high pressure areas were generally moderate and located off the Pacific States or north of the Alaska Range. This pressure distribution was accompanied by more severe cold throughout the Territory except in the southern part of the panhandle. For the entire Territory, temperature was 11° below the normal for this month. The greatest departures were at Dillingham, White Mountain and Fairbanks, 19° below normal. Ketchikan was 5° above normal. On the 14th, with moderate high pressure overspreading Alaska north of the Alaska Range, highest 30.44 inches at Barrow, and low pressure in the Gulf of Alaska, 29.10 inches near Cordova, the temperature at Fairbanks fell to —66°, or 1° lower than previously recorded in that vicinity. At College Farm, four miles distant, with 30 years’ record, the minimum was —65°, equaling the previous low record.

In February, the low pressure areas remained deep but were generally centered near and south of the Aleutian Islands and the Alaska Peninsula, with pressure below normal over much of the interior, and the high pressure areas generally far north in Alaska or in western Canada, and off the Pacific States. This pressure distribution was accompanied by unusually high temperatures throughout the Territory, except in the Pribilof Islands in the Bering Sea where the mean was 0.4° below normal. The mean of all reports so far received shows the temperature for the entire Territory to be 9° above normal. The greatest departure was at McKinley Park where the mean was 14° above normal.—Author’s Abstract.

THE MILD WINTER OF 1933-1934 IN THE PACIFIC NORTHWEST

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The Winter of 1933-34 in the three northwestern states, Washington, Oregon, and Idaho, the Pacific Northwest, was the mildest of record. We shall discuss it first in comparison with other winters, then as to biological and economical effects, and lastly as to causes.

Records of first order and cooperative station have been continuous since 1893 in these states, making available comparisons for 41 winters. An examination of the records reveals that 17 winters in each of these three states had state mean temperatures uniformly above their respective state normals, 12 with winters uniformly below normal temperatures, and 12 winters in which the three states’ departures were not uniformly in the same direction. In two of these 41 winters, 1917-1918 and 1925-1926, the average plus departures for the 3 states amounted to several degrees, but in both winters several of the individual stations had minus departures in spite of the large average plus departure. However, the winter of 1933-1934 is unique in that not a single first order or cooperative station, approximately 350 in all, showed a minus departure. The average mean temperature for the three states was 38.2°F. The departures showed increasing and progressive mildness. Thus the 3-state December departure was 5.2°, January 7.4°, February 9.0°, an average departure for the Northwest for the winter of plus 7.2°. The Northwest winter normal is 31.0°.

In Washington not one of the winter months equalled the record state mean. In Idaho, January and February, and in Oregon, all three

3Cf. notes in May Bulletin, pp. 141-144.
months established new high state averages. One might be led to think that with such general warmth many record state maxima would be reached, but this occurred in Washington in only one month, Wahluke registering 74°, the highest December temperature ever recorded in the state; and it occurred in Oregon in only one month, January, when Fremont registered 82°, Oregon's highest January maximum. Also one could well expect record breaking warm nights, but only in one state, Idaho, and in one month, January, was a high state minimum record made, at Obsidian, elevation 6,900 feet, the highest recording station in the Northwest.

It would appear, therefore, that the mild winter was due more to sustained warmth than to frequent high temperatures. The minimum temperature at Seattle was 32°, reached on only 1 day, as against a normal of 18 days; at Portland 0 days as against a normal of 24 days; at Spokane 46 days with a normal of 70; at Boise 31 with a normal of 71 days. At Boise on every day of the winter the maximum reached 32° or higher and at Spokane on every day but 4. Four well distributed locations in the city or vicinity of Spokane showed by thermograph record, on the average, only 512 hours of freezing, or below, out of a possible 2,160 hours, less than 24% of the time. The longest time during the entire winter that the temperature in this northern city stayed below freezing was 92 hours, and that just before the Christmas season. Further figures could readily be given showing the unusual mildness but are not necessary.

Washington had the highest average total precipitation for a winter, the state average being 23.16 inches. Oregon's state average has been exceeded 40% of the winters. In Idaho 3 winters had greater precipitation than this winter and one other an equal amount. The three states as a whole had the second wettest winter of their weather history, the wettest of which, that of 1917-1918, gave a Northwest record of 14.17 inches, only .08 inch above that of last winter. The departure in each state was plus, as was the temperature. In this respect no records were broken, since plus precipitation departures occurred synchronously with plus temperature departures 4 times before, viz., in winters ending 1896, 1915, 1921 and 1925.

Because of the wide divergence in the length of snowfall records, as well as in the elevation and number of stations, regional snowfall comparisons are unsatisfactory. One state, Idaho, broke the record for light snowfall with its state average of 20.1 inches, less than 50% of the normal of 36 years. Oregon's 9.5 inches was 38% of a 17-year normal and Washington's average of 27.4, or 86% of a 38-year normal. It is obvious that this snowfall shortage must be ascribed to the high temperatures, since in no winter in the Northwest, excepting records at their face value, has so much as normal snowfall been measured when all three states had plus temperature departures, whether the precipitation as a whole was above or below normal.

Such a winter, warmer than any other of record by more than 3 degrees and second highest in precipitation, would be expected to exert a marked influence on the biological activities of the region. This influence was found to be widespread indeed but only typical cases can be cited.

Wild life fared much better than usual. The Bureau of Biological Sur-
vey regards the mildness of the win-
ter with its deficiency of snow and
abundant food supply as a strongly
contributing factor to the early re-
production of jackrabbits and coyotes,
which delivered larger litters than
normal. Ravens, magpies, horned
larks, and sparrows laid their eggs
from 2 to 4 weeks early and in a
number of cases produced more than
the average number of young. Be-
cause of the abundant pasturage and
open weather an increased number of
twin lambs has been born. The
Bureau of Entomology is authority
for the statement that insect life was
active through the winter, mentioning
some of the aphides, especially the
pea, the grain and the oat aphis,
which are capable of wintering as
viviparous forms. In some places in
the Northwest fruit and shrub
aphides were active earlier and on a
wider scale than usual, necessitat-
ing earlier spraying. Also codling
moths came on sooner, requiring
earlier attention. The Hessian fly
came out in Oregon in February.
Wild flowers and, in many cases, cul-
tivated flowers continued to grow all
winter. As an instance of the win-
ter’s balminess far north in the dis-
trict, when at a midwinter Chamber
of Commerce meeting in Spokane a
prize was given to the person pre-
senting the best bouquet of wild
flowers, the winner presented a pot
of 12 species and there were some
close competitors.

The unusual meteorological con-
tions of the winter, also was felt in
the economic life of the Northwest.
Crews of workmen engaged on pro-
jects at the higher elevations where
snow ordinarily interferes with work
were able to keep going all winter.
The cost of snow removal in cities
was much below normal, in most cases
being entirely eliminated. Railroads
also had a minimum of expense for
clearing the tracks of snow. While
winter wheat remained for the most
part uncovered, it didn’t need any
cover as the usual alternate thawing
and freezing and heaving was absent.
The three prominent ski tournaments
in the Northwest were saved from
utter failure only by the energetic
activities of their promoters. Hood
River, Oregon, and Leavenworth and
Spokane, Washington, all transported
snow to their ski courses. In the
case of Spokane the ski course was
100% artificial, snow being brought
for the purpose 200 miles from the
Cascades. So far as we have been
able to ascertain not one of several
ice harvesting companies in the Dis-
trict harvested any lake or river ice,
natural ice being brought in from
Dakota. Skating parties on lakes or
streams were extremely rare and arti-
ficial ice rink parties were more nu-
merous than usual. Frozen water
pipes and frozen radiators brought
scant revenue to plumbers and garage
men. Farmers continued to plow dur-
ing January and February. Oil sta-
tions did a steady business as travel
was not tied up by cold or snow.
Winter overcoats and heavy under-
wear sales were at a low ebb. The
Heating and Ventilating Magazine
is authority for the statement that the
Degree-Days at Spokane were 24%
below normal; at Portland, 28%; at
Seattle, 22%; and at Boise, 31%.
Approximately these figures would
represent the shortage in fuel require-
ments for the winter and the net
shortage of the fuel dealer’s income.

It is quite apparent that the im-
mediate cause of the warm moist
winter described was the system of
winds governing the weather and
these in turn were associated with
the distribution of highs and lows.
The subject may best be discussed
under the head of pressure tracks or courses.

**Pressure Tracks—The Ordinary Winter**

In an ordinary winter in the Northwest, the highs frequently come out of Alaska and move south to southeast, occasionally passing right through the Northwest. Also a number of lows proceed out of southern Alaska along or inside the British Columbia coast, thence crossing the Northwest. Also there may be lows whose paths lead in from the ocean across the Northwest. Their distribution and direction is such as to bring in a good share of Arctic cold air as well as more tempered air of the northern Pacific.

**Pressure Tracks—A Cold Winter, 1928-1929**

By way of contrast it is seen that in the winter of 1928-1929, one of the coldest of the Northwest, with its average departure of —6.0 degrees, the lows and highs proceeded from the Alaskan and Arctic Circle positions, respectively, in a southeasterly direction, on the average. It was the December tendency that winter and markedly the January and February tendency. So far inshore was the path of the lows that the anticlockwise winds brought in little ocean heat from the Pacific and the average source and direction of the highs was quite favorable to draining down the Arctic cold.

**Pressure Tracks—A Warm Winter, 1933-34**

December tracks.—In December in the north Pacific ocean, pressure in the Aleutian area was abnormally high and in midocean unusually low. A pressure ridge also lay between California and Hawaii. Two highs, offshoots from this southern ridge, moved across southern Oregon, bringing warm winds into the Northwest. No other high crossed the Northwest in December, the southernmost one running southeastward near Havre, Montana. The average high path is 400 miles northeast of Havre. The average high at the nearest point to the Northwest was 30.45 inches. All of the lows, average 29.53 inches, moved in from the ocean, their average path being north of the International Line, not a single low passing farther south than the Columbia River in its westward course between Oregon and Washington. It was these cyclones moving in with their warm, moist air meeting the cold brought down by the highs whose paths were just west of Hudson Bay that brought to the Northwest its second wettest winter and to the states of Oregon and Washington the most damaging floods of their history and to portions of Idaho almost equal damage, as well as loss of a number of lives.

January tracks.—In January the reversal of pressure distribution over the Pacific did not halt last winter's increasing mildness, thus affording an illustration of Nature's versatility in weather making.

The semi-permanent low was over Alaskan waters while the semi-permanent high was off the California coast. At least 6 lows leading off from the Aleutian low entered the continent near Juneau, moving southeast, but keeping north of the International Line until having passed Montana. These brought little cold to the Northwest, but were instrumental in bringing in some moderate temperatures from the waters off British Columbia. Also during this month, at least 6 high pressure waves, average 30.40 inches, leading off from
the California high, crossed the North- west, bringing to it the mild tempera- tures of the southern waters over which they originated. In contrast to these a second group of highs at least 10 in number, moved out from within the Arctic Circle, across the Yukon and Northwest provinces, just south of Hudson Bay, not entering the United States until reaching New England, thus definitely shunting from the Northwest any possibility of cold weather. Not one of these 10 highs had any noticeable effect on the Northwest's weather but did contribute heavily toward giving northeastern Canada a very cold winter. It was the ocean lows referred to and the southern highs that were directly responsible for the January mildness.

February tracks.—In February pressure was unusually low over most of the Pacific, no highs of prominence appearing. Influencing the weather in the Northwest were several lows that passed eastward from the ocean north of the International Line, at least one crossing the California line eastward, and several others apparently forming over Nevada and Utah. These, along with one high that moved from the south over the North- west, carried subtropical temperatures across the Oregon and Washington coasts increasing the winter's temperature accumulations. Other highs of the month moved from Arctic Circle positions southeastward through the prairie provinces without cooling the Northwest.

Thus, through all 3 months, systems of winds played upon the North- west in such a way as to bring in temperatures belonging to the middle or southern sections of the north Pacific. The influences were practically all marine and subtropical, the land influences from the Arctic and cold land regions being negligible 95% of the time.

STATIC AND DYNAMIC WORLD MAPS


Just six years ago, at the Pomona meeting of this Society, a resolution was passed calling for the adoption of a Base Map of the World from which all local or national synoptic charts could be cut in suitable rect- angles so that when recorded on, they could be reassembled to yield daily weather maps of the whole world. This resolution carried with it, as a corollary, the standardization also of all over-printed recordings and their symbols so that the parts of the World Map should agree with one another in all particulars.

But before an international base- map of the world can be adopted by meteorologists, it is imperative to de- cide the type of projection most desir- able; whether the angles should be correct for the areas. By far the weightiest judgment favors an equi- angular or conformal projection where compass roses are locally correct. Nevertheless some authorities favor an equal-area map for certain cli- matic purposes or other studies where relative areas are important, and others are without conviction one way or the other. And then again, there is the question of an open or a closed Pole.

These questions have some bearing on another element strangely over- looked by writers on projection, and that is the question of continuity: the difference between what may be called Static world maps with closed-in boundaries and Dynamic world maps whose outer edges are continuabull.