origin which we are now indicating as Ts (Tropical Superior). There is no evidence of any other air to the top of the ascent, as the moisture content *w* continues to decrease steadily with elevation.

February 2. This sounding shows marked changes both at the top and bottom from that of the day before. The surface layer has become much warmer and much drier, showing that the shallow layer of moist NPP at the ground on the preceding day has been displaced by the warm dry outflowing föhn NPP or Ts current aloft. But now, instead of steadily decreasing moisture with elevation, as on the preceding day, we find a deep layer, from 1,260 to 3,430 m, in which *w* increases slightly, and at upper levels it is uniformly much higher than on the previous day. There is no doubt that from 3,430 m to the top we are in Tropical maritime air, either TG or TP from quite low latitudes. The temperature is very little different from that of the Ts current which prevailed there on the preceding day, as shoud be the case. The contrast lies in the moisture difference.

February 3. This sounding shows the almost complete disappearance of the warm dry air mass. It has been replaced at the ground again by somewhat moister and cooler air, probably old NPP from off the water, and at upper levels the Tropical maritime current has become lower and deeper. The transition zone, which on the previous day extended from 1,260 to 3,430 m, now lies between 1,160 and 2,420 m, and above 2,420 to the top of the ascent we find a typical Tropical maritime curve, slightly moister at all levels than on the preceding day.

To help in elucidating these summaries, maps of the air flow at 12,000 feet for the first 4 days of February are submitted. It will be noticed that the increase in moisture in the deep layer aloft occurred when winds aloft changed from northeast to south, and it was not until then that the layer was classified as "tropical maritime air from quite low latitudes". This substantiates the assumption that the southerly current originated in the Tropics, and removes all question as to its source on these dates as well as on the other dates specified.

The area several hundred miles off the coast between Point Eugenia and Point Conception is undoubtedly a source region for these storms; meteorologists who are following weather sequences in southern California must admit that numerous depressions, unheralded and unpredicted, have appeared first in this general vicinity. Why is this a zone of cyclogenesis?

It is to be regretted that the region is more or less remote from the main-traveled steamship routes; the development of these frontal disturbances is often unknown until a full-fledged extratropical cyclone moves into the scene of ocean commerce, or reaches the Pacific coast. This lack of definite reports makes it impossible to ascertain the true situation until they appear within our field of observation.

Nevertheless, it is certain these storms often originate near the southern boundary of the temperate zone, in the so-called calms of Cancer, just north of the trade-wind belt; and it is a matter of observation that they occur at a time and in the season of the year when an enormous outflow of air has been possible over that region from the American continent. Maps and ship reports from Mexican waters prove conclusively that they are not cyclones that form along the southern coast and move northward into this area.

Clearly, then, this must be a region of converging currents, warm, moist southerly air in conflict with colder, drier northerly air. Winds over this part of the Pacific Ocean are largely the outflow from the subtropical high pressure belt, and, as has been emphasized before, during the periods of frontogenesis, widespread anticyclones invariably cover both the western continental areas and the ocean to the west. In the case of the storms of December 6–15, 1934, and February 2–10, 1935, the frontal system did not develop until there was a marked barometric rise to the west. Whether the colder mass is tropical maritime (for tropical may act as a cold mass to equatorial), or transitional polar Pacific can be determined only by a qualitative analysis of the vertical structure of the air involved.

In conclusion, the writer wishes to acknowledge his indebtedness to his associates at San Diego, and to T. R. Reed, in particular, whose interest stimulated the study, and whose advice and help were largely responsible for its completion.

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UNUSUAL THUNDERSTORM ACTIVITY IN THE MOUNTAINS OF OREGON AND WASHINGTON IN 1935

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Thunderstorm frequency in the Oregon Cascade Range and northeastern part of the State was greater in 1935 than in any year since 1930; the storms were likewise numerous in the Cascade Range of Washington, but less so than in 1932. This was shown by an analysis of the records kept annually by fire lookouts on the national forests, describing all thunderstorms seen during the summer. The lookouts selected for the analysis were distributed about 25 miles apart in a network covering nearly all of the mountainous territory of Oregon and Washington, the principal areas of thunderstorm occurrence in these States.

As compared with the 10 previous years of record, 1935 differed by having the preponderance of its lightning-storm days in July instead of either in August or more equally divided between July and August.

On July 23, thunderstorms were more widespread than on any other day since 1930. They were reported from each of the 10 national forests that make a continuous 500-mile chain along the Cascade Range north and south through Oregon and Washington, and from each of 5 forests in a 200-mile chain through the Blue Mountains of northeastern Oregon. Thunderstorms were extensive in the mountains of Oregon and Washington on several other days in the last decade of July, and from July 21 to 31 caused a total of 407 forest fires on the national forests of the region.

During the entire season 885 forest fires or 55 percent of all of the fires on these national forests were started by lightning. This great source of forest fires, in which most of the danger was concentrated upon relatively few days, placed a peak-load burden upon the fire protection organization.

PRELIMINARY REPORT ON TORNADOES IN THE UNITED STATES DURING 1935

By R. J. MARTIN

[Weather Bureau, Washington, January 28, 1935]

In keeping with the custom of recent years, a preliminary statement of loss of life and property damage by windstorms is here included in the December issue of the REVIEW. A final and more detailed study will appear in the Report of the Chief of the Weather Bureau for the year 1935–36. Practically all the information given in this summary is abstracted from the monthly tables of "Severe Local Storms", which are compiled from the reports of many observers and various section directors of the Bureau. While it is thought the figures given are substantially correct, it must be remembered that all are subject to change after the final study mentioned above.

May, with 44 (possibly 45) tornadoes, was the month with the greatest number of such storms; but the total loss of life, 16, was considerably less than the April figure. June, with 28 (possibly 34) storms, was second, while March had 26 (cr 32) and April had 24 (or 27). February and July each had 16 tornadoes, but the later study may change the July figure to 21. The greatest loss of life occurred in April, when 28 persons were killed; 17 deaths were reported in Mississippi and 9 in Louisiana, caused by the storms of the 6th, which are described in the April 1935 Climatological Data for these States. The deaths in Louisiana occurred when the tornado capsized a houseboat. Tornadoes caused 16 fatalities during May, and 13 persons were killed in Texas on February 8 by a tornado which struck 8 counties. Storms resulting in four or more deaths occurred in Nebraska (May 31), Arkansas (June 21), and Mississippi (March 31).

Tornadoes occurred without loss of life in August, October, and November. June had six fatalities, July had five, and four deaths resulted from these storms in September. No tornadoes were reported in January or December.

The total property loss caused by tornadoes in 1935 is estimated at over $4,917,000; March, with estimated tornado or tornadic wind damage of over $1,217,400, was the month of greatest property loss. The second highest figure was $1,009,600 in April; over $395,000 of this was caused by the Louisiana and Mississippi storms (mentioned above) over paths varying in width from 17 to 880 yards. The June storms resulted in losses of more than $979,500, of which $300,000 occurred on the morning of the 21st at Texarkana, Ark., and vicinity.

The total number of tornadoes during the year, approximately 179, was 32 more than in the preceding year, but 81 less than in 1933; the 1935 total has been exceeded 4 times in the last 20 years. During March and May of 1933, 150 tornadoes occurred; the total for the corresponding months of 1935 was 70. The total number of deaths resulting from the 1935 storms is estimated at 86, which is nearly double the figure for the preceding year (47). Other than the Texas, Louisiana, and Mississippi storms mentioned above, there were no unusually severe tornadoes during 1935, and each of these have been greatly exceeded in other years.

If further study shows the storms listed in the table of tornadic winds to be true tornadoes, the 1935 sums will be 200 tornadoes, 86 deaths, and property losses exceeding $5,514,300.

TORNADOES AND PROBABLE TORNADOES

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Number	0	16	26	24	44	28	16	8	13	1	3	0	179
Deaths	----	14	13	28	16	6	5	0	4	0	0	----	86
Damage [1]	----	507.0	1,075.4	1,005.6	884.4	719.5	341.8	52.1	302.3	4.5	24.4	----	4,917.0

TORNADIC WINDS AND POSSIBLE TORNADOES [2]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Number	0	0	6	3	1	6	5	0	0	0	0	0	21
Deaths	----	----	0	0	0	0	0	----	----	----	----	----	0
Damage [1]	----	----	142	4	4	260	187	----	----	----	----	----	597

[1] In thousands of dollars.
[2] Some of these may not be classed as tornadoes in the final study.

THE WEATHER OF 1935 IN THE UNITED STATES

By R. J. MARTIN

[Weather Bureau, Washington, D. C., February 1935]

The year 1935 averaged nearly 2° cooler than 1934; and precipitation, while still subnormal, was considerably more plentiful than in the preceding year. The temperature departure, all sections considered, was +0.7°, as compared with +2.5° in 1934, and the precipitation departure was only −0.6 inch; in 1934 it was −3.7 inches.

Table 1 shows that for the year as a whole only three sections of the country, New England, the Florida Peninsula, and the lower Lake region, averaged cooler than normal, and the maximum deficiency (lower Lake region) was only 0.3°. Five sections were exactly normal, while in the other 13 the temperature ranged from 0.1° to 1.1° above normal. The relatively warmest section was the Middle Slope (portions of Oklahoma, Kansas, and Colorado). The relatively warmest month was February, when the entire country averaged 3.3° above normal; in March the excess was 3°. January, July, August, September, and October were also warmer than normal, while April, May, June, November, and December were below normal. May, with a negative departure of 1.8°, was the relatively coldest month, followed closely by December, with a deficiency of 1.7°. In February, only 2 of the 21 sections had subnormal warmth and in both instances the deficiency was only 0.5°; in North Dakota that month averaged nearly 16° above normal, and elsewhere the plus departures ranged from 0.1° to 8.8°. The largest sectional negative departures occurred in December, due mostly to severe cold in the latter part of the month, and ranged from less than 1° to more than 7°.

Chart 1 shows that those sections of the country averaging cooler than normal were few in number and of