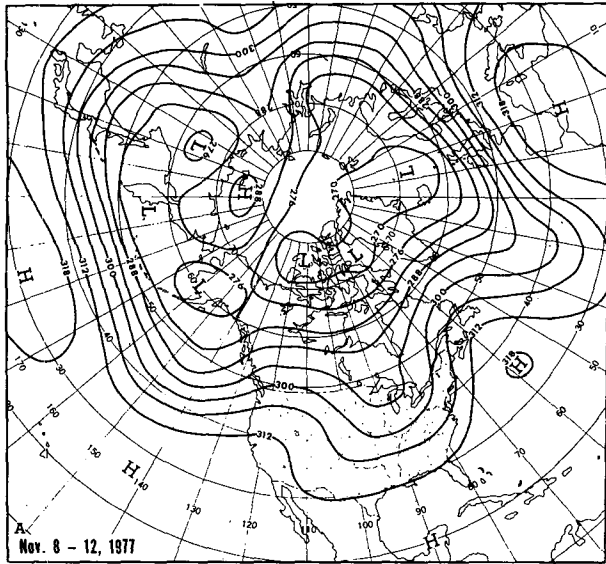


FIG. 6. Percentage of normal precipitation for November 1977 (from National Oceanic & Atmospheric Administration and Statistical Reporting Service, 1977).

(Fig. 8). While much of the country continued warm, increased northerly flow over the Great Plains brought below normal temperatures to the southern Plains and the South.

Greatest precipitation totals occurred in advance of the northeast Pacific trough, near the central United



mean ridge to the Gulf of Alaska (Fig. 9). Together with a deepening mean trough over the northern Mississippi Valley, this drove cold air over the northwestern quarter of the country while the remainder stayed warm. Precipitation was concentrated in advance of the Great Plains trough. Fargo experienced its second blizzard of the month on 19-20 November.

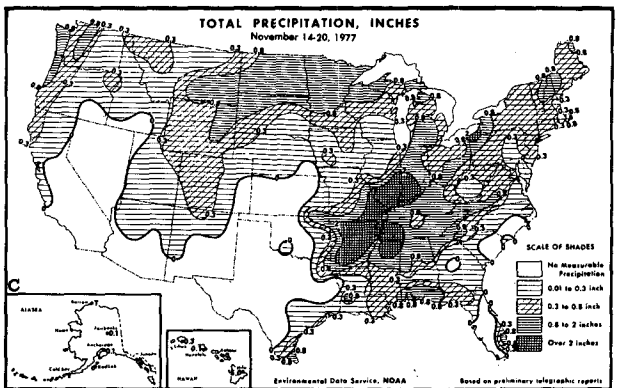
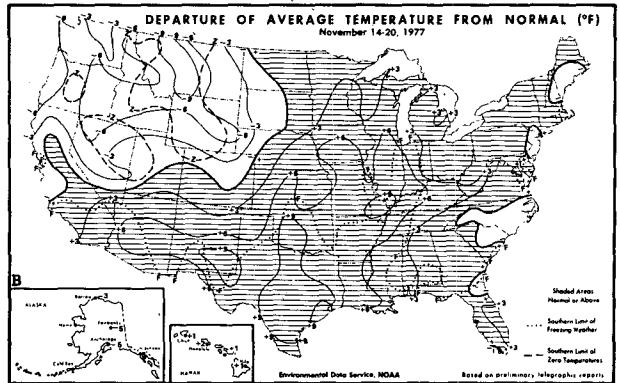
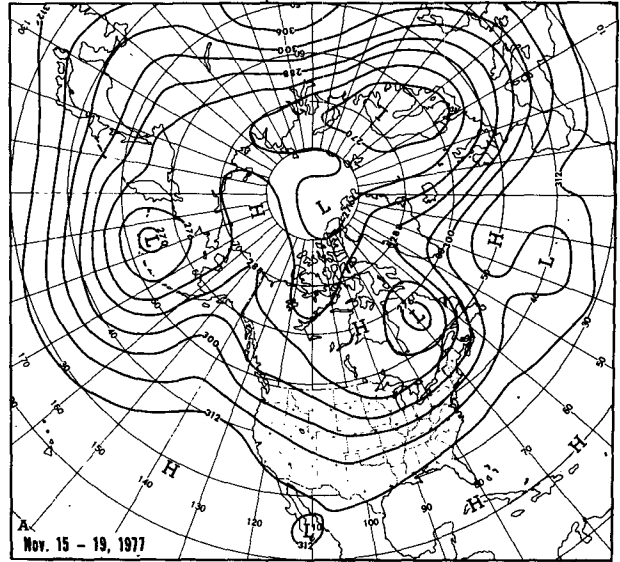


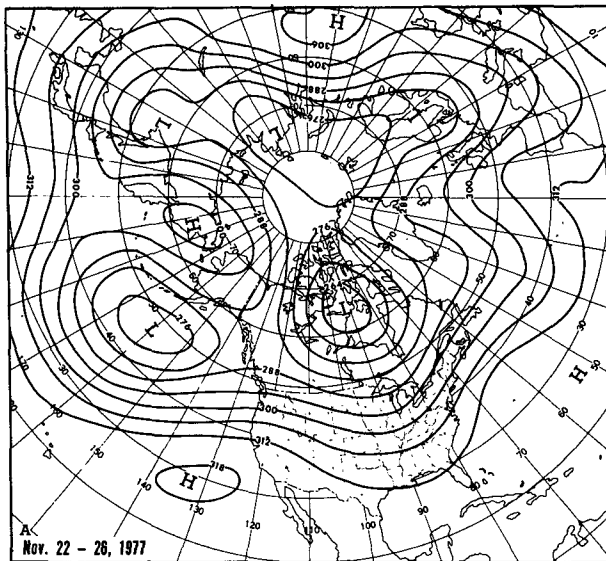
FIG. 8. As in Fig. 7 except for (A) 8-12 November 1977 and (B) and (C) week of 7-13 November 1977.

States trough, and in the Northeast where southerly wind components were quite strong. Blizzard conditions were observed at Fargo, N.D., on 8 and 9 November.

c. 14-20 November

Further retrogression and amplification of the waves in the flow pattern over the Pacific brought a strong

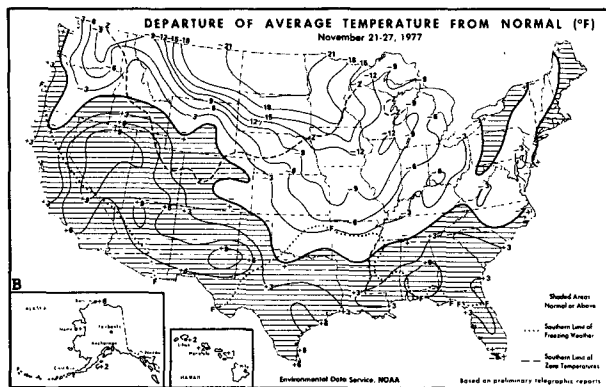
FIG. 9. As in Fig. 7 except for (A) 15-19 November 1977 and (B) and (C) week of 14-20 November 1977.



and over Hudson Bay (Fig. 10). The trough over the United States progressed in the regionally increasing westerly flow.

Confluence of the warm southwesterly flow from the east Pacific with the cold northwesterly flow from western Canada brought strong westerlies and intense thermal contrasts to the United States this week. Extremely cold air covered most of the northern portion of the Nation while mild weather was observed over the Southwest and South. Lowest temperatures for so early in the season and lowest temperatures for the month were observed in Illinois, Iowa, Wisconsin and Minnesota.

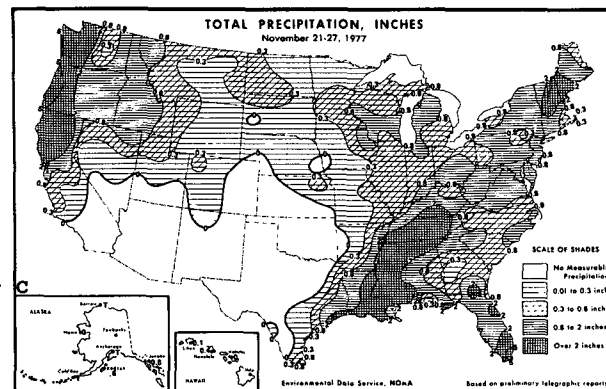
Increasing southwesterly flow over the east Pacific made this the wettest week of the month in the Northwest. Elsewhere substantial precipitation amounts were observed near and east of the progressing mean trough. Record 24 h snowfall totals were reported on 21 November at Red Bluff, Calif., and Medford, Ore.



5. Tropical activity

Tropical Storm Kim formed near 12°N, 152°E on 7 November. Moving westward, Kim became a typhoon on the 8th, and hit the northern Philippines on the 13th. The storm, diminishing to tropical storm strength during its passage over land, further weakened as it was picked up by a cold front north of the Philippines on 16 November.

Two cyclones (i.e., tropical cyclones of hurricane intensity) were observed simultaneously off the southeast and southwest coasts of India on 17 November. The easternmost storm made landfall in Andhra Pradesh state (about 15°N) on 19 November with news reports indicating 90 mph winds followed by an 18 ft tidal wave. According to preliminary reports, at least 13 villages were wiped out leaving about 100 000 people homeless and more than 15 000 dead. Hardest hit areas were the Krishna district (about 225 mi north of Madras) and the Guntur district, just west of Krishna.



The storm off the southwest coast of India moved southeast and then east, in apparent rotation about the stronger storm to its east, and weakened to tropical storm intensity before hitting the west coast at about 13°N.

REFERENCES

FIG. 10. As in Fig. 7 except for (A) 22-26 November 1977 and (B) and (C) week of 21-27 November 1977.

d. 21-27 November

The amplification of waves over the Pacific continued, producing a strong blocking ridge over north-eastern Siberia and deep lows south of the Aleutians

National Oceanic & Atmospheric Administration, U.S. Department of Commerce, and Statistical Reporting Service, U.S. Department of Agriculture, 1977: *Weekly Weather & Crop Bull.*, 64, Nos. 45-49 (8, 15, 22 and 29 November and 6 December 1977).
 Wagner, A. James, 1978: Weather and circulation of October 1977: Cool in the East and warm in the West. *Mon. Wea. Rev.*, 106, 148-154.