DISTRIBUTION OF AIR-MASS TYPES AND FREQUENCY OF CHANGE IN THE WESTERN UNITED STATES DURING 1937–38

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In a study of air masses and their movements in the western United States, a table was made showing the air-mass type present each day at Seattle, Spokane, Williston, Salt Lake City, San Francisco, and Los Angeles during the year March 1, 1937, to March 1, 1938. This year had a slight plus departure in both temperature and precipitation for a majority of the stations. The data were taken from manuscript maps at the Seattle Airport Weather Bureau where the air masses and fronts were plotted according to analyses made at Washington, D. C. The record is incomplete only to the extent that analyses for the western United States were usually omitted on Sundays and holidays.

The number of days on which each air-mass type was present at each station, expressed in percent of the year, is shown in table 1, and gives some indication of the areal distribution of types over the western United States during the year.

Except for the outstanding preponderance of NPP air at every station but Williston, there is nothing about the distribution of air-mass types which is not in conformity with what is normally to be expected considering latitude and distance from the sea.

PP air was more prevalent at Seattle than toward the interior or toward the south. NPP was most extensive at the southwestern and interior stations, where the low latitude or interior position is conducive to modification of the PP air mass properties.

In contrast with the prevalence of PP and its transitional phase on the Pacific coast, Pc and its transitional phase predominated at interior stations. Pc air was most prevalent at the northern interior station, Williston, and rapidly decreased in extent toward the Pacific coast and toward the south. The distribution of NPC air closely resembled that of the true Pc, except that it was present in larger proportion at all stations but Williston. It was peripheral to the Pc air on the west and south, as NPP was peripheral to the PP air on the east and south. Apparently Pc came in contact with PP or NPP air most frequently in the vicinity of Spokane, where there was the highest percent of Pc interspersed with unabsorbed or unmixed layers of PP or NPP air.

Tropical Pacific air was found mainly at Los Angeles, nearest its source region, and decreased in extent northward and toward the interior. Aloft, the drier S was also most prevalent at Los Angeles, with a marked decrease in occurrence toward the northern coastal cities, but a comparatively small decrease over the interior plateau. S was present aloft 7 percent of the year at Salt Lake and 5 percent as far north as Williston, compared with 3 percent at San Francisco and 2 percent at Seattle.

The relation between season and extent of different air-mass types is illustrated by a series of graphs for January, April, July, and October, the midmonths of the four seasons, figure 1.

It is apparent that NPP air was predominant at all seasons, but most extensive in the spring, with a secondary in the fall season. Tropical air was conspicuous only in the spring and early summer. Pc air was most prevalent in the winter, but did not reach as far south even as Salt Lake City or San Francisco during January. NPC was least extensive in winter, being present only at Williston in January, while during the summer and especially the fall season it was found at all stations.

The greatest variety of air-mass types occurred at all stations in the spring, with a secondary in the fall, while the greatest uniformity in type was during the winter with a secondary in summer.

The areal distribution of frequencies of change is shown in table 2, which gives the number of changes of air-mass type that occurred each month at each of the six stations. From the annual totals of this table it appears that the greatest frequency of change was at the interior and northern stations, with the number of changes diminishing toward the coast and southward. The monthly totals show that April had the greatest number of changes (97) followed by September (88), while the fewest occurred in January (23) followed by July (48).

Except for September, these are the midmonths of the four seasons, and therefore should be indicative of air-mass movements during these periods. It is not astonishing to find that fewer changes occurred in January and July, when there was the least variety of air-mass types, nor that most changes occurred during the transitional seasons when there were the greatest number of air-mass types. These changes, which occurred in the transitional seasons when PP and TP air was most prevalent, became much less frequent in January and July when the more predominant NPP and Pc air masses had reached their maximum extent. There were fewer changes in the fall than in the spring because the change from summer to winter is less abrupt than the change from winter to summer which is attended by movements from more radically different surface conditions; i. e., bare ground, snow, ice, dormant vegetation, etc.

TABLE 1.—*Percentage of year during which different types of air masses prevailed*

	PP	NPP	Pc	NPC	Pc-PP	TP	S
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Seattle	33	44	6	10	4	2	1
Spokane	27	45	8	14	5	0	0
Williston	6	32	32	22	4	1	1
Salt Lake City	18	2	2	17	4	3	3
San Francisco	26	1	1	7	3	6	1
Los Angeles	18	1	1	6	2	9	4

TABLE 2.—*Number of changes of air mass*

	Williston	Spokane	Salt Lake City	Seattle	San Francisco	Los Angeles	Monthly totals
March	15	12	15	8	10	10	70
April	21	18	17	13	14	14	97
May	19	13	13	13	9	10	77
June	13	11	12	10	11	10	67
July	13	9	9	7	5	5	48
August	13	16	10	17	13	11	80
September	16	15	14	17	12	14	88
October	16	14	15	11	11	11	78
November	10	15	11	14	9	7	66
December	11	11	12	13	9	11	67
January	15	2	1	2	2	1	23
February	7	15	11	10	10	10	63
Annual totals	169	151	140	135	115	114	

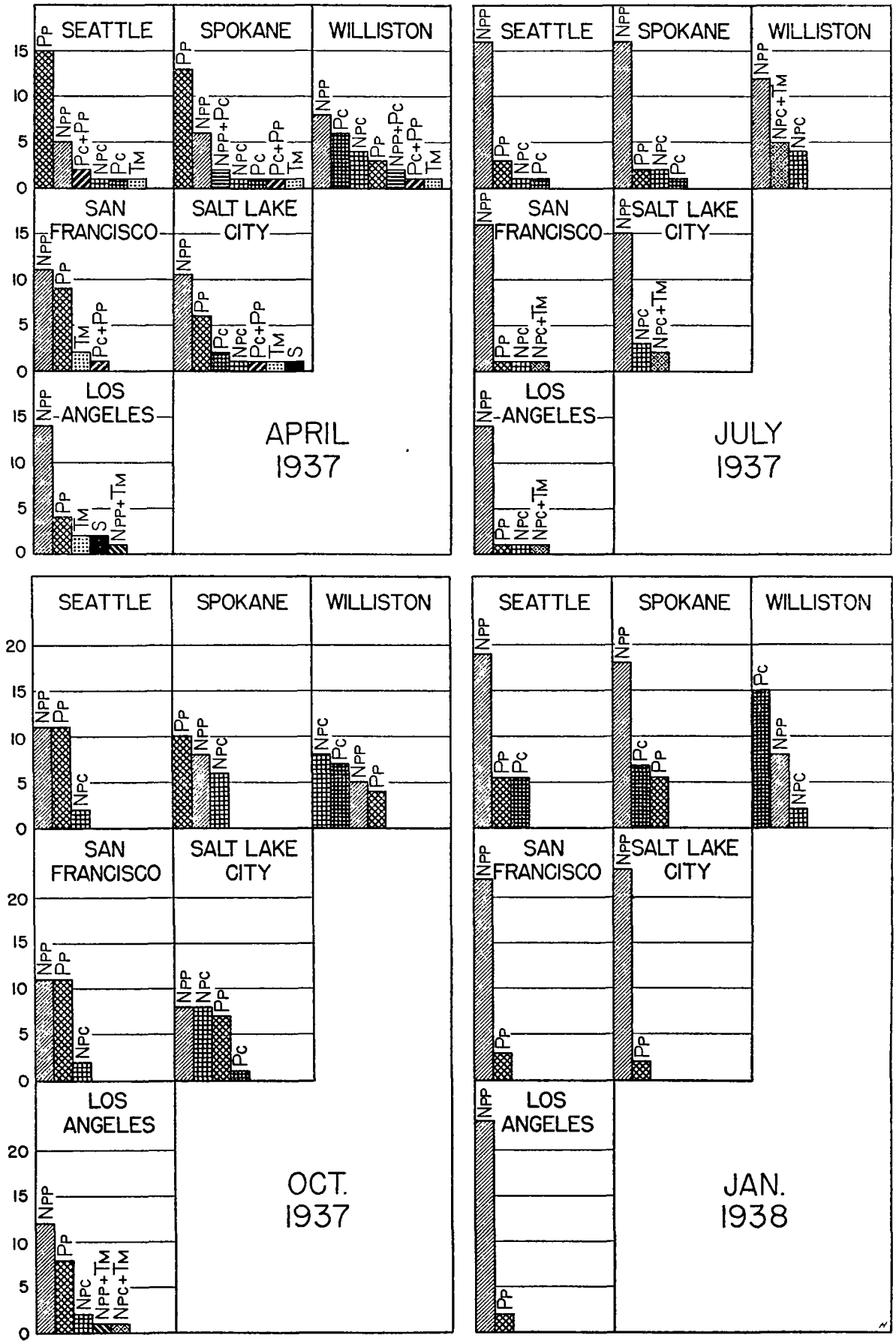

FIGURE 1.—Frequency of air-mass types at six stations in January, April, July, and October.