U. S. DEPARTMENT OF AGRICULTURE
WEATHER BUREAU

CLIMATOLOGICAL SERVICE

DISTRICT NO. 11, CALIFORNIA

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DISTRICT EDITOR

REPORT FOR JUNE, 1912

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DISTRICT No. 11, CALIFORNIA.

Prof. ALEXANDER G. McADIE, District Editor.

GENERAL SUMMARY.

June, 1912, was not as cold as June, 1911, or June, 1910, but nevertheless was cooler than the average June. The month resembled the preceding month and was in many respects more like an average May than an average June. There was more rain than usual, which was of decided benefit, since the seasonal rainfall was deficient. There was less cloudiness and less fog along the coast than usual. There were no strong north winds, which when they do occur at this time of the year are warm and dry. It was extremely fortunate that none of these hot spells occurred, for the ground had comparatively little surface moisture and a desiccating wind of 24 or 48 hours' duration would have caused great damage to the staple crops. While the rainfall for June was above the normal and was well distributed geographically, the total seasonal amounts are still much below the normal, there being a long dry period during the winter and early spring months, and the snow cover was less extensive than usual. At the end of the first week in June snow had disappeared from the 7,000-foot level or remained only in patches on the summits and in the canyons. At the same date last year there was nearly 2 feet of snow on the ground at the same elevations. The supply of water while not abundant is holding out remarkably well. As anticipated in April, the season has been an early and an open one, and trails in the mountains over the passes were open from two to three weeks earlier than is usual. Mining and power operations have been carried on advantageously and there has been no complaint from irrigationists and stockmen.

The month began with pressure distribution favorable for north winds and warm weather. June 3 was the warmest day at San Francisco since June 29, 1909, the maximum temperature being 93°. At Mount Tamalpais the temperature reached 90°, or, in other words, it was warmer at the lower station ,which is an unusual condition in this locality in June during a warm spell. In the Great Valley of California temperatures reached 106°, and a maximum of 103° was recorded at Sacramento June 3 at 6 p. m. The warm spell lasted about three days, moderating gradually.

A marked change in the pressure distribution occurred on June 6, and conditions were favorable for cloudy, cooler weather and light thunderstorms in the Sierra. A rainy period began June 11 and showers occurred in central and northern counties at intervals until the 14th. About the middle of the month there was a return to the dry, warmer type with moderate north winds. Fortunately the high pressure areas moved eastward rather than southeastward and consequently the weather while warm was not excessively hot. Temperatures in the Great Valley on the 18th and 19th ranged from 94° to 104°. Temperatures 10° higher probably would have occurred if the high-pressure area had moved southeastward. There was a quick fall in temperature on June 20 with considerable cloudiness and conditions favoring rain. The rain came June 23, and moderately high south to southeast winds prevailed off the central coast. Small craft warnings were issued for San Francisco Bay and a southwest warning was displayed at Point Reyes. The display of signals for southerly winds is unusual at this time of year.

The weather continued unsettled until the 25th, but the rest of the month was without any features of special interest.

TEMPERATURE.

The temperature for the State was 1° below the normal. The following table gives the mean temperature for California for each June during the time for which records have been kept:

Year.	Mean.	Departure.	Year.	Mean.	Departure.
	°F.	°F.		°F.	°F.
1897	69.8	+ 0.8	1905	67.5	− 1.5
1898	71.3	+ 2.3	1906	66.7	− 2.3
1899	71.5	+ 2.5	1907	66.1	− 2.9
1900	71.4	+ 2.4	1908	66.0	− 3.0
1901	70.5	+ 1.5	1909	68.1	− 0.9
1902	70.2	+ 1.2	1910	67.3	− 1.7
1903	70.9	+ 1.9	1911	66.7	− 2.3
1904	71.1	+ 2.1	1912	68.0	− 1.0

The highest temperature recorded was 120° at Greenland Ranch on the 5th. It may be noted that Greenland Ranch is a new station, located in Death Valley, and that the temperatures recorded at this point will probably be as high if not higher than at any other point in the United States. Heretofore reports have been available from stations in the Mojave Desert and in the Colorado Desert, but not available from Death Valley. The highest temperature reported at any station in Califfornia last June was 113° at Palm Springs on the 11th. The highest temperature at Palm Springs this year was 113° on the 2d. The lowest temperature was 20° at Tamarack on the 1st. The lowest temperature during June, 1911, was 18° at Tamarack on the 23d. This was almost the same as in June, 1910.

The highest mean temperature was 92° at Bagdad. The next highest was 90.2° at Greenland Ranch. The former station has an elevation 784 feet above sea level, while the latter is 178 below sea level. The lowest mean temperature was 44.4° at Tamarack. The lowest monthly mean in June, 1911, was 41.6° at Tamarack.

PRECIPITATION.

The average precipitation for California for June with departures from the normal is as follows:

Year.	Mean.	Departure.	Year.	Mean.	Departure.
	Inches.	*Inches.*		*Inches.*	*Inches.*
1897	0.46	+0.15	1905	0.07	− 0.24
1898	.25	− .06	1906	1.05	+ .74
1899	.57	+ .26	1907	1.02	+ .71
1900	.19	− .12	1908	.17	− .14
1901	.01	− .30	1909	.19	− .12
1902	.10	− .20	1910	.05	− .26
1903	.07	− .24	1911	.15	− .16
1904	.04	− .27	1912	.49	+ .18

The greatest monthly precipitation was 2.80 inches at Edgewood, or 1.50 inches more than the heaviest monthly amount reported during June, 1911. At 63 stations there was no rain during the month.

SNOWFALL IN THE MOUNTAINS.

The snowfall was light during June. Only patches of snow remained on ground at high levels after the 7th and the snow cover may be said to have disappeared at the end of the first week. On the 23d there was a fall of about 1 inch, but this disappeared within 24 hours.

SUNSHINE.

The following table gives the total hours of sunshine and percentages of the possible:

Stations.	Hours.	Percentage of possible.	Stations.	Hours.	Percentage of possible.
Eureka	164	36	Sacramento	329	74
Fresno	403	92	San Diego	245	57
Los Angeles	291	68	San Francisco	301	68
Mount Tamalpais	273	62	San Jose	351	80
Red Bluff	328	73	San Luis Obispo	299	69

There was less sunshine during the current June than during June last year and much less than during June, 1910.

NOTES ON THE RIVERS OF THE SACRAMENTO AND LOWER SAN JOAQUIN WATERSHEDS DURING JUNE, 1912.

By N. R. Taylor, Local Forecaster.

Sacramento watershed.—The average stages of all streams in this watershed were much below those usually maintained during the month of June. In no case, however, were the rivers as low as during the corresponding month in 1910.

The upper Sacramento River remained practically stationary, but from Colusa to Walnut Grove the river fell steadily during the entire month, the ranges between the stages of the first and last dates being 7.1, 8.2, and 7.8 feet, respectively, at Colusa, Knights Landing, and Sacramento City.

Some rain fell during the month in the drainage basins of all streams, but with the exception of the American River at Folsom, which rose slightly over 2 feet during the 24 hours ending at 7 a. m. of the 13th, the rainfall had little effect on stream flow.

Lower San Joaquin watershed.—The rivers of this watershed averaged from 1 foot to over 3 feet below the normal for the month. There was a notable absence of the usual June freshets.

Melting snow slightly increased the run-off of the tributaries of the San Joaquin during the first few days of the month and resulted in a noticeable swell in this river during the latter part of the first decade, otherwise the effect of snow water was not apparent. By the middle of the month a general fall was in progress throughout the lower San Joaquin drainage basin.

Conditions now indicate that the extreme low-water stages will be reached much earlier than usual in this watershed.

NOTES ON THE STREAMS OF THE UPPER SAN JOAQUIN WATERSHED.

By W. E. Bonnett, Local Forecaster.

A somewhat better stage of water was maintained in the streams of the upper San Joaquin watershed during June than the low stages of May indicated as being probable. Of the six years' record, the stages for May, 1912, were the lowest with the one exception of May, 1908, while the June stages this year are higher than those of 1908 and 1910 also. However, the excess over the mean stages of 1910 is not considerable.

The mean of the daily gage readings at Merced Falls for June was 1.7 feet as compared with a six-year average of 2.1 feet, the daily stages ranging from 3.1 feet on the 3d and 4th to 0.7 foot on the 30th. At Friant on the San Joaquin the mean daily stage was 2.6 feet as compared with a six-year average of 4 feet. The extreme stages of 5 feet and 0.7 foot occurred on the same dates as at Merced Falls. At Firebaugh the mean monthly stage was 5.9 feet as compared with an average of 8 feet, 2.4 feet in 1908 and 4.8 feet in 1910. In the Kings River at Piedra the daily stages ranged from 12.2 feet on the 3d and 4th to 6.3 feet on the last day of the month, with a mean stage of 9.1 feet.

WEATHER AT POINT REYES LIGHT, CAL., DURING JUNE, 1912.

By James Jones, Observer.

The meteorological feature of the month was the record-breaking rain storm of June 23 and 24. A total of 1.49 inches fell during this storm, and 1.27 inches fell within a 24-hour period. Not only is this the heaviest 24-hour rainfall ever recorded here in June, but it is also the heaviest in any month since February, 1909.

PRESERVING MAMME CAPRIFIGS FROM FROST.

By G. P. Rixford.

The following article is an extract from an exhaustive paper on Recent investigations in fig culture and caprification, read by Mr. Rixford at the Fruit Growers' Convention, held at Santa Barbara, Cal., May, 1912. Only that portion relating to frost is given.

Dependence on the Blastophaga.—Everybody knows that the Smyrna fig industry is absolutely dependent on the blastophaga which carries the pollen grains from the stamens of the profichi caprifig to the pistillate flowers of the Smyrna fig. The preservation of the insect through the winter is therefore of paramount importance.

The severe frosts of the past winter proved very disastrous to the mamme crop, as well as to thousands of young trees throughout almost the whole of California and Arizona. First, abnormally low temperatures in November, prematurely defoliated the trees and left the figs exposed unusually early; then scanty rainfall during the fall and early winter reduced the vitality of the trees and was a further contributory cause of injury. In the San Joaquin Valley the usual tule fog, which is a great protector against frost, was lacking. Most of the injury was done by the drop in December to 17° at Yuma, Mecca, Indio, Riverside, San Bernardino, Fresno, and so on north to Yuba City and Chico. In normal seasons young fig trees and the mamme crop will endure a temperature of 17°, and probably lower, without injury. These conditions may not happen again in a generation, and yet bearing trees of 6 and 7 years of age suffered no loss of wood, the damage being confined to the winter crop of caprifigs.

The best Capri trees.—There are now established in California, thanks chiefly to the United States Department of Agriculture, probably more capri varieties than are to be found in any other country in the world. We have most of the best from the Smyrna district of Asia Minor, many from Italy, Greece, the islands of the Mediterranean, and especially from the States of northern Africa, besides a host of seedlings of local origin.

Probably every Smyrna fig grower has observed the difference that exists in the ability of different varieties to carry through the winter crop. Many kinds never produce a mamme crop, though they generally yield the profichi in great abundance. Still others produce so few that they are of little use in perpetuating the blastophaga. Quite a number fail to bear a mammoni or late summer crop, or the figs come at a time that leaves a hiatus in the successive generations. Such trees can not produce a mamme crop unless they have the assistance of better trees, for it is well known that the mamme figs dry up and fall unless oviposited in by wasps of the mammoni generation. It is a curious fact that the egg of the blastophaga is just as essential to the caprifig as is the pollen grain to the Smyrna fig.

Careful investigations extending over a period of several years seem to indicate that the ability of a tree to successfully support the mamme crop through the winter is more a question of variety than of climate. Several instances are known where, in frosty portions of the San Joaquin Valley, single trees, unassisted by others in the neighborhood, have carried the different crops uninterruptedly for more than 40 years. The possession of such trees by the grower is of supreme importance.

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Preserving Mamme caprifigs.—After recommending a list of capri trees that when well established can be depended upon to carry the mamme figs through the severest winters yet experienced in California, it may seem superflous to describe a process by which these winter figs can be stored, safe from not only California frosts, but from those of regions where the temperature goes so low as to render it impossible to carry the insect from year to year and consequently to grow Smyrna figs.

Of the three crops of the capri tree, the mamme is vastly the most important, as both the others depend for existence on the insects which live through the winter in this crop. We may, therefore, truthfully say that the whole Smyrna fig industry is actually dependent on the mamme, for failure of this crop means ruin to the others.

The severe frosts of the past winter emphasized the fact that every precaution must be taken to save the mamme crop. A good deal of experimenting has been done with this end in view. George C. Roeding has diminished the loss somewhat by building light shelters of palm leaves or other light material over the trees, mounted on a framework supported on four posts. Experience has shown that it is not best to rely on the roof alone, for much better results are had when the sheltering cover extends down to within three or four feet of the ground on the sides exposed to the morning sun, so as to protect the figs, in case of frost, from too sudden thawing. This method, however, has been only partly effective. Another plan, tried by the writer, which has been fairly successful, is to cut from the tree in December, before the severe frosts, twigs bearing well-developed mamme and plant them in moist soil in the open air, leaving the figs above the surface. The branches should be planted where they would have some protection by trees or buildings from the severest frosts. In this way the caprifigs have been carried through the cool weather, and the insects issued in large numbers at the usual time in spring.

But another step has been taken in this direction by Henry Markarian, of Fresno, that deserves to rank as an important discovery. On the 5th of April last, at his place near Fresno, he handed the writer a dozen mamme figs which had been taken from the tree about the middle of December. These figs were carried to San Francisco in a paper bag and, on the 8th of April, were put into a fruit jar in order to prevent drying out. On the 13th, female blastophaga commenced to issue, and continued to do so every morning, in a sunny window, for more than two weeks. On the 20th they came out in a great rush from 9 a. m. until 10.30. The issue gradually decreased until the 29th, when the largest of the figs was cut open and was found to still contain some females that would have come out later. This fig, the best developed one of the lot, yielded by actual count over 600 females and about 150 males. This certainly is a remarkable demonstration of the efficacy of the plan.

Mr. Markarian's method is simplicity itself. The best developed and most perfect figs are taken from the tree in December before the advent of heavy frosts. They are then packed in a box of clean damp sand. First an inch of sand then a layer of figs, being particular not to let them touch each other or the side of the box, then another inch of sand, pressed down so as to completely envelop the figs, and so in alternate layers of sand and figs until the box is full. Top off with a final layer of sand and cover to prevent evaporation. The box, containing a thousand figs, was kept in a cellar where the temperature was about 55° to 60°. A few which had been frosted during the November freeze had molded, but all sound ones kept perfectly. In due season the figs were hung in his capri trees, and mature blastophaga came out as usual and entered the profichi crop. A surplus of figs was disposed of to neighbors and gave satisfaction.

By this plan the Smyrna fig growers can bid defiance to frost, and the mamme crop can be carried through winters in regions where the cold is too severe to render the growing of Smyrna figs otherwise practicable. In this way all trouble from loss of the winter crop in California and Arizona is obviated and may be the means of making it possible to grow the Smyrna fig all along the Gulf region of the Southern States from Florida to Texas. Another advantage of this plan is that the time of issue of the blastophaga can be regulated by changing the temperature of the storage room. If early insects are wanted, raise the temperature; if a later issue is desired, put the box in a little cooler place.

HEATING THE ATMOSPHERE.

By ALEXANDER G. McADIE.

Sitting by an open fire, watching the coals burn, the thought may come that we are, indeed, burning ancient starshine. For the sun is of course a star, and, fortunately for our personal comfort, the only one near enough to present a face for study. The next nearest sun is 300,000 times as far away, or, in astronomical units, four light years distant. Therefore, we need not concern ourselves much about the amount of stellar energy other than solar intercepted by the earth and stored as fuel.

Now, the solar radiation does not fall directly upon the earth's surface, which, as will appear later, is also most fortunate for us; but falls upon a thin gaseous envelope and passes through this to the earth. Some of the solar energy is absorbed by the atmosphere, and for different rays the atmosphere has different coefficients of absorption. Some of the energy is reflected back into space. In fact, the albedo or proportion of reflection may be as much as 33 per cent. And, finally, some of the energy, especially some of the short waves, may undergo transformation in the higher levels, possibly through ionization. The chief absorbing medium in the lower air is water vapor, particularly effective with the long waves.

Abbot, Fowle, and Aldrich, in various reports of the work carried on at the astrophysical observatory, have fixed the average value of the solar constant of radiation at 1.925 calories per square centimeter per minute for the epoch 1905–1909. Higher values are to be expected during the sun spot minimum. For a sun spot cycle, 11.1 years, the average value may be taken as 1.95 calories.

In 1909 Abbot, using a spectrobolometer on the summit of Mount Whitney (14,502 feet), determined the energy distribution in the solar spectrum outside the atmosphere lying between wave lengths 0.29μ in the ultra-violet and 3.0μ in the infra-red.

The average temperature of the earth is 287° A. (absolute) and that of the upper atmosphere approximately 220° A. The apparent temperature of the sun, computed by various methods, ranges from 5,840° A. to 6,430° A.

If there were no atmosphere, the earth would receive heat during the day at a rapid rate and lose it rapidly during the night. Life in its present form would not be possible. But the atmosphere, and, as we shall see further on, the water vapor in particular, maintain conditions as we now know them.

In discussing the effect of the isothermal layer upon the temperature of the earth and lower atmosphere, Humphreys [1] shows that if this outer atmospheric shell lets in

[1] Bulletin Mount Weather Observatory, vol. 2, pt. 5, p. 288.

heat more rapidly than it lets it out, the inclosed object—the earth—will become warmer. Assuming that the earth radiates as a black body, the sum of the incident and reflected energy passing through the outer layer is approximately 4/3 of that originally incident, and the radiant energy received by the earth will be about 11 per cent greater than if there were no absorptive layer. The surface of the earth is therefore some 7° C. warmer than it would be without this absorbing layer. But this is a general statement, limited to the action of the isothermal layer alone. In fact, owing to the alternation of day and night, and changes due to the earth's motion in its orbit, the changing angle of incidence of the solar rays, and, above all, the varying distribution of water vapor over the earth, it is a difficult matter to estimate accurately the incoming and outgoing energy.

In the atmosphere itself the heat is not uniformly distributed for, as clouds form, the latent heat of condensation may cause peculiar temperature inversions; and, conversely, as the clouds become invisible, the latent heat of vaporization may also cause an inversion of temperature. Furthermore, there are various convectional gains and losses. The diurnal vertical convection is confined chiefly to the layers below 5,000 meters; but there are certain cyclonic circulations in which the convection extends to higher levels.

If the so-called solar constant were constant, the earth would receive in a year something over one million million million million calories of heat. In popular terms, this is sufficient heat to melt a layer of ice 33 meters (100 feet) thick over the entire earth's surface annually, or to evaporate 1.66 x 10^{13} kilograms of water. This, then, is what the surface of the earth would receive if there were no atmosphere, and absorbs if there were no reflection.

On the other hand, the surface receives heat from the interior, and a rough estimate of the amount may be obtained by multiplying the temperature gradient in the soil—1° C. for 35 meters—by the average thermal conductivity, which is .006 gram calories per square centimeter per second. According to Abbe and von Herrmann, the amount in a year is 54 calories per square centimeter, or sufficient to melt a layer of ice 7 millimeters thick (0.28 inch). From above and below, then, the atmosphere receives heat.

But the so-called solar constant is not constant, and solar physicists have of late noted changes. Abbot,[1] speaking of variations in his computed values of the solar constant of about 10 per cent states that a change of the intensity of solar radiation of 3½ per cent, due to the decrease in solar distance, occurs from August to October, and this is readily discernible in the work done on Mount Wilson; so that there can be little question that the changes noted there are really solar changes and not of atmospheric or accidental origin.

Kimball states:[2] "There is evidence that the so-called solar constant is a variable quantity. There is stronger evidence that the atmospheric transmissibility undergoes marked changes that are nearly synchronous over considerable portions of at least a hemisphere, and that diminished transmissibility is accompanied by a diminution in temperatures and in temperature amplitudes. Marked diminutions in atmospheric transmissibility occurred in 1884–1886 and 1903–4 that were undoubtedly connected with violent volcanic eruptions. Less marked diminutions occurred in 1891 and 1907 that have not yet been connected with phenomena of this nature."

[1] Annals of the Astrophysical Observatory, p. 235.
[2] Bulletin of Mount Weather Observatory, vol. 3, pt. 2, p. 117, Oct. 19, 1910.

The question then arises: If on the one hand the solar output varies and on the other the transmissibility of the atmosphere also varies according to its dust and vapor content, how are we to differentiate the effects if we make use only of surface temperatures? Accurate measurements of both should be made at widely separated stations. Abbott, from a comparison of temperatures at many points concludes that certain abnormal temperature departures at continental stations are recognizable as due to change of solar radiation. At insular stations, however, the temperature departures are less marked.

Temperature abnormalities as shown in annual departures may throw some light upon variations in solar output. For this purpose long series of standardized observations are of unusual value, but one must be on guard for variations caused instrumentally.

Meteorologists are now paying special attention to the so-called permanent pressure areas or centers of action. Possibly future study of variations in location and intensity of these centers may lead to the detection of a relation with solar conditions. But at the present time the outlook is not promising. It may be said that there are at least five well-marked ocean highs in the belts of high pressure and two great lows. The intensities, durations, and surface temperatures of the great ocean currents are bound up with the position and strength of these centers.

We return, then, to our open fire and as we watch the coals burn, we realize that the processes through which the solar energy became converted into fuel and all the intermediate steps connected with the heating of the atmosphere are yet largely unknown and imperfectly understood. Assuming that a pound of the imprisoned starshine, or lump of fuel, has approximately 14,500 British thermal units, then the equivalent energy would be about eleven million foot-pounds or a million and more calories. But, as we saw at the beginning, this is practically the amount of solar energy which each square centimeter of the earth would intercept each year, provided the receiving surface were perpendicular to the sunbeam and that there were no atmosphere.

CONVENIENT CONVERSION TABLE FOR FROST WORK.

By A. G. McADIE.

Orchard heaters, evaporators, and frost protectors of various forms have come into such widespread use that a convenient table for the quick conversion of heat units into power units, and vice versa, seems to be much needed.

It may be pointed out that the British thermal unit is the quantity of heat required to raise the temperature of 1 pound of pure water at maximum density, 39.1° F., 1° F. This is the unit most frequently used by engineers in this country and Great Britain, although it is desirable that the old English units and the Fahrenheit scale be used as little as possible. A British thermal unit is equal to 0.252 calorie and also equal to 777.5 foot-pounds. One therm will raise the temperature of 1 gram of water 1° C.; 1,000 therms equal 1 calorie, equal to 3.968 British thermal units.

In problems connected with the heat of water, it should be remembered that the total heat is the latent heat plus the sensible heat. The total heat required to evaporate water at a given temperature is 1,059.7 + 0.428 T, where T is given temperature. This holds for temperatures between 32° F. and 212° F.

In changing to steam at 212° F. a pound of water at 212° F. absorbs 970.4 British thermal units and the total heat is therefore 1,150.4 British thermal units. This is starting from a temperature of 32° F. A pound of ice at 32° requires 142.4 British thermal units to change into water at 32° F.

The latent heat of aqueous vapor may be found from the following formula:

$$L_d = 1{,}091.7 - 0.572\ t_d$$

Where L_d = latent heat

t_d = temperature of water.

For convenience in frost work the following may be used:

1 kilowatt hour=3,412.66 B. t. u.
1 H. P.=746.3 watts.
1 H. P. hour=2,544.6 B. t. u.
1 B. t. u.=777.5 foot-pounds.
1 B. t. u.=0.252 calories.
1 calorie=1,000 therms.
1 calorie=3.968 B. t. u.
1 calorie per kilogram=1.8 B. t. u. per pound.
1 pound of air at 32° F. occupies about 12.4 cubic feet.
1 pound of water at 212° F. occupies 0.0161 cubic feet.
1 pound of steam at 212° F.occupies 26.14 cubic feet.
1 pound of water at 212° F. contains 181.8 B. t. u.
1 pound of steam at 212° F. contains 1,150.4 B. t. u.
1 pound of ice requires 143.8 B. t. u. to change to water.
1 cubic foot of water at 212° F. weighs 59.84 pounds.
1 cubic foot of water at 62° F. weighs 62.2786 pounds.
1 cubic foot of steam at 212° F. weighs 0.03826 pound.
1 cubic foot of dry air at 32° F. weighs 568 grains.
1 cubic meter of dry air at 0° C. weighs 1,293.05 grams.
Specific heat of water, 1.000.
Specific heat of ice, 0.489.
Specific heat of water vapor, 0.453 at atmospheric temperatures.
Specific heat of air, 0.241.

Values given above are laboratory values, obtained by using distilled water. Ordinary drinking water is heavier than distilled water, because of matter in solution. Salt water is also heavier. It may also be remarked that the temperature of the freezing point in ordinary use, i. e., 32° F., or 0° C., may not hold for the freezing of water in plant life. W. N. Shaw instances one plant where the freezing point is apparently 21° F. In other words, the change of water from the liquid to the solid state under natural conditions is somewhat different from the change as studied in a laboratory.

NOTE.—Some of the values given above differ slightly from those found in textbooks, but it is believed they are the most recent.

TABLE 1.—*Climatological data for June, 1912. District No. 11, California.*

Stations.	Counties.	Elevation, feet.	Length of record, years.	Temperature, in degrees Fahrenheit. Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Precipitation, in inches. Total.	Departure from the normal.	Greatest in 24 hours.	Total snowfall, unmelted.	Number of rainy days, 0.01 inch or more.	Sky. Number of clear days.	Number of partly cloudy days.	Number of cloudy days.	Prevailing wind direction.	Observers.
Oregon.																				
Klamath Agency	Klamath	4,169	3	54.0	...	85	18	29	15†	49	3.75	...	1.25	0	5	14	9	7	w.	N. D. Ginsbach.
Klamath Falls	....do	4,100	22	59.0	− 0.1	89	5	32	15	39	2.80	+ 2.02	0.91	0	8	12	6	12	nw.	Leland Moser.
Lakeview	Lake	4,825	28																	Bert Rice.
Merrill	Klamath	4,070	5	57.6	...	91	4	30	15	43	3.12	...	0.90	0	7	21	1	7	...	Mrs. Agnes Ritchson.
Yonna	....do	4,146	4	56.0	...	90	4	28	15	48	1.61	...	0.57	0	10	12	15	3	nw.	Jacob Rueck.
California.																				
Alameda	Alameda	19	2																	Chas. E. Sears.
Alturas	Modoc	4,460	8	59.2	...	93	4	29	22	53	0.90	...	0.44	0	6	15	12	3	nw.	Prof. C. B. Towle.
Angiola	Tulare	208	12	75.2	+ 2.8	108	2	45	1†	59	T.	0.00	T.	0	0	29	0	1	nw.	Santa Fe Co.
Antioch **	Contra Costa	46	33	76.6	+ 4.6	100	2	51	1	...	0.66	+ 0.55	0.66	0	1	26	0	4	...	Southern Pacific Co.
Aptos **	Santa Cruz	102	27	64.0	+ 1.5	78	2†	54	22	...	0.30	+ 0.20	0.30	0	1	20	3	7	nw.	Do.
Arrowhead Springs	San Bernardino	2,000	3																	Dr. E. A. Crokat.
Auburn	Placer	1,360	41																	Southern Pacific Co.
Avalon	Los Angeles	30	2	61.7	...	72	19	52	24†	18	0.00	...	0.00	0	0	29	1	0	w.	T. S. Manning.
Azusa	....do	540	10																	A. P. Griffith.
Bagdad	San Bernardino	784	9	92.0	...	113	5	66	23	32	0.00	...	0.00	0	0				...	Santa Fe Co.
Bakersfield	Kern	404	23	76.7	− 2.7	103	10	55	24	33	0.00	− 0.03	0.00	0	0	30	0	0	...	Do.
Barstow	San Bernardino	2,105	9	76.0	...	110	4	40	17†	51	0.00	0.00	0.00	0	0	30	0	0	w.	E. L. White.
Berkeley	Alameda	317	25	62.7	+ 1.8	90	2	50	21	32	0.85	+ 0.65	0.61	0	4	13	8	9	sw.	State University.
Biggs **	Butte	98	13	76.6	+ 3.1	106	4	57	21†	...	0.00	− 0.50	0.00	0	0	24	0	6	s.	Southern Pacific Co.
Bishop	Inyo	4,450	17																	Paul E. Lodge.
Bishop Creek	....do	8,500	2	53.6	...	76	2†	24	23	35	0.60	...	0.60	6.0	1					Do.
Blocksburg	Humboldt	1,700	6	62.0	...	104	6	38	15	49	1.17	...	0.56	0	4	10	7	13	s.	Victor Hope.
Blue Canon	Placer	4,695	13	55.2	− 5.2	82	5	30	21	39	1.87	+ 0.56	1.10	0	2	24	0	6	...	Southern Pacific Co.
Blythe	Riverside	268	3	81.8	...	114	6	52	1	56	0.57	...	0.57	0	1	21	3	6	s.	D. H. Carey.
Branscomb	Mendocino	2,000	12	58.8	...	94	3	37	9	41	1.41	+ 0.02	0.64	0	4	18	7	5	n.	A. J. Haun.
Brawley	Imperial	− 105	3	84.1	...	111	4†	59	21	42	0.25	...	...	0	2					M. D. Witter.
Burney	Shasta	3,300	2	58.2	...	98	11	31	16	50	1.64	...	0.86	0	3	9	11	10	sw.	Mrs. M. D. Chambers.
Cahuilla	Riverside	3,600	1																	Carl Stevens.
Calexico	Imperial	0	7	85.7	...	112	4†	62	22†	42	0.27	...	0.22	0	2	27	0	3	nw.	J. E. Peck.
Caliente **	Kern	1,290	36	80.2	+ 1.3	105	4	60	24	...	0.00	− 0.13	0.00	0	0	23	0	7	...	Southern Pacific Co.
Calistoga	Napa	363	40	60.3	− 9.3	100	1	50	10†	...	1.17	+ 0.81	1.14	0	2	14	0	16	w.	Do.
Campbell	Santa Clara	217	15	64.0	+ 1.9	98	2†	40	22	49	0.33	+ 0.23	0.15	0	3	22	1	7	nw.	F. M. Righter.
Camptonville (near)	Yuba	3,500	5	67.6	...	104	4	40	21†	42	1.35	...	0.80	0	3	20	4	6	s.	Cal. Gas & Elect. Co.
Cedarville	Modoc	4,675	18	60.6	+ 0.2	90	19	34	21	39	0.76	+ 0.08	0.30	0	6	11	19	0	sw.	T. H. Johnstone.
Chico	Butte	189	42	72.7	− 4.4	111	4	48	24	49	0.12	− 0.29	0.12	0	1	20	1	9	n.	G. H. Stephenson.
China Flat	Humboldt	600	3	67.6c	...	101	4†	43	15	50	1.27	...	0.37	0	7	13	8	9	w.	O. I. Westerburg.
Chino **	San Bernardino	714	20	72.5	+ 0.3	98	19†	56	15†	...	0.00	− 0.03	0.00	0	0	21	9	0	...	Southern Pacific Co.
Cisco **	Placer	5,939	41																	Do.
Claremont	Los Angeles	1,200	20	68.2	+ 1.0	98	18	46	23†	47	0.03	− 0.11	0.03	0	1	17	10	3	...	Prof. F. P. Brackett.
Cloverdale	Sonoma	340	10	65.4	− 3.0	102	2	44	10	44	1.27	+ 1.00	0.45	0	4	25	0	5	s.	John O. Ogle.
Coalinga	Fresno			76.5	...	109	4	38	21	44	0.00	...	0.00	0	0	27	1	2	w.	Union Oil Co.
Colfax	Placer	2,421	41	64.0	− 7.2	95	4†	40	21	40	1.01	+ 0.31	0.71	0	2	20	1	9	n.	Southern Pacific Co.
Colusa	Colusa	60	9	71.7	...	102	3†	53	8†	37	0.17	+ 0.17	0.17	0	1	20	8	2	...	C. D. McComish.
Corning **	Tehama	277	26	80.4	+ 3.1	106	4	58	21	...	0.21	+ 0.05	0.21	0	1	15	11	4	s.	Southern Pacific Co.
Cuyamaca	San Diego	4,677	13	63.2	+ 2.8	84	2†	39	22	28	0.42	+ 0.17	0.27	0	2	21	6	3	e.	L. L. Macquarie.
Davisville	Yolo	51	40	69.6	− 5.2	106	3†	43	21	51	0.74	+ 0.59	0.60	0	3	20	9	1	sw.	S. H. Brackett
Deer Creek	Nevada	3,700	5	58.0	...	9	4	34	21†	42	1.45	...	0.90	0	4	21	1	8	w.	Cal. Gas & Elect. Co.
Del Monte	Monterey	25	1	63.6	...	79	3	52	19	24	0.11	...	0.11	0	1	21	3	6	n.	H. R. Warner.
Delta	Shasta	1,138	27	72.6	+ 1.1	96	16	52	12	37	0.14	− 1.20	0.10	0	2	22	4	4	s.	Southern Pacific Co.
Denair	Stanislaus	126	12	67.5	− 4.1	104	4	37	21	52	0.29	+ 0.20	0.29	0	1	27	0	3	...	Santa Fe Co.
De Sabla	Butte	2,500	8	64.2	...	96	3†	40	21†	39	0.65	...	0.65	0	1	14	12	4	sw.	Cal. Gas & Elect. Co.
Dobbins (near)	Yuba	1,650	8	70.2	...	104	4	48	22	38	0.63	...	0.42	0	2	20	8	2	s.	Do.
Downieville	Sierra	3,150	1	61.4	...	96	3†	36	22	48	1.40	...	0.64	0	3	17	9	4	s.	J. T. Mason.
Dudley	Kings	595		77.9	...	109	2†	50	22†	44	0.00	...	0.00	0	0	27	0	3	nw.	Union Oil Co.
Dudleys	Mariposa	3,000	3	56.0	...	90	2†	32	23	42	0.20	...	0.20	0	1	23	4	3	nw.	W. H. Dudley.
Dunlap (near)	Fresno	2,800		64.4	...	98	2†	41	20	42	0.00	...	0.00	0	0	23	3	4	...	U. S. Forest Service.
Dunnigan**	Yolo	65	35	80.3	+ 2.4	105	4	59	24	...	0.13	− 0.07	0.10	0	2	25	0	5	n.	Southern Pacific Co.
Dunsmuir **	Siskiyou	2,285	23	63.0	− 1.7	100	5	42	21	...	1.48	+ 0.54	0.43	0	8	21	0	9	n.	Do.
Durham	Butte	160	17	72.7	+ 0.1	102	4	49	8	42	0.20	− 0.09	0.15	0	2	18	5	7	s.	R. W. Durham.
El Cajon	San Diego	482	13	67.6	+ 0.4	91	2†	46	24	37	0.70	+ 0.59	0.70	0	1	29	1	0	sw.	H. H. Kessler.
Electra	Amador	725	8	71.8	...	100	3†	50	15†	44	0.68	...	0.63	0	2	24	3	3	...	Cal. Gas & Elect. Co.
Elsinore	Riverside	1,234	17	70.6	− 0.6	104	2	42	24	53	0.00	− 0.04	0.00	0	0	25	5	0	w.	A. F. Schult.
Emigrant Gap	Placer	5,230	38																	Southern Pacific Co.
Escondido	San Diego	657	18	68.6	+ 0.4	91	4†	44	24†	44	0.08	− 0.02	0.08	0	1	12	18	0	w.	A. R. Moon.
Eureka	Humboldt	64	26	54.8	+ 0.2	65	11	46	16	16	1.29	+ 0.11	0.53	0	7	8	10	12	n.	U. S. Weather Bureau.
Farmington **	San Joaquin	111	33	80.6	+ 6.9	103	3	60	23†	...	0.39	+ 0.25	0.32	0	2	23	3	4	nw.	Southern Pacific Co.
Folsom	Sacramento	252	40	71.2	− 2.9	104	3	48	15	41	0.55	+ 0.32	0.30	0	2	24	2	4	s.	F. O. Hutton.
Fordyce Dam	Nevada	6,500	17	57.0	...	85	3	38	23	38	1.97	+ 0.20	0.82	3.0	6	10	16	4	sw.	E. E. Roening.
Fort Bidwell	Modoc	4,735	23	58.0	− 6.2	92	5	25	15†	49	0.80	− 0.23	0.50	0	3	13	11	6	...	E. O. Franklin.
Fouts Springs	Colusa	1,650	8	65.4	...	96	5	37	21†	44	1.10	...	0.68	0	4					A. J. Burgi.
Fresno	Fresno	293	25	75.2	− 0.6	107	3	51	23	38	T.	− 0.10	T.	0	0	23	4	3	nw.	U. S. Weather Bureau.
Galt**	Sacramento	49	34	73.4	− 1.2	100	3	50	22	...	1.28	+ 1.14	0.68	0	4	22	2	6	nw.	Southern Pacific Co.
Georgetown	El Dorado	2,650	39	65.6c	− 5.3	94	3†	41	21	35	0.93	+ 0.15	0.71	0	2	22	0	8	sw.	H. D. Jerrett.
Gilroy **	Santa Clara	193	38	72.3	+ 5.3	105	2†	55	22	...	0.03	− 0.05	0.03	0	1	28	0	2	n.	Southern Pacific Co.
Gilta	Siskiyou	3,300	2	61.9	...	96	4	37	14†	42	2.00	...	0.66	0	8	13	2	15	s.	A. Dannenbrink.
Glennville	Kern	3,300	2	65.4	...	94	2†	38	23	37	T.	...	T.	0	0	23	7	0	w.	C. H. Likely.
Gold Run	Placer	3,222	13	65.7	− 2.8	95	5	40	23	39	1.15	+ 0.46	0.65	0	3	20	5	5	...	Southern Pacific Co.
Gonzales **	Monterey	127	13	74.5	+14.4	96	1	58	4†	...	0.00	− 0.01	0.00	0	0	30	0	0	...	Do.
Grass Valley	Nevada	2,690	40	62.6	...	94	4	38	23	32	0.75	− 0.01	0.52	0	2	20	8	2	sw.	F. R. Hull.
Greenland Ranch	Inyo	− 178	1	90.2	...	120	5	57	9	49	0.00	...	0.00	0	0	30	0	0	s.	J. W. Corkhill.
Greenville	Plumas	3,600	18	58.6	− 0.9	94	3	34	17†	50	0.67	− 0.12	0.37	0	3	17	8	5	sw.	C. H. Higbie.
Groveland	Tuolumne	2,828	3																	H. S. Richardson.
Guinda **	Yolo	350	14																	Southern Pacific Co.
Hanford	Kings	249	12	72.2	− 3.2	101	3	51	24	40	0.00	− 0.07	0.00	0	0	16	14	0	...	Santa Fe Co.
Healdsburg	Sonoma	110	19	68.0	+ 2.1	116	3	45	10	58	1.73	+ 1.38	1.05	0	3	19	0	11	s.	F. J. Kinley
Hearst	....do	1,800	2	64.5	...	93	6	43	1	43	0.54	...	0.22	0	7	20	8	2	nw.	H. D. Ellmaker.
Heber	Imperial	− 20	6	84.2	...	114	5	57	22	46	0.15	...	0.15	0	1	26	2	2	se.	C. J. Booth.
Hetch Hetchy	Tuolumne	3,665	2																	E. W. Brown.
Hollister	San Benito	284	38	64.4	− 1.5	97	3	42	30	46	T.	− 0.13	T.	0	0	23	4	3	w.	J. N. Thompson.
Hornbrook **	Siskiyou	2,154	24	53.7	−12.8	93	5	32	22	...	1.50	+ 0.94	0.50	0	5	18	8	4	...	Southern Pacific Co.
Hot Springs	Tulare	3,300	5	67.6	...	96	3	40	23	37	0.02	...	0.02	0	1	23	4	3	...	U. S. Forest Service.
Hullville	Lake	2,250	5	62.5	...	93	4	36	21	41	0.41	...	0.24	0	5	2	20	8	nw.	T. H. Betterton.
Idyllwild	Riverside	5,250	11																	Earl Powers.
Independence	Inyo	3,907	16	70.7	− 2.7	97	3†	32	23	39	0.00	− 0.04	0.00	0	0	26	3	1	n.	U. S. Weather Bureau.

TABLE 1.—*Climatological data for June, 1912. District No. 11*—Continued.

Stations.	Counties.	Elevation, feet.	Length of record, years.	Temperature, in degrees Fahrenheit. Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Precipitation, in inches. Total.	Departure from the normal.	Greatest in 24 hours.	Total snowfall, unmelted.	Number of rainy days, 0.01 inch or more.	Sky. Number of clear days.	Number of partly cloudy days.	Number of cloudy days.	Prevailing wind direction.	Observers.
California—Continued.																				
Indio	Riverside	− 20	34	87.6	− 0.7	114	4†	61	23	41	0.02	+ 0.02	0.02	0	1	26	4	0	nw.	F. N. Johnson.
Inskip	Butte	4,975	5	62.2	...	92	3†	36	21†	30	1.23	...	0.63	0	4	15	7	8	...	Cal. Gas & Elect. Co.
Ione**	Amador	287	34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Southern Pacific Co.
Jamestown	Tuolumne	1,471	9	69.1	...	98	1†	45	8	43	T.	...	T.	0	0	25	0	5	...	Sierra Railway Co.
Kennett	Shasta	730	...	73.4	...	107	3†	49	24	43	1.43	...	0.84	0	5	18	11	1	ne.	O. J. Egleston.
Kentfield	Marin	65	24	64.1	...	104	2	43	30	50	2.10	+ 1.63	...	...	3	...	...	...	...	Miss M. E. Parsons.
King City	Monterey	333	25	76.2	+12.6	112	3	54	21	54	0.00	− 0.02	0.00	0	0	30	0	0	s.	Southern Pacific Co.
Lake Eleanor	Tuolumne	4,700	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	O. J. Todd.
La Porte	Plumas	5,000	18	55.1	− 1.1	86	4	33	23	37	1.57	− 0.03	0.95	0	6	11	15	4	s.	Chas. W. Hendel.
Le Grand	Merced	255	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Santa Fe Co.
Lemon Cove	Tulare	600	17	71.8	− 4.2	110	3	45	1	60	0.00	− 0.09	0.00	0	0	27	3	0	w.	G. W. Sandidge.
Lick Observatory	Santa Clara	4,209	23	59.2	− 0.8	84	3	35	21	22	0.44	− 0.04	0.14	0	6	19	4	7	n.	The Director.
Livermore	Alameda	485	41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	E. G. Still.
Lodi	San Joaquin	45	30	71.3	+ 2.2	102	2†	50	21	43	0.35	+ 0.14	0.18	0	2	23	2	5	w.	Ezra Fiske.
Lone Pine	Inyo	2,728	7	70.1	...	98	3	35	23	50	0.00	...	0.00	0	0	28	2	0	s.	G. F. Marsh.
Long Valley	Lassen	4,400	3	63.0	...	92	19	35	16	46	0.53	...	0.22	0	6	10	6	14	sw.	A. G. Evans.
Los Angeles	Los Angeles	293	35	65.4	+ 0.9	83	18	52	24	26	0.00	− 0.10	0.00	0	0	10	17	3	sw.	U. S. Weather Bureau.
Los Banos**	Merced	121	25	74.4	− 1.0	102	2†	60	20†	...	0.00	− 0.08	0.00	0	0	17	0	13	w.	Southern Pacific Co.
Los Gatos	Santa Clara	600	25	65.4	+ 0.6	102	3	44	10†	40	0.33	+ 0.24	0.18	0	3	19	6	5	n.	F. H. McCullagh.
McCloud	Siskiyou	3,410	2	57.2	...	87	4†	32	15†	43	1.46	...	0.78	0	6	15	12	3	...	F. F. Spencer.
Macdoel	....do	4,258	5	54.3	...	89	4†	25	15	50	1.20	...	0.87	0	5	19	5	6	nw.	Butte Valley Land Co.
Madeline	Lassen	5,270	3	55.4	...	88	4	28	16†	48	1.14	...	0.32	0	7	14	7	9	nw.	J. H. Williams.
Magalia	Butte	2,321	8	66.9	...	100	4	41	20	43	0.59	...	0.29	0	4	20	4	6	se.	Butte Co. R. R. Co.
Mammoth Tank	Imperial	257	34	88.6	− 3.9	113	4	60	22†	35	0.15	+ 0.15	0.15	0	1	27	0	3	w.	Southern Pacific Co.
Maricopa	Kern	640	1	75.7	...	105	4	50	22	35	0.11	...	0.11	0	1	25	2	3	e.	Union Oil Co.
Marysville	Yuba	67	41	72.3	− 3.9	106	3	51	21†	47	0.32	+ 0.05	0.32	0	1	23	0	7	s.	Southern Pacific Co.
Mecca	Riverside	− 185	6	86.4	...	114	4†	62	21	41	T.	...	T.	0	0	25	5	0	nw.	E. A. Palmer.
Menlo Park**	San Mateo	64	34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Southern Pacific Co.
Merced	Merced	173	38	76.4	+ 1.1	105	3	52	21	33	0.04	− 0.08	0.04	0	1	24	6	0	nw.	Santa Fe Co.
Middlewater	Kern	...	1	81.4	...	114	19	46	25	58	0.00	...	0.00	0	0	26	4	0	n.	Union Oil Co.
Mill Creek No. 1	Amador	...	5	61.8	...	89	3	40	22	37	1.24	...	0.95	0	3	21	6	3	n.	Cal. Gas & Elect. Co.
Milton (near)	Calaveras	660	21	72.5	+ 0.7	102	3	47	22†	36	0.47	+ 0.22	0.35	0	3	24	3	3	nw.	J. H. Southwick.
Modesto**	Stanislaus	90	40	80.5	+ 3.9	102	3	58	24	...	0.75	+ 0.64	0.60	0	2	...	...	...	...	Southern Pacific Co.
Majave	Kern	2,751	35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Do.
Mokelumne Hill	Calaveras	1,550	19	69.1	+ 1.0	99	3	43	21	44	0.90	+ 0.49	0.70	0	2	19	4	7	...	C. E. Prindle.
Mono Ranch	Ventura	3,210	6	62.1	...	93	4	36	24†	42	T.	...	T.	0	0	24	5	1	w.	Herbert Lathrop.
Montague	Siskiyou	2,450	24	62.1	− 4.8	95	5	33	16	52	1.68	+ 1.05	0.92	0	5	7	12	11	n.	I. E. Deboy.
Monterey**	Monterey	15	47	64.9	+ 4.1	78	2†	58	9†	...	0.12	+ 0.02	0.12	0	1	29	0	1	e.	Southern Pacific Co.
Monterio	Kern	4,500	13	63.4	− 3.2	96	5	38	23†	30	0.16	+ 0.03	0.16	0	1	20	2	8	nw.	John C. Knecht.
Mount Tamalpais	Marin	2,375	13	60.5	− 3.6	90	3	43	20	27	1.20	+ 1.08	1.03	0	8	14	7	9	nw.	U. S. Weather Bureau.
Napa City	Napa	20	35	64.4	− 0.2	104	1	44	23†	49	0.94	+ 0.73	0.57	0	2	11	19	0	s.	Alex. Hall.
Napa (S. H.)	....do	60	34	66.8	+ 1.4	101	3	49	21	42	0.89	+ 0.68	0.48	0	3	17	7	6	sw.	W. H. Martin.
Needles	San Bernardino	477	20	88.2	+ 0.9	108	5†	69	1	33	0.25	+ 0.24	0.25	0	1	27	0	3	...	Santa Fe Co.
Nellie	San Diego	5,350	3	64.0	...	87	4†	33	23	50	0.18	...	0.18	0	1	30	0	0	...	T. O. Bailey.
Nevada City	Nevada	2,580	20	62.0	− 0.7	96	3†	35	22	47	0.59	− 0.08	0.35	0	2	18	8	4	se.	S. W. Marsh.
Newhall**	Los Angeles	1,200	35	71.8	+ 1.1	100	2†	60	22	...	T.	− 0.07	T.	0	0	28	0	2	se.	Southern Pacific Co.
Newman	Stanislaus	91	23	81.4	+ 4.9	104	2†	57	13	25	0.11	+ 0.05	0.10	0	2	25	0	5	n.	E. S. Wangenheim.
North Bloomfield	Nevada	3,214	15	66.2	+ 1.2	94	4	26	9	49	0.42	− 0.49	0.42	0	1	22	2	6	s.	J. R. McIntosh.
North Fork	Madera	3,000	8	66.1	...	98	4	31	11	53	0.06	...	0.06	0	1	23	7	0	nw.	U. S. Forest Service.
Oakdale**	Stanislaus	156	18	73.8	+ 1.9	105	3	56	23†	...	0.31	+ 0.10	0.31	0	1	25	2	3	nw.	Southern Pacific Co.
Oak Grove	San Diego	2,751	2	...	...	107	17	38	23	...	0.24	...	0.24	0	1	...	...	...	...	B. L. Johnson.
Oakland	Alameda	36	36	64.4	+ 2.9	91	2	51	18†	34	0.68	+ 0.38	0.56	0	4	15	8	7	w.	Chabot Observatory.
Oceanside	San Diego	60	2	67.5	...	76	17†	54	25	20	0.32	...	0.32	0	1	13	17	0	w.	H. D. Brodie.
Ojai Valley	Ventura	900	6	65.3	...	100	18	38	24†	49	T.	...	T.	0	0	26	3	1	sw.	W. H. Duncan.
Orland	Glenn	254	30	74.8	− 3.9	109	4	48	22	46	0.12	− 0.22	0.08	0	2	20	6	4	n.	U. S. Reclamation Service.
Orleans	Humboldt	520	9	70.9	...	106	4†	45	16	49	1.53	...	0.48	0	10	12	0	18	...	F. T. Hale.
Oroville (near)	Butte	250	28	73.1	− 1.4	108	4	52	8†	45	0.25	− 0.08	0.25	0	1	22	0	8	s.	E. D. Fairchild.
Palermo	....do	213	21	70.9	− 2.1	100	29	42	12	52	0.10	− 0.25	0.10	0	1	11	13	6	n.	Western Pacific Co.
Palm Springs**	Riverside	584	23	84.5	− 3.2	113	2	61	12†	...	0.00	0.00	0.00	0	0	25	4	1	w.	Southern Pacific Co.
Pasadena	Los Angeles	827	22	66.2	− 4.4	96	18	43	25	48	0.00	− 0.01	0.00	0	0	26	4	0	sw.	E. D. Sorver.
Paso Robles	San Luis Obispo	500	25	66.2	− 2.0	96	18	43	25	48	0.00	− 0.03	0.00	0	0	26	4	0	sw.	Dr. F. W. Sawyer.
Peachland	Sonoma	190	16	62.4	− 1.5	97	2	41	10†	46	1.57	+ 1.19	1.33	0	3	18	6	6	sw.	E. H. Parnell.
Placerville	El Dorado	1,875	23	65.6	− 0.8	98	3	44	15†	44	0.80	+ 0.14	0.73	0	2	...	...	...	...	A. Baring-Gould.
Point Lobos	San Francisco	250	19	58.9	+ 2.6	88	2	47	19	32	0.84	+ 0.70	0.63	0	6	3	20	7	nw.	John Hyslop.
Point Reyes	Marin	490	20	54.2	+ 1.4	76	3	46	18	26	1.53	+ 1.28	1.27	0	5	9	6	15	nw.	U. S. Weather Bureau.
Porterville	Tulare	464	23	75.8	− 3.0	107	3	54	14†	45	0.00	− 0.11	0.00	0	0	20	10	0	...	Leslie McAuliff.
Quincy	Plumas	3,400	17	58.4	− 2.4	91	4	27	27†	50	1.01	+ 0.08	1.00	0	2	18	9	3	w.	U. S. Forest Service.
Red Bluff	Tehama	307	35	73.2	+ 2.5	105	4	50	24	35	0.55	+ 0.06	0.37	0	6	19	4	7	se.	U. S. Weather Bureau.
Redding	Shasta	552	37	75.8	+ 0.2	106	4	50	24	39	1.51	+ 0.78	0.82	0	2	21	8	1	n.	W. W. Jones.
Redlands	San Bernardino	1,352	19	69.8	− 1.9	99	1†	46	23	47	0.00	− 0.11	0.00	0	0	23	5	2	w.	P. W. Moore.
Reedley	Fresno	347	12	73.6	− 2.4	104	3	50	24	43	0.00	− 0.02	0.00	0	0	29	0	1	n.	Santa Fe Co.
Rialto (near)	San Bernardino	2,250	6	70.0	...	98	2†	49	23†	37	T.	...	T.	0	0	18	9	3	se.	Southern Cal. Edison Co.
Riverside	Riverside	851	30	69.5	− 1.1	102	18	42	24	56	0.00	− 0.05	0.00	0	0	20	10	0	w.	J. N. D. Cox.
Rocklin	Placer	249	41	71.6	− 3.4	105	4	45	30	43	0.42	+ 0.17	0.30	0	3	27	0	3	s.	Southern Pacific Co.
Rohnerville	Humboldt	75	9	57.2	...	75	4†	40	16	30	1.54	...	0.66	0	6	15	4	11	nw.	Dr. R. Callahan.
Sacramento	Sacramento	71	35	69.2	+ 0.3	103	3	49	21	36	0.58	+ 0.41	0.47	0	3	24	2	4	s.	U. S. Weather Bureau.
St. Helena	Napa	255	4	66.2	...	103	2	43	11†	51	1.27	...	0.65	0	3	22	3	5	...	E. E. Hooper.
Salinas	Monterey	40	38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Miss E. Ruth Abbott.
San Bernardino	San Bernardino	1,054	20	70.4	+ 0.6	102	18	44	24†	55	0.00	− 0.08	0.00	0	0	21	9	0	sw.	Dr. A. K. Johnson.
San Diego	San Diego	93	41	63.2	− 0.6	72	29	54	24	14	0.16	+ 0.10	0.16	0	1	12	15	3	nw.	U. S. Weather Bureau.
San Francisco	San Francisco	207	41	60.4	+ 3.4	93	2	48	18	35	0.81	+ 0.57	0.68	0	6	16	7	7	w.	Do.
San Jacinto	Riverside	1,550	19	71.7	+ 1.3	102	2	46	24	46	0.00	0.00	0.00	0	0	26	4	0	w.	E. T. Tanner.
San Jose	Santa Clara	95	37	65.0	0.0	99	3	44	10	45	0.46	+ 0.33	0.36	0	3	22	5	3	nw.	U. S. Weather Bureau.
San Luis Obispo	San Luis Obispo	201	17	60.9	+ 0.5	90	17	42	22	46	0.00	− 0.12	0.00	0	0	12	11	7	nw.	Do.
San Mateo**	San Mateo	22	38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Southern Pacific Co.
San Miguel**	San Luis Obispo	616	25	72.1	+ 1.4	102	3	55	25	...	0.00	− 0.02	0.00	0	0	25	4	1	...	Do.
San Miguel Island	Santa Barbara	500	18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Capt. W. G. Waters.
Sanger**	Fresno	371	23	80.8	+ 0.7	108	2	59	22†	...	0.00	− 0.11	0.00	0	0	20	0	10	...	Southern Pacific Co.
Santa Barbara	Santa Barbara	130	28	60.7	− 1.9	81	26	45	23†	34	T.	− 0.09	T.	0	0	19	11	0	sw.	G. W. Russell.
Santa Clara	Santa Clara	90	23	65.4	+ 3.3	103	3	41	10†	49	0.64	+ 0.62	0.33	0	3	24	2	4	nw.	Santa Clara College.
Santa Cruz	Santa Cruz	20	39	63.0	− 0.1	93	1†	42	10	48	0.45	+ 0.23	0.40	0	2	27	0	3	w.	W. R. Springer.
Santa Margarita **	San Luis Obispo	996	23	62.8	− 5.5	96	3	40	7†	...	0.00	− 0.05	0.00	0	0	12	0	18	s.	Southern Pacific Co.
Santa Maria	Santa Barbara	220	24	63.4	+ 0.9	87	5	41	13	39	0.00	− 0.01	0.00	0	0	24	0	6	w.	Edwin Morris.
Santa Monica	Los Angeles	110	27	59.1	− 6.0	69	15	47	25	20	0.00	0.00	0.00	0	0	18	7	5	w.	N. D. Ingham.
Santa Rosa	Sonoma	181	23	63.2	− 2.0	99	3	41	10†	45	1.14	+ 0.89	1.11	0	2	18	3	9	s.	Southern Pacific Co.
Selma **	Fresno	311	26	75.7	− 2.5	104	3	55	21†	...	0.00	− 0.04	0.00	0	0	29	0	1	...	Do.

TABLE 1.—*Climatological data for June, 1912. District No. 11*—Continued.

Stations.	Counties.	Elevation, feet.	Length of record, years.	Temperature, in degrees Fahrenheit. Mean.	Departure from the normal.	Highest.	Date.	Lowest.	Date.	Greatest daily range.	Precipitation, in inches. Total.	Departure from the normal.	Greatest in 24 hours.	Total snowfall, unmelted.	Number of rainy days, 0.01 inch or more.	Sky. Number of clear days.	Number of partly cloudy days.	Number of cloudy days.	Prevailing wind direction.	Observers.
California—Continued.																				
Seven Oaks	San Bernardino	5,000	2	60.4		89	3	29	21	44	0.00		0.00	0	0	27	1	2	w.	M. Lewis.
Shasta	Shasta	1,048	16	68.0	− 7.6	102	3	39	15	43	2.08	+ 1.39	1.80	0	4	23	1	6	nw.	Dr. T. J. Edgecomb.
Sierra Madre	Los Angeles	1,400	15	66.8	− 0.2	93	18	50	25	37	0.10	− 0.15	0.10	0	1	9	19	2	s.	Mrs. A. E. Gregory.
Sierraville	Sierra	5,000	2	54.7		89	3	28	16	50	0.83		0.43	0	2	15	10	5	sw.	C. D. Johnson.
Sisson	Siskiyou	3,555	23	57.2	− 5.3	88	4†	32	15	42	0.90	+ 0.26	0.60	0	3	13	13	4	n.	Southern Pacific Co.
Soledad **	Monterey	188	38	73.8	+ 8.3	100	1	60	29		0.00	− 0.05	0.00	0	0	23	0	7	n.	Do.
Sonora	Tuolumne	1,825	24	69.0		97	4	44	22	40	0.47	+ 0.16	0.47	0	1	24	3	3	nw.	Chas. P. Jones.
Southeast Farallon	San Francisco	30	9	54.2		66	3	47	18	14	1.97		1.68	0	2	13	11	6	nw.	U. S. Weather Bureau.
Springville	Tulare	4,000	5	63.3		95	3	38	22	40	0.00		0.00	0	0	24	2	4		D. L. Wishon.
Squirrel Inn	San Bernardino	5,280	2	61.0		92	6	36	23	42	0.00		0.00	0	0	28	0	2	n.	A. D. Frantz.
Stanwood	Butte	2,140	8	60.0		96	6	38	24	40	0.57		0.34	0	2	23	2	5	s.	Cal. Gas & Elect. Co.
Stirling City	do	3,525	8																	Butte Co. R. R. Co.
Stockton (S. H.)	San Joaquin	23	41	70.2	+ 0.3	105	3	49	21	42	0.25	+ 0.13	0.18	0	2	23	3	4	nw.	State Hospital.
Storey	Madera	296	12	71.8	− 0.5	106	3	46	22†	49	0.00	− 0.01	0.00	0	0	27	0	3		Santa Fe Co.
Suisun **	Solano	20	32																	Southern Pacific Co.
Sulphur Banks	Lake	1,350		67.8		97	3	45	30	37	0.59		0.52	0	3	17	11	2	w.	J. T. La Bree.
Summerdale	Mariposa	5,270	16	58.4	− 1.4	85	3	33	23	27	0.50	+ 0.08	0.30	0	2	19	8	3	e.	Bertus Gude, jr.
Summit	Placer	7,017	39	44.0	− 9.2	65	2	29	9†	31	0.20	− 0.44	0.10	1.0	2	22	0	8	sw.	Southern Pacific Co.
Susanville	Lassen	4,175	23	59.0	− 3.4	88	5	33	15†	41	0.78	+ 0.28	0.30	0	5	13	15	2	sw.	James Branham.
Tamarack	Alpine	8,000	6	44.4		72	19	20	1†	46	1.08		0.65	4.0	4	13	11	6	sw.	Cal. Gas & Elect. Co.
Tehachapi **	Kern	3,964	35																	Southern Pacific Co.
Tehama **	Tehama	220	41	72.8	− 4.8	106	4	50	12		T.	− 0.27	T.	0	0	17	0	13	s.	Do.
Tejon Rancho	Kern	1,500	10	66.8[f]		90	2	42	23†	29	0.00		0.00	0	0					S. E. Bailey.
Three Rivers	Tulare	870	2	73.5		106	3	41	24	47	0.00		0.00	0	0	16	13	1	sw.	E. D. Barton.
Towle	Placer	3,704	26																	Southern Pacific Co.
Tracy **	San Joaquin	64	32	75.9	0.0	105	3	58	12†		0.38	+ 0.21	0.29	0	2	15	11	4	nw.	Do.
Ukiah	Mendocino	620	19	66.4	+ 1.0	101	3	40	30	52	0.44	+ 0.10	0.28	0	3	18	6	6	nw.	Dr. Geo. McCowen.
Upper Lake	Lake	1,350	27	66.0	− 0.7	101	3	39	30	48	0.32	+ 0.07	0.21	0	3	19	2	9	nw.	C. M. Hammond.
Vacaville	Solano	175	24	70.4	− 0.6	107	2†	47	13†	49	0.00	− 0.16	0.00	0	0	21	7	2	sw.	G. C. Coburn.
Valley Springs **	Calaveras	673	23	75.5	+ 1.4	102	3	62	22		0.51	+ 0.24	0.51	0	1	24	2	4	nw.	Southern Pacific Co.
Visalia	Tulare	334	24	70.2	− 3.1	107	12	35	24	61	0.00	− 0.10	0.00	0	0	30	0	0		Santa Fe Co.
Warner Springs	San Diego	3,165	4	66.5		93	18	41	22	41	0.22		0.22	0	1	28	2	0		Mrs. F. S. Sandford.
Wasco	Kern	336	12	75.4	+ 0.4	109	5	42	24	53	0.00	0.00	0.00	0	0	30	0	0		Santa Fe Co.
Watsonville	Santa Cruz	23	16	56.0	− 6.4	84	16	31	21	52	0.14	0.00	0.14	0	1	11	14	5	w.	Spreckels Sugar Co.
Weaverville	Trinity			62.8		96	4†	35	16	51	1.08		0.67	0	4	16	4	10	w.	U. S. Forest Service.
Weitchpec	Humboldt	1,700	2	60.2		94	4	38	15†	40	1.98		0.76	0	8	18	7	5	w.	M. E. Lathrop.
Westley **	Stanislaus	90	23	78.5	+ 0.9	104	3	55	23		0.70	+ 0.64	0.38	0	3	23	0	7	n.	Southern Pacific Co.
Wheatland	Yuba	84	25	70.8	− 0.6	102	3	50	21	38	0.28	0.00	0.20	0	2	19	7	4	s.	William Lumbard.
Willows	Glenn	136	33	74.8	− 2.1	110	4	46	13	45	0.19	+ 0.01	0.19	0	1	24	3	3	n.	E. C. Mills.
Yosemite	Mariposa	3,945	8	62.6		94	5	32	23	51	0.14		0.06	0	3	27	0	3	s.	J. P. Kelley.

a, b, c, etc., indicate respectively 1, 2, 3, etc., days missing from the record.
**Temperature extremes are from observed readings of the dry bulb; means are computed from observed readings.
† Also on other dates.
T. Precipitation is less than 0.01 inch rain or melted snow.

TABLE 2.—*Daily precipitation for June, 1912. District No. 11, California.*

Stations.	Watershed.	Day of month. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total.
Oregon.																																
Klamath Agency	Klamath											.40	.50	.70								1.25		.90								3.75
Klamath Falls	do						.03	T.	.47				.58	.51	.09							.09	.12	.91								2.80
Lakeview	Pitt																															
Long Valley	do					T.		.03		.09			.29	.27	.43						.05	.19	.07	.28	.02							1.72
Merrill	Int. drainage																															
Yonna	do					.01		.12	.23				.57	.15								.01	.03	.43	.01					.05	T.	1.61
California.																																
Aguanga	Coast																								.02							0.02
Alameda	do																															
Alturas	Sacramento							.02						.01	T.						.01	.20	.22	.44								0.90
Angels Camp	San Joaquin												1.03										T.	.07								1.10
Angiola	do												T.																			T.
Antelope Valley	do																															0.00
Antioch	do																							.66								0.66
Aptos	Coast																								.30							0.30
Arrowhead Springs	do																															
Auburn	Sacramento																															
Avalon	Ocean																															0.00
Azusa	Coast																															
Bagdad	Desert																															0.00
Bakersfield	San Joaquin																															0.00
Barstow	Desert																															
Bear River	San Joaquin																															
Bear Valley (1)	Sacramento												.65	.08									T.	.48								1.21
Bear Valley (2)	San Joaquin																															0.00
Bear Valley Dam	Coast																															0.00
Beaumont	do																															
Beaumont (near)	do																															
Belotta	San Joaquin													.21																		0.21
Ben Lomond	Coast																							.75								0.75
Berkeley	do												.02	.01										.21	.61							0.85
Biggs	Sacramento																															0.00
Bishop	Owens																															
Bishop Creek	do																						.60									0.60
Blocksburg	Coast								T.	T.			T.	.56	.13						.20			.28	T.	T.						1.17
Blue Cannon	Sacramento													1.10										.77								1.87
Blythe	Desert																													.57		0.57
Boulder Creek	Coast																							.75								0.75
Branscomb	do												.64	.43							.12			.22	T.	T.						1.41
Brawley	Desert																															‡0.25
Burney	Sacramento						T.					.22	T.								T.	.56		.86								1.64
Butte Valley	do																															
Cahuilla	Coast																															
Calexico	Desert																													.22	.05	0.27
Caliente	San Joaquin																															0.00
Calistoga	Coast																								1.14	.03						1.17
Campbell	do												.10											.08	.15							0.33
Campo	do																													.15		0.15
Camptonville (near)	Sacramento												.80	.05	T.									.50								1.35
Cedarville	Mountain Lakes						T.	T.					.12	.02	.06						T.	.11	.30	.15						T.		0.76
Chester	Sacramento				.15				.22				.13	.01							T.	.12	.13	.28								1.04
Chico	do																							.12								0.12
Chico (near)	do													T.										.17								0.17
China Flat	Coast											.17	.03								.32		.37		.05	.13	.20					1.27
Chino	do																															0.00
Cisco	Sacramento																															
Claremont	Coast													.03																		0.03
Cloverdale	do					T.	.34						.07	T.									T.	.45	.41							1.27
Coalinga	San Joaquin																															0.00
Colfax	Sacramento													.71										.30								1.01
Colgate	do												.20	.20										.19								0.59
Colusa	do											T.											T.	.17								0.17
Corning	do																							.21								0.21
Corona	Coast																															
Cuyamaca	do																												.15	.27		0.42
Davisville	Sacramento												.05											.60	.09							0.74
Deer Creek	do												.90	.05									.01	.49								1.45
Del Monte	Coast																							.11								0.11
Delta	Sacramento											.04	.10																			0.14
Denair	San Joaquin												.29																			0.29
De Sabla	Sacramento																							.65								0.65
Descanso	Coast																												.12			0.12
Devils Canyon	do																															
Dinuba	San Joaquin																															
Dobbins	Sacramento												.42											.21								0.63
Downieville	do					T.							.60		.06							T.	.10	.64								1.40
Dudley	San Joaquin																															0.00
Dudleys	do												.20										T.									0.20
Dunlap (near)	do																															0.00
Dunnigan	Sacramento											T.												.10	.03							0.13
Dunsmuir	do									.05			.13	.13	.10							.28	.28	.43	.08							1.48
Durham	do											.05			T.							T.		.15	T.							0.20
East Park	do					.34							.04										.15	.59								1.12
Edgewood	do									.56			.04									.95	.26	.92	.07							2.80
Edison	San Joaquin																															
El Cajon	Coast																													.70		0.70
Electra	San Joaquin												.63	.05										T.								0.68
Elsinore	Coast																															0.00
Emigrant Gap	Sacramento																															
Escondido	Coast																													.08		0.08
Eureka	do											.45	.08	.07						.12	.19		.02	.36								1.29
Fairmont	do																						.10									0.10
Farmington	San Joaquin												.32										.07									0.39
Felton	Coast																								.62							0.62
Firebaugh	San Joaquin													T.																		T.
Folsom	Sacramento													.30										.25	T.							0.55
Fordyce Dam	do					.30			T.	.05			.82	.32								T.	.03	.45								1.97
Fort Bidwell	Mount'n Lakes					T.	T.	T.	T.	T.		T.	T.	T.	.10						T.	.50	T.	.20						T.		0.80
Fort Bragg	Coast											.35	.09	.15									.04	.15	.10							0.88
Fort Ross	do																															

TABLE 2.—*Daily precipitation for June, 1912. District No. 11*—Continued.

Stations.	Watershed.	Day of month.																														Total.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
California—Contd.																																
Fouts Springs	Sacramento								.15				.05											.68	.22							1.10
Fredalba	Coast																															0.00
Fresno	San Joaquin												T.																			T.
Friant	do																															0.00
Fruto	Sacramento																															
Galt	San Joaquin												.33										.68	.22	.05							1.28
Georgetown	do													.71										.22								0.93
Gilroy	Coast																								.03							0.03
Gilta	do						.14					.59								.08	.09	.21	.66			.01	.22					2.00
Glendora	do																															
Glen Ranch	do																															0.00
Glenville	San Joaquin												T.										T.									T.
Glenwood	Coast													T.										T.	.50							0.50
Gold Run	Sacramento												T.	.65										.40	.10							1.15
Gonzales	Coast																															0.00
Grass Valley	Sacramento												.52										T.	.23								0.75
Greenland Ranch	Desert																															0.00
Greenville	Sacramento				T.	T.			T.				.09									.37	T.	.21							T.	0.67
Gridley	do												.07											.20								0.27
Groveland	San Joaquin																															
Guinda	Sacramento																															
Hanford	San Joaquin																															0.00
Head Dam	Sacramento												.64											.27								0.91
Healdsburg	Coast											T.											.67	1.05	.01							1.73
Hearst	do												.22	.12								.02	.11	.02		.02	.03					0.54
Heber	Desert																												T.	.15		0.15
Helen Mine	Coast																															
Hetch Hetchy	San Joaquin																															
Holcomb	Coast																															0.00
Hollister	do												T.																			T.
Hornbrook	Klamath																															‡1.50
Hot Springs	San Jaoquin												T.										.02									0.02
Hullville	Coast												.24	.03							.02			.08	.04							0.41
Idyllwild	do																															
Independence	Owens																															0.00
Indio	Desert																												.02			0.02
Inskip	Sacramento												.31	T.	.17							T.	.12	.63						T.		1.23
Ione	San Joaquin																															
Jacksonville	do													.38																		0.38
Jamestown	do												T.																			T.
Jenny Lind	do													.35																		0.35
Jolon	Coast																						.08									0.08
Julian	do																														.20	0.20
Kennedy Mine	San Joaquin																															‡0.65
Kennett	Sacramento											.03	.40	.08									.08	.84			T.					1.43
Kentfield	Coast																															‡2.10
Kernville	San Joaquin																															0.00
King City	Coast																															0.00
Knights Landing	Sacramento												.05	.09										.24	.09							0.47
La Grange	do												.24										.06									0.30
La Jolla	Coast																											.05				0.05
Lake Eleanor	San Joaquin																															
Lakeside	Coast																															
La Porte	do				T.	.05					T.		.95	T.	.01						T.	.05	.05	.46	T.							1.57
Lathrop	San Joaquin												T.	.15										.12	.05							0.32
Laurel	Coast																								.55							0.55
Latonville	do																															
Le Grand	San Joaquin																															
Lemon Cove	do																															0.00
Lick Observatory	Coast												.14		.02						.06		.03	.11	.08							0.44
Livermore	do																															
Lodi	San Joaquin												.17										T.	.18								0.35
Lone Pine	Owens																															0.00
Long Valley	Mount'n Lakes				T.	T.	.05				.22		.04									.06	.14	.02								0.53
Lordsburg	Coast																															0.00
Los Alamos	do																															
Los Angeles	do																															0.00
Los Banos	San Joaquin																															0.00
Los Gatos	Coast												.05										T.	.10	.18							0.33
Los Molinos	Sacramento																															
Lowe Observatory	Coast																															0.00
McCloud	Sacramento							.08					.19	.18							.14	.08	T.	.79						T.		1.46
McDoel	Klamath												.10	.06								.12	.05	.87								1.20
Madeline	Mount'n Lakes						.01	.03		T.			T.	.30							.08	.20	.32							.20		1.14
Magalia	Sacramento												.15	.04								.11	.29									0.59
Mammoth Tank	Desert																													.15		0.15
Maricopa	San Joaquin				.11																											0.11
Mariposa	do													.10																		0.10
Marysville	Sacramento																							.32								0.32
Mecca	Desert																												T.	T.		T.
Melones	San Joaquin													.71																		0.71
Menlo Park	Coast																															
Merced	San Joaquin												.04																			0.04
Merced Falls	do																						.01									0.01
Mesa Grande	Coast																													.29		0.29
Middlewater	San Joaquin																															0.00
Mill Creek (1)													.95	.21									.08									1.24
Mill Creek (2)	Coast																						.05									0.05
Mills College	do												.07	.01										.15	.40							0.63
Milo	San Joaquin																															0.00
Milton (near)	do												.35	.10									.02	T.								0.47
Modesto	do													.15											.60							0.75
Mojave	Desert																															
Mokelumne Hill	San Joaquin												.70										.20									0.90
Mono Ranch	Coast																						T.									T.
Montague	Klamath								T.			.15	.21							T.	.35	.05		.92			T.					1.68
Monterey	Coast																								.12							0.12
Monterio	San Joaquin																							.16								0.16
Montgomery Creek	Sacramento												.40	.50										1.00	.23							2.13
Mount Tamalpais	Coast											.02	.02	.03	.01						.03		.05	.78	.26							1.20
Mount St. Helena	do														.17									1.15								1.32
Napa City	do												T.											.57	.37							0.94
Napa (S. H.)	do												.01											.48	.40							0.89

TABLE 2.—*Daily precipitation for June, 1912. District No. 11*—Continued.

Stations.	Watershed.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total.
California—Contd.																																
Needles	Desert																													.25		0.25
Nellie	Coast																												.18			0.18
Nevada City	Sacramento												.35								T.		T.	.24								0.59
Newcastle	do																															
Newhall	Coast																						T.									T.
Newman	San Joaquin												.10												.01							0.11
North Bloomfield	Sacramento																								.42							0.42
North Fork	San Joaquin													.06																		0.06
North Lakeport	Coast											.04												.65								0.69
Oakdale	San Joaquin			T.										.31									T.									0.31
Oak Grove	Coast																													.24		0.24
Oakland	do									T.			.01	.01										.10	.56							0.68
Oakville	do																							.60	.68							1.28
Oceanside	do										T.																		T.	.32		0.32
Ojai Valley	do																						T.									T.
Orland	Sacramento				T.							T.		T.									.08	.04								0.12
Orleans	Klamath											.48	.03							.04	.10	.13	.15	.12	.06	.20	.22					1.53
Oroville	Sacramento																							.25								0.25
Ozeana	Coast																															0.00
Palermo	Sacramento										.10																					0.10
Palm Springs	Desert																															0.00
Parkfield	Coast																															0.00
Pasadena	do																															0.00
Paso Robles	do																															0.00
Peachland	do												T.	T.									T.	1.33	.23	.01						1.57
Phoenix Dam	San Joaquin												.41																			0.41
Pilot Creek	Sacramento									T.			.87	.15								T.	.20	T.								1.22
Pinchot	Coast																															0.00
Pine Crest	do																															0.00
Placerville	Sacramento													.73										.07								0.80
Point Lobos	Coast												.04	.03							.02		.02	.10	.63							0.84
Point Loma	do	.01	.01								T.	.01				.04														.13	.02	0.22
Point Reyes	do											.01	.03	T.										1.09	.39	.01						1.53
Porterville	San Joaquin																															0.00
Portulaca	do																															
Prattville	Sacramento									T.		.01		.02							.05	.16	.01	.10								0.35
Priest Valley	Coast																															
Quincy	Sacramento												.01										1.00									1.01
Red Bluff	do											.07	.01		.04						.37		.01	.05								0.55
Redding	do				T.								.82	T.							T.			.69								1.51
Redlands	Coast																															0.00
Reedley	San Joaquin																															0.00
Repressa	Sacramento												.29										.23		.05							0.57
Rialto (near)	Coast													T.																		T.
Rio Vista	Sacramento												T.	.13										.69	.29	T.						1.11
Riverside	Coast																															0.00
Rocklin	Sacramento												.10										.02	.30								0.42
Rohnerville	Coast							.08	T.			.14	.16	.12							.38			.66		T.						1.54
Sacramento	Sacramento												.11										.03	.44								0.58
St. Helena	Coast																					.02	.60	.65								1.27
Salinas	do																															
San Bernardino	do																															
San Diego	do																													.16		0.16
San Francisco	do											.02	.04								.01		.02	.47	.25							0.81
San Jacinto	do																															0.00
San Jose	do												.10										T.	.24	.12							0.46
San Luis Obispo	do																															0.00
San Mateo	do																															
San Miguel	do																															0.00
San Miguel Island	Ocean																															
Sanger	San Joaquin																															0.00
Santa Ana River	Coast																															0.00
Santa Barbara	do																							T.								T.
Santa Clara	do												.16											.15	.33							0.64
Santa Cruz	do				.05																			.40								0.45
Santa Margarita	do																															0.00
Santa Maria	do																															0.00
Santa Monica	do																															0.00
Santa Rosa	do																					.03			1.11							1.14
Sausalito	do												.01	.12									.03	.01	.52							0.69
Selma	San Joaquin																															0.00
Seven Oaks	Coast																															0.00
Shasta	Sacramento											.16	1.80										.08	.04								2.08
Shingle Springs	San Joaquin																															0.00
Shrively	Coast																															
Sierra Madre	do												T.	.10																		0.10
Sierraville	Mountain Lakes												.43										.40									0.83
Sisquoc Ranch	Coast																															
Sisson	Sacramento											.10									.20		.60									0.90
Soledad	Coast																															0.00
Sonora	San Joaquin												.47																			0.47
Southeast Farallon	Ocean											T.												1.18	.79							1.97
Spreckels	Coast																															
Springville	San Joaquin																															0.00
Squirrel Inn	Coast																															0.00
Stanwood	Sacramento												.23											.34								0.57
Stirling City	do																															
Stockton (S. H.)	San Joaquin												.18											.07								0.25
Storey	do																															0.00
Suisun	Sacramento																															
Sulphur Banks	do											.01												.52	.06							0.59
Summerdale	San Joaquin												.20										.30									0.50
Summit (1)	Sacramento												.10										.10									0.20
Summit (2)	Coast																															
Susanville	Mountain Lakes								.07													.30	.23	.13						.05		0.78
Tamarack	Sacramento					.03			T.				.65								.20	.20										1.08
Tehachapi	San Joaquin																															
Tehama	Sacramento																				T.			T.								T.
Tejon Rancho	San Joaquin																															0.00
Three Rivers	do																															0.00
Towle	Sacramento																															
Tracy	San Joaquin												.29												.09							0.38

TABLE 2.—*Daily precipitation for June, 1912. District No. 11*—Continued.

Stations.	Watershed.	Day of month. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total.
California—Contd.																																
Tulare	San Joaquin																															0.00
Tustin (near)	Coast																															0.00
Ukiah	do												.07	T.										.28	.09							0.44
Upland	do																															....
Upper Lake	Sacramento												.08											.21	.03							0.32
Upper Mattole	Coast							.02					.35	.01	.10						.11	.19	.34	.35	T.		.05					1.52
Vacaville	Sacramento																															0.00
Valley Springs	San Joaquin													.51																		0.51
Visalia	do																															0.00
Warner Springs	Coast																												.22			0.22
Wasco	San Joaquin																															0.00
Watsonville	Coast																							.14								0.14
Weaverville	do												.22											.67	.01		.18					1.18
Weitchpec	Klamath											.01	.76	.10							.15		.08	.41		.05	.42					1.98
West Branch	Sacramento												.36		.10						T.			.42								0.88
Westley	San Joaquin												.30										.38	.02								0.70
West Point	do										T.			1.18										.04	T.	T.						1.22
West Saticoy	Coast																															0.00
Wheatland	Sacramento												.08											.20								0.28
Willows	do																							.19								0.19
Yosemite	San Joaquin				.04								.04										.06									0.14

* Precipitation included in that of the next measurement.
‡ Separate dates of falls not recorded.
‖ Precipitation for the 24 hours ending on the morning when it is measured.
T. Precipitation is less than 0.01 inch rain or melted snow.

TABLE 3.—*Maximum and minimum temperatures for June, 1912. District No. 11, California.*

Date.	Lakeview, Oreg.		California. Alturas.		Barstow.		Branscomb.		Brawley.		Colusa.		Eureka.		Fresno.		Independence.		Los Angeles.		Mount Tamalpais.		Nevada City.		Porterville.		Red Bluff.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	......	......	87	36	108	58	88	51	105	66	96	60	57	50	103	65	91	58	76	57	85	75	88	46	104	60	100	67
2	......	......	87	39	105	55	93	53	107	66	100	65	58	48	106	69	95	56	77	57	90	74	94	47	106	61	99	68
3	......	......	89	42	104	59	94	58	109	67	102	65	63	48	107	71	97	62	75	57	90	77	96	51	107	65	101	79
4	......	......	93	41	110	59	91	59	111	69	102	67	65	49	105	73	97	63	74	56	81	74	96	53	104	64	105	70
5	......	......	92	45	105	58	85	53	111	70	96	63	57	49	103	69	94	62	74	56	77	66	93	55	99	63	101	70
6	......	......	90	48	103	60	78	50	111	78	87	62	56	49	97	66	93	62	71	57	69	46	85	50	95	60	92	67
7	......	......	82	43	98	56	70	40	105	74	81	54	62	53	91	58	90	57	73	53	57	45	79	48	90	61	85	56
8	......	......	80	34	93	60	71	41	101	60	81	53	57	53	85	57	90	54	74	54	50	46	77	42	90	59	81	55
9	......	......	79	49	91	58	70	37	97	61	82	53	57	52	85	56	81	54	72	56	63	44	77	42	93	58	85	55
10	......	......	85	38	94	57	69	38	97	63	88	54	58	52	89	56	84	54	72	56	70	50	79	45	96	60	92	60
11	......	......	82	41	101	60	67	38	99	64	85	55	65	52	94	60	87	57	74	57	64	52	78	48	94	59	84	62
12	......	......	71	51	92	54	56	48	100	65	81	62	63	55	78	62	78	62	68	57	56	47	60	53	86	58	76	64
13	......	......	65	46	89	60	58	47	98	69	81	55	63	53	83	57	85	52	69	59	62	46	71	48	84	56	76	56
14	......	......	60	40	90	58	62	42	99	62	79	54	58	51	83	57	88	59	71	57	61	44	72	50	85	54	76	58
15	......	......	63	33	94	60	79	43	98	61	81	61	58	49	86	57	82	53	73	59	68	51	76	36	97	60	78	58
16	......	......	78	39	87	54	85	46	98	67	89	57	61	46	92	59	79	48	75	59	76	58	85	44	100	63	88	58
17	......	......	91	38	93	50	87	46	99	66	94	57	58	52	98	63	85	52	82	58	83	67	87	44	103	65	97	63
18	......	......	90	46	101	55	86	50	104	65	96	59	55	50	102	66	91	52	83	57	85	70	93	47	106	64	99	65
19	......	......	91	44	103	56	75	43	104	67	96	63	58	50	104	68	93	56	77	59	76	49	90	48	87	61	98	66
20	......	......	84	34	100	60	56	43	100	69	80	57	58	50	80	57	92	66	74	58	55	43	68	47	86	54	79	52
21	......	......	52	33	90	55	59	44	90	59	75	55	58	47	78	51	82	53	73	58	56	43	64	39	83	55	72	52
22	......	......	57	29	76	54	66	45	97	60	78	57	59	46	71	54	71	52	67	57	60	44	67	35	79	58	72	54
23	......	......	64	43	81	50	58	42	......	......	70	54	58	51	74	51	69	32	68	55	46	44	56	39	90	54	60	54
24	......	......	82	33	86	51	59	42	......	......	73	54	65	49	84	51	78	48	73	52	54	46	74	44	93	55	78	50
25	......	......	82	40	96	53	61	41	104	65	80	54	60	52	85	55	85	56	75	52	54	47	75	42	92	58	80	57
26	......	......	78	40	100	52	65	41	106	74	78	54	62	52	85	55	90	58	78	54	57	46	74	40	89	59	78	60
27	......	......	78	40	98	58	72	42	106	74	86	55	58	52	90	56	90	52	82	59	69	50	81	38	87	56	88	58
28	......	......	79	47	97	56	76	44	98	75	86	57	57	50	96	62	90	53	75	55	73	57	82	41	88	55	90	63
29	......	......	79	39	91	58	72	44	84	72	87	58	59	50	93	64	85	54	81	55	67	54	74	45	89	56	86	64
30	......	......	64	30	92	58	70	43	99	66	83	58	57	47	88	55	84	49	75	53	68	52	75	38	86	57	78	58
Mns.	......	......	78.5	40.0	95.6	56.4	72.6	45.1	101.3[b]	66.9[b]	85.7	57.7	59.3	50.2	90.5	60.0	86.5	54.9	74.4	56.3	67.4	53.6	78.9	45.1	92.7	58.9	85.8	60.6

Date.	California. Redlands.		Sacramento.		San Diego.		San Francisco.		San Jose.		San Luis Obispo.		Santa Barbara.		Santa Rosa.		Sisson.		Stockton.		Summit.		Susanville.		Yosemite.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	99	55	99	68	68	60	80	58	94	55	77	53	68	56	92	53	82	54	100	64	59	35	84	43	90	45
2	99	55	98	68	68	58	93	58	99	56	78	48	68	55	96	58	81	52	104	66	65	36	86	47	91	48
3	96	55	103	69	68	59	86	60	99	59	77	52	67	55	99	62	82	45	105	68	57	36	84	46	87	46
4	96	54	93	64	66	58	70	53	88	57	75	51	67	55	78	43	88	48	96	69	59	35	87	49	86	48
5	89	54	87	58	66	59	63	53	81	55	68	54	68	56	72	58	88	50	90	58	60	36	88	51	94	49
6	88	54	72	56	66	60	59	53	78	51	66	54	65	56	64	53	88	46	79	58	62	38	86	50	88	50
7	85	51	75	53	67	59	65	56	75	52	66	51	70	55	70	54	78	38	78	53	63	35	82	47	86	46
8	84	49	70	53	67	59	62	57	71	52	66	53	68	49	70	50	74	42	77	52	54	35	78	43	84	40
9	77	55	75	53	67	60	60	52	69	51	66	54	65	52	71	51	74	40	79	51	45	29	76	45	82	41
10	77	54	81	57	66	60	60	51	71	44	67	51	65	50	75	41	78	45	80	53	56	33	78	45	78	40
11	81	55	75	52	66	59	61	51	73	44	74	47	68	51	76	43	72	52	84	53	50	31	76	46	75	42
12	75	57	69	57	64	58	63	54	72	56	70	50	63	57	69	55	64	44	80	53	52	30	78	48	73	40
13	71	56	75	55	68	59	66	55	75	55	67	52	72	52	70	50	68	42	77	53	58	34	67	44	80	43
14	77	56	78	52	67	59	69	53	73	52	70	52	70	50	79	41	58	40	80	53	57	32	70	40	84	38
15	81	56	80	61	68	59	71	53	79	46	73	51	68	52	85	46	60	32	86	55	49	31	64	33	85	48
16	90	51	89	64	66	59	80	53	86	47	86	53	71	51	88	49	74	40	94	56	52	30	69	33	86	42
17	96	49	95	59	70	60	78	48	92	47	90	47	78	58	91	46	80	46	100	58	55	32	76	38	85	43
18	94	54	96	65	68	58	70	48	93	52	90	44	73	57	90	45	86	46	102	62	58	32	83	42	89	45
19	87	51	95	59	66	59	63	49	87	51	71	47	65	55	83	45	81	50	95	63	61	34	86	45	91	45
20	89	53	75	56	68	60	62	53	68	53	68	52	67	55	72	46	59	38	73	56	59	35	63	40	78	40
21	85	50	73	49	66	61	62	52	69	46	62	50	67	51	74	41	55	35	68	49	48	30	63	39	80	35
22	72	53	73	54	63	60	63	51	69	48	61	42	65	52	73	50	55	42	68	53	41	32	54	36	81	33
23	76	46	59	53	68	55	58	54	62	53	64	49	65	45	62	52	54	36	66	52	38	29	61	41	81	32
24	83	47	73	54	68	54	66	54	68	53	67	46	68	46	67	53	59	42	76	53	42	30	73	39	84	33
25	88	57	75	54	69	55	67	56	74	51	70	47	68	45	68	50	68	40	74	51	57	31	76	43	82	34
26	92	50	76	54	70	57	65	53	70	53	67	52	81	47	73	48	68	38	75	52	60	31	72	43	83	38
27	92	54	84	54	71	59	68	53	80	51	79	52	74	51	80	46	72	46	84	52	61	33	75	39	81	40
28	91	54	85	57	69	61	67	52	84	48	75	50	67	56	82	48	68	46	88	56	63	32	77	44	81	44
29	89	58	77	56	72	62	59	52	78	52	69	51	66	54	79	46	64	40	84	57	58	33	76	43	80	46
30	86	55	80	55	69	59	69	52	80	47	73	49	70	49	79	43	60	37	83	53	57	31	68	38	80	45
Means	86.2	53.3	81.2	57.1	67.5	58.8	67.5	53.2	78.6	51.4	71.7	50.1	68.6	52.8	77.6	48.9	71.3	43.1	84.2	56.1	55.2	32.7	75.2	42.7	83.5	42.0

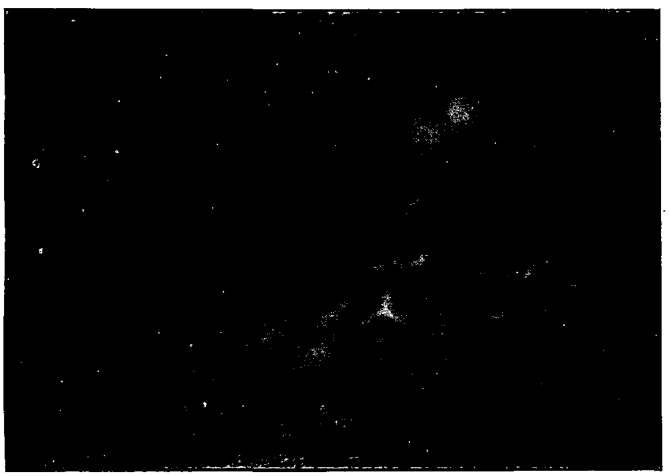
[a], [b], [c], etc., indicate, respectively, 1, 2, 3, etc., days missing from the record.
§§ Instruments are read in the morning; the maximum temperature then read is charged to the preceding day, on which it almost always occurs.

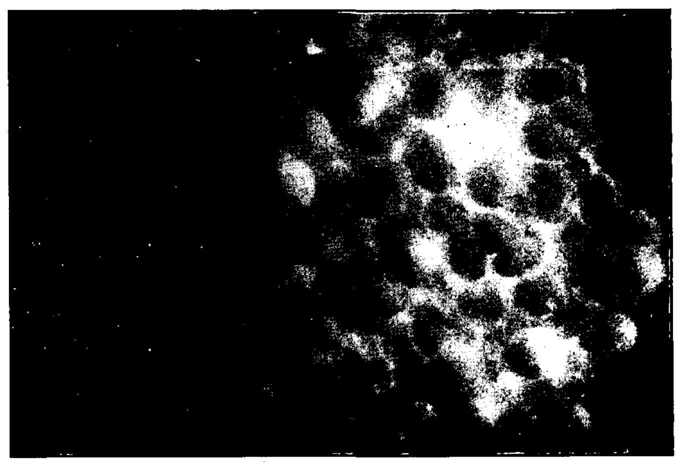
MAMMATO-CUMULUS CLOUDS.

By W. J. Humphreys, Professor of Meteorological Physics, U. S. Weather Bureau.

The accompanying illustrations, from photographs taken at Bartlesville, Okla., June 15, 1912, at 6.30 p. m., by Mr. Loran C. Twyford, show an admirable example of that unusual cloud formation commonly known as the mammato-cumulus.

Mr. Twyford writes that possibly 45 minutes before the clouds were seen a cyclone did great damage about 20 miles away, and in the direction from which the clouds came. Similar clouds were observed by Prof. H. C. Frankenfield [1] at St. Louis in connection with and just preceding the tornado of May 27, 1896, that did much damage in that city. They have also been noted occasionally by many other observers and in various parts of the world but usually in the neighborhood of tornadoes, squalls, or other violent atmospheric disturbances.





Osthoff [2] in his report on 67 occurrences of the mammato-cumulus which he observed during the course of 21 years, 1885–1905, says that they are tenfold more frequent during summer than in winter, and nearly as many fold more frequent of afternoons than of mornings. He also finds that this particular formation occurs at various levels and especially as a modification of the strato-cumulus and other sheet clouds.

Presumably, then, the formation of mammato-cumuli is dependent upon certain unusual conditions incident to hot weather and that are often productive of severe local storms. Just exactly how they are formed, however, is not certain, but apparently they are due to local down rushes, or cataracts, of cold air, the general process conceivably being as follows:

1. A violent up rush, under cyclonic conditions, of the lower atmosphere, and consequent projection, by virtue of acquired momentum, to elevations beyond the equilibrium level, where it is dynamically cooled to temperatures below that of the surrounding air.
2. A rapid horizontal spreading, under the influence of the cyclonic whirl, of the overlying cooled atmosphere at a considerable elevation, and therefore often above a stratus cloud of some type.
3. A descent in numerous places of the abnormally cold and consequently unstable air upon and through the underlying cloud stratum; thereby in each such place forcing the cloud below its wonted level and at the same time, through counter convection, raising its intermediate portions above their former position, and thus accentuating the whole phenomenon of pendulous formation.

The actual process, whether in general as above suggested, or some other not so obvious, seems to require an existing cloud to render it visible, and to be such as to convert a stratus of whatever type into a group of festooned, pendulous, pocket or mammato-cumulus clouds, as run some of its numerous names.

Apparently this type of cloud has very rarely been photographed, and therefore it is earnestly hoped that Mr. Twyford and many others may secure additional records for the further study of this interesting, unusual, and, because of its frequent close relation to tornadoes, perhaps even ominous phenomenon.

[1] Monthly Weather Review, vol. 24, p. 77, 1896.
[2] Met. Zeit., vol. 23, p. 401, 1906.

Total Precipitation, June, 1912.

Departure of the Mean Temperature from the Normal, June, 1912.