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J. S. Ricard

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March, 1918

The Sunspot

CONTENTS

BY

J. S. RICARD

OBSERVATORY UNIVERSITY OF SANTA CLARA

SANTA CLARA, CALIFORNIA

U. S. A.

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Entered as second class matter March 24, 1915, at the Post office at Santa Clara, Cal., under the Act of March 3, 1879.

VOL. IV. MACH, 1918 NO. 1

The March Weather

March is generally a stormy and rainy month. There is some well-founded evidence that this year, it will not belie the old tradition. Only the rainfall will be better distributed than during February. The sun being a huge magnet and its spots minor magnets of great power, it cannot approach and recede from the earth's equator, without leaving unmistakable traces of its passage. This, after all, is the fundamental reason of the so-called equatorial storms. Those who contend that individual sunspots have but little influence if any on the earth, mean only **directly**. For, in order to explain the other influence, the so-called **indirect** one, they are building a whole structure of cathode rays, β rays and what not; and, besides, mobilize a whole army of ionized ether and air particles in order to affirm in the second breath what they have denied in the first.

The main storms of the month will develop on this Coast, without affecting equally every part of it, specially on March 13, 19, 25 and 28. A great high pressure area will start on the 26th, followed by reinforcements till the end of the month, producing severe colds in the Northwest, extending very far down this way and making the citrus fruit growers look out.

An area of proportionately low pressure (stormy area) will intersect the period March 26-30, and another immediately follow said period. Also, the interval March 2-5 is expected to be severely disturbed with both high and low barometers.

The March Stormy Areas.

These will arrive on

March 1, 5, 7, 9, 13, 16, 19, 22, 25, 28, 31, April 3, 5, 9.

The Highs of March, by Sunspots Astride Central Meridian.

These consist of cold dry air falling from the upper regions of the atmosphere, pressing down the superficial air and making the barometer rise. In one and the same locality, they follow the storm whipping it away a tergo. For different localities, say British Columbia and California, they go nearly abreast; the high in the Far North, the low in the Warm South. And this is the reason of our late drenching. If the high should insist on landing repeatedly over California, then the low will equally insist landing over the Northwest, which means a drought for these parts and the loss of millions in grass, fruit, grain and cattle.

The dates for the arrival of the highs follow:

March 1, 3, 5, 9, 12, 15, 18, 21, 24, 27, 30, April 1, 5, 9.

Revamping of Old Objections

(Editorial Page of the San Diego Sun, Jan. 16, 1918.)

Old objections to a new truth die hard. There are yet those in this very country of ours who still hold, prove and teach that the earth is an indefinite plane or a something in the form of a saucer. And, although their proof is in itself hackneyed, erroneous and illogical, it nevertheless is cogent to them. Similar to this may be, and no doubt is the case as regards rain and sunspots.

It seems to be the fashion now-a-days with certain men, otherwise of high standing in the world of science and worthy of all respect, to think in all seriousness that learning in one line is learning in all lines. Thus, the astronomer as such forgetting that in all likelihood he is not the meteorologist that he takes himself to be, is apt to venture forth into the realm of the weatherman, there to get trapped in a pitfall, than which nothing can be more harmful to the progress of science.

To exemplify. Some one among these modern gentlemen might reason thus. The variations of sunspottedness are visualized in a curve. The rainfall over a given area is also visualized in like manner. But the two curves do not agree. Therefore sunspots and rainfall are mutually independent. Or, in other words, a maximum of sunspots may equally correspond to a minimum or a maximum of rainfall over a given area and conversely. Many a time have we been regaled with such dainty specimens of specious reasoning.

But the meteorologist rebels at once and throws down the gauntlet. He would say:—Rainfall is attached to an area of low barometer on the approach of an area of high barometer. These areas are in strict correspondence to sunspots or their equivalents in due positions. The same areas invariably change their path across the country week in and week out, month in and month out, year in and year out. Therefore rainfall can be due to sunspots or their equivalents, without any correspondence whatever between the sunspot curve and the rainfall curve for San Diego or Santa Clara or any other place in creation.

Right here the objector is on his feet again, urging that rain, if originally due to sunspots, should fall **equally** over the same parallel of latitude; nay, that it should fall **equally** over the whole earth, "as one can readily see." In fact, it has been shown that sunlight reaches the earth in 8 minutes. Whence it appears that the action of a sunspot should likewise reach it in 8 minutes. And as the great circle passing through the centers of the earth and the sun, makes a semi-rotation in 12 hours, all the points which lie on it in the rear must be brought to the front once more in the same lapse of time, which means that in 12 hours, the effect of a sunspot must be equally diffused over the whole earth, from the Arctic circle down to the South Pole during our winter. Such is the objection and it is not minimized.

When a professor reaches certain portions of his subject with which he is not familiar, his wont is to say: "You can readily see." In the Dark Ages, people readily saw that the sun was going round the earth. In like manner, we of to-day must readily see that a sunspot must affect the whole earth. It is indeed hard to understand why some individuals should be so oblivious of Physical Science as dare to make such an assertion. No physical agent acts equally over the whole region within its reach, especially when the question of distance comes in to complicate matters. If you are talking to a large auditnce under an elliptical roof, the sound of your voice will be distinctly heard at and near the foci; but elsewhere people will say that man cannot be heard a few feet away from the center of action. So it is with heat and light, electricity and magnetism. The lightning does not fall everywhere, but only on a chosen spot, as any one can truly readily see. Had our distinguished friend never seen the lightning fall, would he argue that it must fall everywhere, "as any one can readily see"?

Why should not the same thing happen with sunspot activity is what is not so obvious, the moment we begin to reflect on it. As the sunspots are magnetic, they must act like magnets. Therefore in the display of their activity, their lines of force must make for the magnetic centers and go of preference where the centers of maximum intensity are to be found. The Carnegie Institution of Washington has discovered several of these centers of maximum intensity. There is one near Juneau; there is another in Siberia; and, if our memory is not at fault, there is another in or near the Caribbean Sea.

On the other hand, it is well-known that the storms of these parts of America are bred and reared in the North Pacific, whence they speed away on their southeastward journey. And again storms go around the magnetic poles with variable southward and northward extensions. And upon this their demeanor, the U. S. Weather Bureau had built a system of forecasting at a long range, until they found that the highs and the lows would sometimes exchange places and thus vitiate the forecast.

Passing over the fact that astronomers, on the whole, are only a poor set of meteorologists, it is not true that they have found no concurrence between sunspots and weather. Frank Bigelow of the U. S. Weather Bureau has found such a concurrence. The Observatory of Santa Clara has most distinctly found such a concurrence. Prof. Campbell, Director of the Lick Observatory, has affirmed such a concurrence in the matter of temperature. No man who thinks at all can deny that temperature belongs to the weather. Through variations in temperature alone, some meteorologists explain the origin of both the highs and the lows. Thus Prof. Willis L. Moore, for 18 years head of the U. S. W. B., ably seconded by W. F. Carothers.

As to Santa Clara guessing at the weather, it is a sheer calumny that our southern friend can retract at his own leisure. We are so far from guessing that, every year, we spend two or three months of arduous labor converting heliocentric into heliographic coordinates in order to know **where** and **when** the sunspots of the future will be astride the central meridian; for, at that very time, allowing 8 minutes if you so please, masses of cold dry air will fall on some preferred portion of the Coast, making the barometer rise and nearly three and a half days later, the barometer will fall, generating the storm.

Sunspots and equivalents cross the central meridian at very various times. Hence there is no **fixed** interval between storm and storm; counter-storm and counter-storm. Sometimes said internal is 1 day, sometimes 2, sometimes 3, sometimes 4, sometimes 5, and sometimes even 6. Hence the guesser is invariably bound to end in dismal failure, just as much as the clumsy rain-faker. Hence the idea of building on the arithmetical series

0. 5. 10. 15, 20. 25. 30. . . . .,

or

0. 4. 8. 12. 16. 20. 24. 28. . . . . .

or, again,

0. 3. 6. 9. 12. 15. 18. 21. 24. 27. . . . . .

is the fruit of a distracted imagination, pursuing an ignis fatuus in the darkness of night, in utter oblivion of the concrete realities of physical nature.

Planetary Phenomena for March

(Gr. mean-time. Subtract .33 for S. P. T. and convert remaining decimal into hours.)

On March 2.59, **Mercury** lies opposite Saturn, on the other side of the sun. On March 5.87, it and Uranus stand in **heliocentric opposition.** On March 12.61, it lies opposite Earth in the rear of the sun. On March 12.90, it arrives at a point behind the sun opposite Mars. On March 18.31, it does the same for Venus. On March 27.82, it and Jupiter stand in line with the sun, at this side of the latter. As soon as Mercury has passed the earth-sun line on March 12.61, it becomes an evening star.

Venus has been a morning star since Feb. 9.58. Weather conditions here did not allow observation while it had the singular privilege of being both an evening and a morning star at the same time, which was that of **inferior conjunction.** Venus will be at her maximum distance from Mercury on March 18.31. The early riser can behold her in great splendor in the morning sky.

In the race around the ecliptic, **Mars** is overtaken by Earth on March 14.77, being thus left at the east of the earth-sun line and thereby becoming an evening star. Mars can be seen in the morning when devout people go to prayer. It lies about 30° west of the meridian. There is much of the spectacular about it, with a spread of redness, somewhat like the glow of the setting sun pictured on a dark cloud overhanging the horizon. It can be seen also, but to less advantage, in the eastern sky from 8:30 onward. On March 14.77, it will rise at sunset, and by the end of the month, it will have ascended to fair heights for an evening scrutiny. An opposition of Mars like the forthcoming one, is most welcome to the star-gazer. But, as on March 14.77, it is a little less than 11° 44′ 43″ north of the equator, the southern observer is infintely better situated than we who stand north of the 37th parallel of latitude. In order to get a clear idea of the circumstance, let a straight line shoot forth from the sun through the earth and indefnitely beyond. It will strike Mars in the very heart, somewhere in the east, at its shortest distance from here, a bagatelle of a little less than 36,000,000 miles, as against 118,000,000 miles at maximum when the planet is describing the other part of its orbit in the rear of the sun.

Jupiter is yet at the service of any observer from nightfall to past midnight.

Saturn is still at the eastern apex of an isosceles triangle formed by joining Procyon and Pollux to each other and to the next brightest object at the east, which is the planet.

Neptune, not moving as fast as Saturn, is getting left somewhat behind, say 8° east of Saturn. It is not hard to find, after a little practice in observational diagnosis.

Uranus remains still at the west of the earth-sun line in those vast regions of space which lie on the other side of the sun. It is, of course, a morning star.

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April, 1918

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VOL. IV. APRIL, 1918 NO. 2

The April Weather

Showery April bodes well. The splendid conditions ushered in by March will be sustained and brought to a satisfactory finish. More rain, more showers, more sunshine. No great promise of chilling blasts or damaging frosts, beyond what the alertness and skill of the farmer can easily counteract.

Nature, like ourselves, seems to be subject to the law of habit. So, if the weather, once for all, falls into the habit of raining, as it has during March, in virtue of this new disposition, it will keep raining for a fairly long period, say until the dawn of summer. In point of fact, this figurative language means that those portions of the great North Pacific **low** which, abandoning the parental home, start on a tour of the world, include California in their itinerary, instead of tracing a more direct path to the eastward.

The Lows of April and the Early Part of May.

These stormy areas will land for the most part in Southern Alaska or Upper British Columbia, very approximately on the following dates:

April 4, 8, 12, 16, 20, 23, 26, 30, May 4, 7, 11.

These dates can be calculated directly; but there is no need. This time, we have simply added 3 instead of 4, as was our wont, to the dates for the arrival of the highs. The trouble is that the number to be added is a variable fraction oscillating between 3 and 4. This degree of accuracy, however, is amply sufficient for any practical purpose. Those affected with unbelief, mistrust or contempt require absolute mathematical rigor. Suppose we should exchange places, would they require it for themselves?

Dates for the Arrival of the Highs or Cool Waves.

These are:

April 1, 5, 9, 13, 17, 20, 23, 27, May 1, 4. 8.

The Heavier Disturbances of April.

1. **High April 5; low April 8;**
2. **High April 11; low April 14;**
3. **High April 13; low April 16;**
4. **High April 20; low April 23;**
5. **High April 27; low April 30.**

N. B. The high barometric area of the 11th counts as a reinforcement to that of the 9th and the low barometric area of the 14th as an addition to that of the 12th.

Opposition of Mars March 14, 1918

On March 14.77, Greenwich mean time, which translated means March 14 at 10:33:36 p. m. standard Pacific time, Mars, earth and sun will stand on line. It is one of those rare opportunities when Mars is best situated for a study of its surface, owing to its comparative nearness to earth.

Assume the **mean** distance from earth to sun to be 92,897,416 st. miles. On that basis as the unit of planetary distances, the logarithm of the radius vector of Mars, for the precise moment of opposition, is 0.2191361 and its distance from the sun 1.6563. On the other hand, the logarithm of the radius vector of earth, for the same moment, is 9.9976951 and its distance from the sun 0.994704. Multiplying the mean distance from earth to sun by 1.6563 and 0.994704, respectively, we find, for the time of opposition:

153,864,982 st. miles, distance of Mars to Sun;
92,405,702 st. miles, distance of Earth to Sun;
61,459,280 st. miles, distance of Earth to Mars.

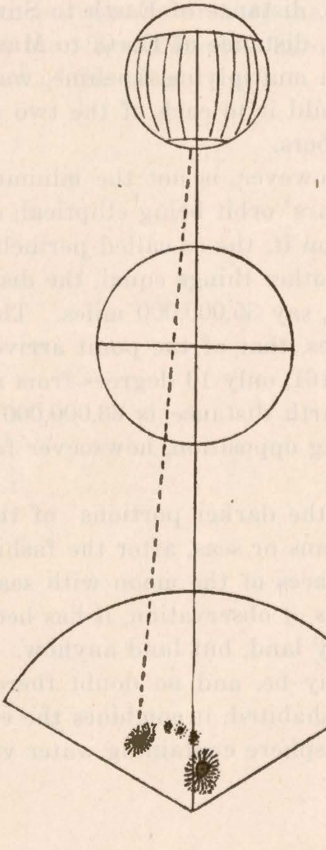
In the absence of a multiplying machine, we get the logarithm of the mean distance, add it to each of the two above and look up the corresponding numbers.

61,000,000 miles, however, is not the minimum distance from earth to Mars. For, Mars' orbit being elliptical, eccentricity 0.0933, there must be a point on it, the so-called perihelion, which is nearest to the sun. Hence, other things equal, the distance from here to Mars can be much less, say 35,000,000 miles. The longitude of the perihelion is 335 degrees, that of the point arrived at on March 14 is only 174, difference 161, only 19 degrees from aphelion, where, at opposition, the Mars-earth distance is 63,000,000 miles, whence we perceive that the coming opposition, howsoever favorable, is not superlatively so.

Once upon a time the darker portions of the Martian surface were thought to be oceans or seas, after the fashion of Galileo, who filled all the vacant spaces of the moon with seas. But nowadays, with our superior means of observation, it has been ascertained that it is all land, not all dry land, but land anyhow.

Although there may be, and no doubt there is, lack of proof that Mars is **actually** inhabited, it combines the conditions of habitability. It has an atmosphere containing water vapor in which men can live. It is easier on the lungs to breathe a rarified air, as is the case on Mars, and never so oppressive as when our barometer stands above 30. Its mean temperature is about 48 degrees Fahrenheit, when a light overcoat becomes too heavy. Mars is a place where the drys can thrive. There is plenty of fresh water on it in streams that flow from the snow or ice caps during the spring and the whole summer.

Some wonderful things have been done on that planet. No earthly men ever built canals like those they have up there. If you understand, and surely you do, what a great circle of the sphere is and what an argument for design it contains, you will easily discover the might of intelligence that presided over the construction of those canals. These, of course, should not be understood as great waterways, establishing lines of communication between the two poles of our sister planet, but as wide strips of blue-green vegetation, alimented from the true but invisible canals or streams connecting the two poles.



The Planets for April

Mercury crossed the earth-sun line on the other side of the sun on March 12.61, thereby becoming an evening star. Since then it has been traveling toward the easternmost point of its orbit and it will reach it on April 7. After this, it once more begins the journey toward **inferior** conjunction where it will be on April 26.64; whence it appears that it can be observed to best advantage during the first week in April and to less satisfaction during the 2nd week. After that, it sets rapidly in the evening twilight.

Venus has been a morning star since Feb. 9.58 and it will remain such till Nov. 23.52. It shines with great effulgence in the eastern sky before sunrise and can be seen even after sunrise, if only one knows where to look for it.

Mars has been an evening object since March 14. It now occupies a very prominent place in the eastern sky, it being singled out from among the other denizens of the sky by its redness. It can be observed into the wee hours of the morning. On April 18.70, the sun, Mercury and Mars will stand on line.

Jupiter is drifting gradually into the western sky and is most favorably situated for evening observation. By the end of the month, it will set before 10 p. m. On April 24.37, it will stand in line with the sun and Venus: heliocentric opposition.

Saturn and **Neptune** are still evening objects observable practically throughout the whole night. On April 6, Saturn and Mercury are in line with the sun, and on April 5 Neptune and Mercury are similarly situated.

Uranus will be in heliocentric opposition to Mercury on April 8. It has been lagging behind at the west of the earth-sun line since Feb. 12.71, thus playing the role of a morning star.

N. B. Time used in the above dates is Greenwich mean time.

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May, 1918

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VOL. IV. MAY, 1918 NO. 3

The May Weather

Certain indications of summer weather have already set in, such as the persistence of the Southern low pressure and attendant heat as well as the high geographical position of the low pressure areas that start from the Aleutian Archipelago, along with a predominance of comparatively high pressures over Central and Northern California and the Southernmost portions of Oregon and Idaho.

It would, however, be presumptuous to announce that May will go entirely immune from rain. In matters meteorological, the expected and the unexpected often interchange places, the only requisite for that being, as indicated above, a slight alteration in the relative positions of the highs and lows which, by an unalterable decree of nature, constitute the very **substance** of weather; wind, water vapor condensation in all its forms, temperature, percentage of humidity, even the electromagnetic status itself, being only the passing and fitful **accidents.** Hence the need of great caution in tracing the possible effects of sunspots, where hastiness, as has been seen more than once, may cause the otherwise clever reasoner to conclude a **substantial** disconnection from a merely **accidental** disagreement, occasioned either by a simple change of the storm-track or some other accidental cause.

The Lows for May and the First Part of June.

These stormy areas will begin to enter upon the Coast and develop themselves in the following order:

May 1, 4, 7, 11, 14, 18, 22, 25, 28, June 1, 5. 8.

Needless to say that only a few of these storms will affect California. By far the largest number will pass along to the eastward or the southeastward, without any other sign of their crossing than a few cirrus clouds or lifted morning fogs along the immediate Coast, which may include from 50 to 100 miles inland.

The Heaviest Disturbances of the Month.

1. High, May 4; Low, May 7.
2. High, May 22; Low, May 25.

The High Pressures for May and First Part of June.

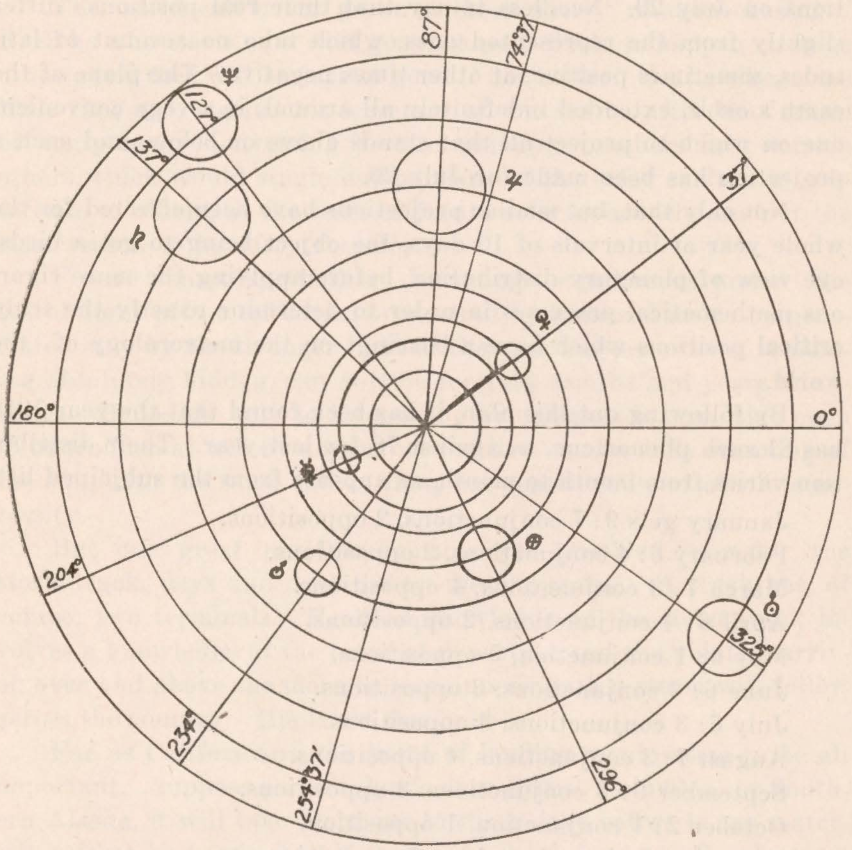
The high pressure areas or counter-storms will land according to the following schedule which differs but slightly from the one calculated for the lows.

May 1, 4, 8, 11, 15, 19, 22, 25, 29, June 2, 5, 8.

N. B. The high pressures start at 30.0 (barometric reading) and rise successively to 30.1, 30.2, 30.3, 30.4 and sometimes higher. This successive rise is accomplished by a number of reinforcements which for brevity sake are here omitted.

Widest Scattering of Planets During 1918

(Occurring in July.)



EXPLANATORY NOTE—The plane of the paper may represent the plane of the ecliptic. On this plane, the planets are shown in their respective positions, around the sun in the innermost circle. No attempt has been made to be accurate in their distances from the great luminary, nor are the dimensions true to nature. Saturn in particular is much too large and Jupiter too small in comparison. The line 0°-180° is the Equinoctial line; the line 74° 37′-254° 37′, the sun's Nodical line; the line 296°, prolonged through and beyond the sun, the earth-sun line. When a planet is 90° away from any one of these lines it is said to be in Quadrature. The two first lines are practically fixed, the third varies, moving very nearly one degree per day to the eastward. Hence the quadrature, say, of Jupiter, should be taken to the fixed lines, preferably to the earth-sun line. A certain writer is making Jupiter responsible for untold woes, when in quadrature with respect to the earth-sun line and for benefits unnumbered when quite away from quadrature. Wonder how much science there can be in these assertions!

In singular contrast to the small sector of the ecliptic occupied by the planets December 1917 and January 1918, stands their wide dispersion during July 1918. The above diagram shows their positions on July 20. Needless to say that their **real** positions differ slightly from the represented ones, which take no account of latitudes, sometimes positive, at other times negative. The plane of the earth's orbit, extended indefinitely all around, is a very convenient one on which to project all that stands above or below, and such a projection has been made for July 20.

Not only that, but similar projections have been effected for the whole year at intervals of 10 days, the object being to get a birdseye view of planetary distribution, before applying the more rigorous mathematical processes in order to determine exactly the truly **critical** positions which have a bearing on the meteorology of the world.

By following out this plan, it has been found that the year 1918 has 81 such phenomena, as against 78 for last year. Their distribution varies from month to month, as appears from the subjoined list.

January gets 9: 7 conjunctions, 2 oppositions.
February 6: 4 conjunctions, 2 oppositions.
March 7: 3 conjunctions, 4 oppositions.
April 6: 4 conjunctions, 2 oppositions.
May 6: 1 conjunction, 5 oppositions.
June 6: 3 conjunctions, 3 oppositions.
July 6: 3 conjunctions, 3 oppositions.
August 7: 3 conjunctions, 4 oppositions.
September 9: 6 conjunctions, 3 oppositions.
October 2: 1 conjunction, 1 opposition.
November 7: 2 conjunctions, 5 oppositions.
December 10: 5 conjunctions, 5 oppositions.
Total 81: 42 conjunctions, 39 oppositions.
Last year's total 78: 42 conjunctions, 36 oppositions.

The reader will naturally ask: Cui bono bestow so much labor on such an arid subject, so far removed from the prevalent commercialism of mankind. The answer is not far to seek.

Meteorology has, in more than one respect, run itself into a blind alley, where all further advance seems to be impossible. The chapter on "Forecasting" in particular lies covered with antique dust. Even Prof. Alexander McAdie, in his new book on "Aerology," with all its progressiveness, does not attempt to brush away the cobwebs from the musty shelf. And yet progress is the order of the day.

The world can never go on without some "rainbow-chasing." Even he who starts on a wild goose chase is liable to happen on some other game that will be just as good if not better. So, he who, some little time ago, started his secretary on the search after the origin of sunspots by converting certain planetry numbers into certain others which would single out portions of the solar surface in preference to others, as the seats of future solar upheavels, has not the least reason to be sorry therefor.

Future sunspots, whether becoming conspicuous under the search-light of the telescope, or covered by a solar haze to be penetrated only by the stronger light of the spetroscope, or even remaining absolutely hidden, can now be foretold months and years in advance. Hence the way to forecasting by sunspots is now wide open to be trodden at will by anyone who so lists; and a daily scanning of the sun, with the same end in view, has ceased to be of absolute necessity.

But one great problem remains yet unsolved, namely, the **storm-track,** days and days before the happening. A track has, of course, two terminals. Hence a knowledge of the storm-track involves a knowledge of the point of departure and the point of arrival, over and above the more or less sinuous path a storm will follow across the country. Hic labor, hoc opus!

For us Californians, the **point of landing** would seem to be all important. Suppose a storm lands over British Columbia, or Southern Alaska, it will take from one to three days before it can materially affect us here; but if it should land between Eureka and Rosebury, it will be upon us in from six to twelve hours; should it land between say San Luis Obispo or Monterey and Santa Rosa or Eureka with a point off shore opposite San Francisco as its center, it will pour a flood of rain over the whole region immediately affected in four or six hours or almost instantaneously, in which case, forecasting at sight as is ordinarily done by our experts, is hunting for a game which is already in the bag. The misfortune, however, is that this bag happens to be wrapped up in a London fog and cannot be seen. The storm which came here during the night of February 18-19 is a fair illustration of hypothesis No. 2.

I. PLANETARY HELIOCENTRIC PHENOMENA DURING MAY.

1. Mercury and Jupiter come to opposition (☍ ☿ ♃) on May 12.42.
2. Venus and Neptune come to opposition (☍ ♀ ♆) on May 24.18.
3. Mercury and Neptune come to opposition (☍ ☿ ♆) on May 27.86.
4. Venus and Saturn come to opposition (☍ ♀ ♄) on May 29.87.
5. Mercury and Saturn come to opposition (☍ ☿ ♄) on May 30.48.
6. Mercury and Venus come to conjunction (☌ ☿ ♀) on May 30.99.

II. ORIGINAL POSITIONS OF THE CORRESPONDING SUNSPOTS.

1. ☿ Spot { $\phi = -\ {}^\circ\ 24'\ 57''.5$
$\lambda = -\ 28^\circ\ 56'\ 40''.2 = 2.18$ days West of Central Meridian.

♃ Spot { $\phi = -\ 1^\circ\ 25'\ 24''.5$
$\lambda = \ 150^\circ\ 50'\ 34''.4 = 11.42$ days E.

2. ♀ Spot { $\phi = \ 3^\circ\ 15'\ 22''$
$\lambda = -\ 64^\circ\ 3'\ 19''.8 = 4.85$ days W.

♆ Spot { $\phi = -\ 5^\circ\ 58'\ 50''$
$\lambda = \ 113^\circ\ 31'\ 27''.5 = 8.60$ days E.

3. ☿ Spot { $\phi = -\ 0^\circ\ 52'\ 51''$
$\lambda = -\ 60^\circ\ 30'\ 38''.8 = 4.58$ days W.

♆ Spot { $\phi = -\ 5^\circ\ 51'\ 19''.2$
$\lambda = \ 120^\circ\ 3'\ 17''.2 = 9.09$ days E.

4. ♀ Spot { $\phi = \ 3^\circ\ 24'\ 10''$
$\lambda = -\ 64^\circ\ 31'\ 19''.4 = 5.11$ days W.

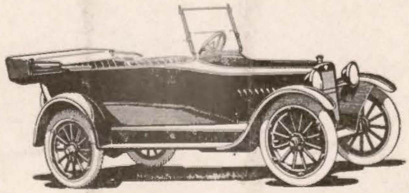
♄ Spot { $\phi = -\ 5^\circ\ 22'\ 51''$
$\lambda = \ 112^\circ\ 56'\ 37''.3 = 8.55$ days E.

5. ☿ Spot { $\phi = -\ 0^\circ\ 47'\ 14''$
$\lambda = -\ 66^\circ\ 51'\ 51''.7 = 5.07$ days W.

♄ Spot $\begin{cases} \phi = -\ 5^\circ\ 58'\ 50'' \\ \lambda = 113^\circ\ 31'\ 27''.5 = 8.60 \text{ days E.} \end{cases}$

6. ☿ Spot $\begin{cases} \phi = -\ 1^\circ\ 23'\ 25'' \\ \lambda = -\ 68^\circ\ 14'\ 52''.5 = 5.16 \text{ days W.} \end{cases}$

♀ Spot $\begin{cases} \phi = 3^\circ\ 30'\ 20'' \\ \lambda = -\ 67^\circ\ 56'\ 12'' = 5.15 \text{ days W.} \end{cases}$



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June, 1918

The Sunspot

CONTENTS

BY

J. S. RICARD

OBSERVATORY UNIVERSITY OF SANTA CLARA

SANTA CLARA, CALIFORNIA

U. S. A.

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The Sunspot

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VOL. IV. JUNE, 1918 NO. 4

The Weather for June

The Warm Waves.

During June, the low pressure areas with their ever faithful attendants, **the warm waves**, will develop on the more or less immediate coast according to the following schedule, based upon the arrival of solar disturbances somewhere between the 39th and 40th Meridian West, namely, on

June 1, 4 and 5, 7, 9, 11, 16, 19, 22, 26, 29, July 1, 4, 8,

The warmth will tarry from two to three days, not everywhere, but mostly in the region of the low barometer.

The Cool Waves.

Close upon the heels of the above, follow the areas of high pressure or cool waves which, upon their arrival, distribute a certain coolness all around and allay the ardors of the broiling sun. Descending noiselessly from on high, they gradually overpower the low, fill it up and take possession of its terrain. They will land as follows, namely, on

June 2, 4, 6, 8, 13, 16, 19, 21, 23, 26, 28, July 1, 4 and 5, 9, 12.

Not all of them will travel as separate entities from the Pacific to the Atlantic; but some of them, acting merely as reinforcements, will lose their individuality on their way to the eastward.

Disturbances of Greater Intensity.

These will be due in the following order and possibly cause tornadoes over the Plains States.

High, June 4; low, June 7.

High, June 14. low, June 17.

High, June 15; low, June 18.

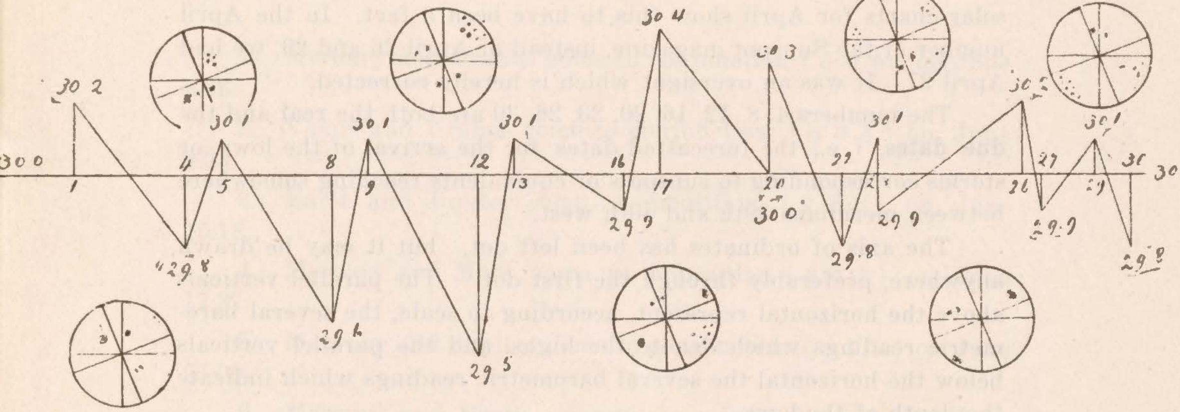
High, June 21; low, June 24.

High, June 25; low, June 28.

General Character of the Month.

During the course of June, the **trend of temperatures will be upwards,** especially after the solar eclipse of June 8; not causally, for its effect is rather in the opposite direction, but as a mere unconnected sequence; not as a mere effect of declination either, i. e., the advance of the sun to the northward, but owing to the quality of the causes at work. Briefly, June, as a whole, will be a warm month, fully making up for the rather salutary deficiency of warmth during May.

The Baro-Sunspot Curve for April, 1918



Substantially, the weather, lawless and capricious though it may seem to be, yields to the exigencies of mathematical rigorism. A glance at the above diagram, which is the skeleton frame on which the barometric curve can be laid, will convince the most skeptical and fastidious enquirer.

The figure is a true barogram representative of the amount of air pressure over those parts of the Pacific coast which were covered by the incoming highs and lows during April this year. Not only that, but the part of it which is of priceless value is that it shows the exact correspondence of barometric change with real individual sunspots or equivalents in certain definite and precise positions, namely, the central meridian and a place between the 39th and 40th meridians west.

Now by observation or calculation or both, it can be known for certain when sunspots or equivalents shall reach those meridians. It follows in due logical sequence that by virtue of the above-mentioned correspondence, one can with equal certainty foretell when the highs and lows of any given month or year shall set foot on certain preferred portions of the Pacific coast.

The horizontal line is the axis of abscissae on which the 30 days of April are marked by dots at equal distances. At this line, the barometer is supposed to read 30.0. The numbers 1, 5, 9, 13, 17, 20, 23, 26, 29 are those days of the month on which the highs, as forecasted, were expected to make their appearance, on the ground that simultaneously sunspots or equivalents were, according to calculation, to be astraddle the central meridian or very nearly so. The solar charts for April show this to have been a fact. In the April number of the Sunspot magazine, instead of April 26 and 29, we had April 27. It was an oversight which is hereby corrected.

The numbers 4, 8, 12, 16, 20, 23, 26, 30 are both the **real** and the **due dates,** i. e., the forecasted dates for the arrival of the lows or storms corresponding to sunspots or equivalents reaching somewhere between meridians 39th and 40th west.

The axis of ordinates has been left out, but it may be drawn anywhere, preferably through the first dot. The parallel verticals above the horizontal represent, according to scale, the several barometric readings which denote the highs, and the parallel verticals below the horizontal the several barometric readings which indicate the depth of the lows.

Finally, to fill up vacant spaces, several suns have been drawn at random with groups of spots in various places, some on central meridians, others anywhere, just to impart a general notion. The lines in the suns are the celestial axis and equator, the solar axis and equator respectively, at an angle of nearly 26 degrees during April.

Planetary Heliocentric Phenomena for June, 1918

1. Mercury and Uranus come to conjunction (☌ ☿ ♅) on June 2.08.

2. Venus and Uranus come to conjunction (☌ ♀ ♅) on June 4.23.

3. Earth and Jupiter come to opposition (☍ ⊕ ♃) on June 15.18.

4. Mercury and Mars come to opposition (☍ ☿ ♂) on June 17.37.

5. Mercury and Jupiter come to conjunction (☌ ☿ ♃) on June 25.00.

6. Mercury and Earth come to opposition (☍ ☿ ⊕) on June 26.60.

Original Position of the Respective Solar Phenomena

1.	☿ Spot	$\phi=$	—0° 6′ 52″.6
		$\lambda=$	—73° 35′ 28″=5.57 days West of Central Meridian.
	♅ Spot	$\phi=$	6° 5′ 26″.3
		$\lambda=$	—73° 32′ 19″.7=5.57 days West.
2.	♀ Spot	$\phi=$	3° 40′ 58″
		$\lambda=$	—70° 28′ 5″=5.34 days West.
	♅ Spot	$\phi=$	6° 5′ 39″
		$\lambda=$	—70° 21′ 54″=5.33 days West.
3.	⊕ Spot	$\phi=$	—0° 10′ 13″.3
		$\lambda=$	0° 0′ 0″, i. e., on Central Meridian.
	♃ Spot	$\phi=$	—1° 30′ 2″
		$\lambda=$	180° 2′ 48″.9=13.64 days East.
4.	☿ Spot	$\phi=$	3° 10′ 47″
		$\lambda=$	—131° 37′ 52″.7=9.97 days West.
	♂ Spot	$\phi=$	—4° 1′ 56″
		$\lambda=$	48° 8′ 11″.7=3.65 days East.
5.	♂ Spot	$\phi=$	2° 57′ 48″
		$\lambda=$	—172° 4′ 36″.2=13.04 days West.
	♃ Spot	$\phi=$	—1° 35′ 46″
		$\lambda=$	—171° 30′ 30″.7=12.99 days West.
6.	☿ Spot	$\phi=$	6° 33′ 28″.8
		$\lambda=$	178° 55′ 3″.2=13.554 days East.
	⊕ Spot	$\phi=$	2° 28′ 33″
		$\lambda=$	0° 0′ 0″, i. e., on Central Meridian.

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July, 1918

The Sunspot

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VOL. IV. JULY, 1918 NO. 5

The Weather for July

THE GENERAL CHARACTER OF THE MONTH.

Excepting San Francisco and some similar spots on the Coast, where western currents play a winter game in proportion to the prevalence of dissimilar conditions a few miles inland, it may be stated with the assurance of physical certainty, that July will generally be a very warm month over the Pacific States.

The proximate cause of these warm or hot spells lies in the relative positions of the highs and lows, the latter being tenaciously attached to the South and the former to the Northwest and the Northeast, whence it follows that huge masses of air heated by internal friction, celerity of movement and contact with the ground as a reservoir of heat, fall hitherward and thitherward as if blowing from the mouth of an oven. Hence it is that the cool wave which is only another name for an area of rising barometer, is a powerful contributor to the making of a hot wave, in that it erects a mountain of air which, though crisp and cold at first, is destined to become a storer and a distributor of heat in those regions through which the area of low barometer directs the flow.

It follows, too, that the **scientific** cause of warm or hot spells must be that which produces the highs and lows and presides over their location, quantity and distribution. And here we may hint at the variable output of solar heat and those mighty electromagnetic currents which, originating in sunspots, rive their way acrorss ethereal spaces and, reaching our atmosphere, determine therein those self-same rotations by which they are themselves animated.

THE JULY WARM WAVES.

These will reach the immediate Coast on

July 1, 4, 7 and 8, 12, 15, 18, 21, 24, 26, 29, Aug. 1, 4, 6, 9.

THE COOL WAVES.

These will alight on the immediate Coast on

July 1, 4 and 5, 9, 12, 15, 18, 21, 23, 26, 29, Aug. 1, 3, 6, 9, 12.

As stated above, these areas of rising or high barometer will land mostly from Central California to the northward and very soon after their landing, contribute powerfully to the making of hot waves not only in the South, but also here and in the very heart of the great Northwest.

Just a few of the areas of low pressure will arrive by way of North and distribute some scanty rains.

THE MAIN DISTURBANCES OF JULY.

1. High July 5; low July 8.
2. High July 9; low July 12.
3. High July 12; low July 15.
4. High July 15; low July 18.
5. High July 18; low July 21.
6. High July 23; low July 26.
7. High July 26; low July 29.

The Whirling Psychrometer

We read in "Current History": "On April 8, 1918, there were heavy bombardments in the region of La Bassée and Armentiéres which were followed by strong attacks on this front." "And on April 9, 1918, General Haig reported:" "Favored by a **thick mist which made observation impossible,** the enemy succeeded in forcing his way into the Allies' positions in the neighborhood of Neuve Chapelle."

Are there any meteorologists at the front? Were it not worth our while to guard our soldiers there against sudden attacks under the cover of heavy fogs or mists or other forms of condensed water vapor which render ordinary observation impossible?

There is in our midst a humidity instrument called "**Whirling Psychrometer**" used by the U. S. Weather Bureau and certain co-operative observers, with the full approval of the Chief at Washington, which, by means of an apparently **insignificant difference,** enables the weatherman to tell the actual percentage and the pressure of water vapor present in the air, along with the temperature of the dew-point.

Through an intelligent use of such data, it is possible to tell with physical certainty the state of the weather for the next morning. According to our experience, a rise of 1, 2, 3, etc. millimeters in the amount of vapor pressure, means a more or less thick fog the next morning; likewise, a considerable rise in the humidity percentage means clouds or an overcast sky the next morning; and, again, a rising barometer, under favorable conditions, means very much the same thing. Why would not our army leaders avail themselves of such precious advantages against an insidious foe?

The trouble may be that meteorology is set aside in our universities and colleges and even derided by a host of men who are certainly entitled to know better.

Sunspots Up to Date

In appearance, sunspots of integral form consist of **umbrae, nuclei, penumbrae** and **bright rings.** The umbra is a shaded area of a deep violet-blue tint. The nuclei are still darker patches within the umbra. The penumbra is a region of lighter hue surrounding the umbra in wavy filaments. The extremities of these filaments are tapering points curving over towards the umbra with diminishing brightness. The bright ring is a belt of narrow width between the umbra and the penumbra.

In reality, according to the latest spectroscopic observations, the umbra is a mountainous mass of metallic vapors expelled from the solar core, which, on rapid expansion, cool off, absorb solar light and by contrast look darker. The nuclei are those portions of the umbra where the expansion, the cooling off and the absorption being greater, cause greater darkness. Both the umbra and the nuclei rise above the common level of the sun's bright surface into the **Reversing Layer.** (See account of reversing layer below.)

The penumbra consists of the same vapors which caused the dark appearance, falling back all around radially, contracting, getting warmer, absorbing less light and, by the impetus of gravity, seeking a level slightly below the sun's bright surface. Hence its filamentous appearance and greater brightness. The bright ring separating the umbra from the penumbra, is the effect of the more rapid fall and heaping together, around the mouth of the crater, of brilliant photospheric clouds.

As a matter of experience at the Observatory of Santa Clara and as a sort of general rule, the first thing to appear on the eastern limb is a thick-set patch of intensely white clouds, the so-called **faculae,** within which one or more dots sooner or later intrude, as it were, to mar the prospect. Out of these, there generally evolves a **binary,** consisting of a **leader** and a **follower,** or of a western and an eastern spot, with several intervening minor spots mostly in the form of an arc. In this middle space, a vast display of energy has been observed. It is no doubt here that the opposite electricities of the loaded principals do combine in frightful discharges. At any rate, the spectroscope shows many reversals and distortions. At a later date, the subsidiary spots disappear; then the follower disintegrates and vanishes; next, the leader, too, as if tired of old age, dwindles down and is finally replaced by a family of dwarfs; the latter, in turn, goes off the scene, to be succeeded by many branching lanes of snow-white faculae.

By far the most interesting feature of the double spot formation is its **opposite polarity and rotation.** The leader and the trailer, as a whole, constitute a real magnet, in that the former exhibits one kind of magnetism and the latter the opposite kind, whence the name "**bipolar**" group. So, likewise, the leader has a left-handed or cyclonic rotation, and the trailer a left-handed or anticyclonic one. But this only in northern and middle solar latitudes. Reversions elsewhere.

It is not altogether certain, however, that the spots themselves do rotate, although what may be construed to be a gyratory movement has once in a while been observed in some of them; and this uncertainty applies equally well to all sunspot elements, as enumerated above.

In order to gain certainty, we have to pass through the Reversing Layer and go to the very top of Chromosphere and even beyond, and use a new instrument, known as the **Spectroheliograph.** What we see of the sun by means of ordinary optical appliances is only the **Photosphere,** i. e., the sun's bright light-giving surface. The next envelope is the reversing layer, some 500 miles in depth, whose existence is revealed to science by transforming a telescope into a **spectroscope.** By looking through this new eye-piece we no longer see a globe of dazzling splendor, which is the Photosphere, but as many variously-tinted regions as there are colors in the rainbow, and each region traversed by so many dark lines that the eye fails in the attempt to count them. The presence of these countless dark lines, it is contended, must be due to the absorption of photospheric light passing through a stratum of vapors and gases expanding and cooling. If the same stratum could be covered by placing a dark solid screen in front of it, the dark lines of the spectrum should suddenly become bright. This actually happens when the moon passes in front of the sun, when we have what is called the "**flash spectrum**". Thus, then, there exists around the sun a gaseous and vapory envelope which, through absorption, reverses the bright into the dark lines, whence the name **Reversing Layer.**

Still another envelope lies within the range of the spectroscope. It is the **Chromosphere,** which is about 3600 miles high and is full of hydrogen gas, of calcium and helium vapors and out of which shoot forth the **prominences,** whether **eruptive** or **quiescent.** Beyond the Chromosphere, at a height of between 15,000 and 16,000 miles, float luminous clouds of hydrogen and calcium, which have been called hydrogen and calcium **flocculi** respectively. No telescope, howsoever powerful, can make the flocculi visible, nor can the spectroscope either which gives only **spectral lines.**

Hence a special instrument had to be devised, which, as a modification of the spectroscope, is fittingly called **spectroheliograph.** This new apparatus is able to photograph not only the Photosphere and the spots, but also the Reversing Layer and the Chromosphere together with the luminous clouds of hydrogen and calcium. The spectroheliograms thus obtained show that the spots are covered and surrounded by the calcium and hydrogen flocculi and that, while the calcium flocculi give no evidence of gyratory motion, those of hydrogen, on the contrary, have a distinct linear structure strongly suggestive of magnetic whirls. This, taken with the now commonly admitted fact that the spots themselves can have a magnetic field able to rise to 4500 units, an intensity equal to 9000 times that of the earth's, is ample proof that very much of the whole sunspot edifice must consist of rotary movement.

Therein may be found the **scientific** link between sunspots and weather which hitherto has existed as a mere fact of observation, entirely sufficient for the forecaster, but wholly insufficient for the philosopher. Let the leader spot of the aforesaid binary be astride the sun's central meridian. Its lines of magnetic force will be along the line of sight and **cyclonic.** Therefore, on reaching the earth, they will determine in the gases which constitute our atmospheric envelope, a like **cyclonic motion**—which is a storm. Let the trailer spot arrive also at the central meridian. Its lines of magnetic force will likewise be along the line of sight, but **anticyclonic.** Hence, on reaching our atmosphere, they must determine therein an **anticyclonic motion**—which is the counter-storm or area of rising barometer.

In conclusion, it may be stated in general that sunspots are cooler and faculae warmer than the Photosphere; that the sun, as a whole, is a powerful magnet with its poles near the geographical; that the spots, though subsidiary magnets, possess many more lines of force; that the temperature of the Photosphere, on the absolute centigrade scale, is about 6000 degrees; and that of the spots about 3500, which permits the formation of chemical compounds.

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August, 1918

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VOL. IV. AUGUST, 1918 NO. 6

The August Weather

Broadly speaking, a weather disturbance consists of an area of high barometer followed by an area of low barometer. In a more limited sense, however, the word "disturbance" is reserved to denote an area of low barometer. Generally speaking, the warm wave goes with the low barometer; but, as shown in the July issue of this magazine, the cool wave of the high barometer quickly translates itself into a source and reservoir of heat. In such a case, the high blows additional heat into the low.

THE MAIN DISTURBANCES OF THE MONTH.

These will enter on the following dates:

1. High August 3; low August 6.
2. High August 11; low August 14.
3. High August 16; low August 19.
4. High August 23; low August 26.
5. High August 28; low August 31.
6. High August 30; low September 2.
7. High September 10; low September 13.

The above disturbances, whether it be the high or the low, do not necessarily come in first, but sometimes creep in as the complement of a disturbance which is already on the Coast. Hence, in order to fill any possible gap, we subjoin the general list of the highs and lows for August and the first decade of September.

THE WARM WAVES.

These will be due to enter upon the Coast on

Aug. 1, 6, 9, 13, 15, 19, 22, 26, 29, Sept. 2, 5, 9.

THE COOL WAVES.

The corresponding Cool Waves will be expected on

Aug. 3, 6, 10, 12, 16, 19, 23, 26, 30, Sept. 2, 6, 9.

N. B. Venus and Jupiter will be in line with and on the same side of the sun on August 21.83, say August 22. It is a rare occurrence greatly affecting the weather and also the solar surface. The spots due to that phenomenal meeting will not be astride the Central Meridian before September 10. On that day, watch for a big barometric rise and a corresponding depression on September 13.

The Earthquake of July 14th, 1918

For beauty, clearness and completeness of description, the record of the earthquake of July 14 is hardly surpassed by any previous one. It has all the recognized phases: the two preliminaries, the long waves, the maximum and an infinity of insensibly waning trailers, dying away like the roar of a distant thunder-storm traveling at the rate of 500 miles an hour.

One highly appreciated feature of it is that the scene of disturbance was near enough to inscribe a faultless record, and far away enough to have left no trace of its happening. It passed through Eureka as a mighty wave, doing no damage, was felt along and near the San Andreas rift, as for instance at Boulder Creek and Morgan Hill, and traversed the whole of the Santa Clara Valley mostly unfelt.

The record is entirely along the east-west line, with an indecision, which is altogether removed by further examination and the fact of greater intensity at Eureka than farther inland. According to the record, the seat of the subterranean explosion was 362.43 miles, direct west of this station, below the ocean bottom.

The calculated elements stand as follows, in standard Rocky Mountain time, which is that of the 105th meridian, now replacing the 120th, for the sake of light saving.

P=4:25:57 p. m.,
L=4:27:12 p. m.,
M=4:28:37 p. m.,
C=4:32:57 p. m.,
F=5:17:57 p. m.,
A=44 mm. p. m.,
Period=1½, 3, 6 seconds,
Distance=583.25 Kms,
=362.43 st. mi.,
Azimuth=90° West.

N. B. P stands for beginning of 1st preliminary tremors; L for long waves; M for maximum; C for trailers; F for ends; A for amplitude.

The formula for distance is

$$x=(7.27)\,y+38.$$

Heliocentric Planetary Phenomena

1. Venus and Mars come to opposition (☍ ♀ ♂) on Aug. 4.64.
2. Earth and Saturn come to opposition (☍ ⊕ ♄) on Aug. 11.08.
3. Earth and Uranus come to conjunction (☌ ⊕ ♅) on Aug. 19.04.
4. Venus and Jupiter come to conjunction (☌ ♀ ♃) on Aug. 21.83.
5. Mercury and Neptune come to opposition (☍ ☿ ♆) on Aug. 23.99.
6. Mercury and Saturn come to opposition (☍ ☿ ♄) on Aug. 27.36.
7. Mercury and Uranus come to conjunction (☌ ☿ ♅) on Aug. 29.30

Original Positions of the Corresponding Sunspots

1. ♀ spot $\left\{ \begin{array}{l} \phi = 0^\circ\ 46'\ 46'' \\ \lambda = -110^\circ\ 7'\ 21''.2 = 8.34 \text{ days W.} \end{array} \right.$

   ♂ spot $\left\{ \begin{array}{l} \phi = -2^\circ\ 0'\ 42'' \\ \lambda = 69^\circ\ 43'\ 18''.5 = 5.28 \text{ days E.} \end{array} \right.$

2. ⊕ spot $\left\{ \begin{array}{l} \phi = 6^\circ\ 28'\ 57''.5 \\ \lambda = 0^\circ\ 0'\ 0'' \end{array} \right.$

   ♄ spot $\left\{ \begin{array}{l} \phi = -7^\circ\ 36'\ 57''.1 \\ \lambda = 180^\circ\ 3'\ 58'' = 13.636 \text{ days E.} \end{array} \right.$

3. ⊕ spot $\left\{ \begin{array}{l} \phi = 6^\circ\ 51'\ 27''.6 \\ \lambda = 0^\circ\ 0'\ 0'' \end{array} \right.$

   ♅ spot $\left\{ \begin{array}{l} \phi = -7^\circ\ 35'\ 22''.3 \\ \lambda = -0^\circ\ 3'\ 5''.2 = 0.004 \text{ days W.} \end{array} \right.$

4. ♀ spot $\left\{ \begin{array}{l} \phi = -1^\circ\ 10'\ 7'' \\ \lambda = -121^\circ\ 7'\ 23''.3 = 9.17 \text{ days W.} \end{array} \right.$

   ♃ spot $\left\{ \begin{array}{l} \phi = -1^\circ\ 52'\ 4'' \\ \lambda = -121^\circ\ 7'\ 23''.3 = 4.17 \text{ days W.} \end{array} \right.$

5\. ☿ spot { $\phi = -12^\circ\ 36'\ 23''.9$
$\lambda = 24^\circ\ 10'\ 20''.6 = 1.83$ days E.

♆ spot { $\phi = -5^\circ\ 50'\ 51''$
$\lambda = -156^\circ\ 18'\ 24''.4 = 11.85$ days W.

6\. ☿ spot { $\phi = -13^\circ\ 30'\ 28''.3$
$\lambda = 15^\circ\ 40'\ 36''.8 = 1.11$ days E.

♄ spot { $\phi = -5^\circ\ 32'\ 38''$
$\lambda = -164^\circ\ 52'\ 52''.5 = 12.49$ days W.

7\. ☿ spot { $\phi = -13^\circ\ 47'\ 5''.7$
$\lambda = 10^\circ\ 4'\ 31'' = 0.76$ days E.

♅ spot { $\phi = -7^\circ\ 36'\ 40''.4$
$\lambda = 9^\circ\ 52'\ 43''.3$ E.

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VOL. IV. SEPTEMBER, 1918 NO. 7

The September Weather

The Goose and the Duck as Weather Forecasters.

Rumor has it in the rice-fields of Sacramento Valley and the bean plantations of the South, that the wild goose and duck, led by unerring instinct, have bidden a hasty adieu to the ice-cold regions of the Far North, in obedience to a call to the milder climate of these lower latitudes, the obvious inference being that early rains and temperatures below normal will seriously interfere with rice-harvesting and greatly impair the value of the bean crop.

It may serve a good purpose to recall, in this connection, how a neighboring weatherman of great zeal has latterly administered a severe rebuke to the poor hedgehog for daring trespasses on the province of official meteorology. What the same gentleman and others of the same high rank think of the forecasting virtue of the wild goose and duck, it is not our privilege to be able to tell.

It is, of course, clear and beyond the range of doubt, that nature is infallible and such infallibility attaches to any true natural sign. But the same cannot be predicated of the conclusions of certain reasoners. An early departure from a certain region, may, at the utmost, be taken as an infallible sign of bad weather coming over that region, although even this much may possibly be questioned; but it is not necessarily a sign of such weather invading the region arrived at also. That entirely depends on the storm-track, which, as is well-known, is as inconstant as the gyrations of the weather-cock. It is not usual for any one storm, nay it is most unusual, to cover the whole length and far less usual the whole width of the country.

All that may be looked upon as certain in the **goose-duck sign,** is that wild fowl are in search of food and shelter. More certainty about an early winter and an abundance of rain, can be gathered from the Californian's old experience **that dry seasons never go beyond the third year.** Sunspots serve eminently well for each storm in particular; but much more painstaking study remains to be done before we can delineate the character of a season. A **seasonal** weather prophet, hailing from Oregon and made much of in certain quarters, has not so far come up to our expectation.

Areas of Low Pressure.

These areas of light air which of themselves make it warmer during both winter and summer, will set foot on the Coast according to the following schedule:

Sept. 2, 5, 9, 11, 14, 16, 18, 23, 26, Oct. 1, 4, 6, 9.

Areas of High Pressure.

These areas of heavier air which induce coolness where they alight and forge heat for places where they are not, will arrive on our Coast, on

Sept. 2, 6, 8, 11, 13, 15, 20, 23, 25, 28, Oct. 1, 3, 6, 8.

N. B.—I. By scanning the above series of September dates, the most casual reader will notice how there is no fixed regularity, but rather a sort of prevalent disorder, showing that the use of arithmetical progressions in longrange forecasting is fatuous.

II. No surprise if we got a taste of "heavenly dew" sometime during the month, verifying the goose-duck anticipation.

III. We would call attention to the following

Heavier Disturbances of the Month.

1. High, Sept. 2; low, Sept. 5.
2. High, Sept. 7; low, Sept. 10.
3. High, Sept. 9; low, Sept. 12.
4. High, Sept. 15; low, Sept. 18.
5. High, Oct. 1; low, Oct. 4.
6. High, Oct. 8; low, Oct. 12.

Varia

Up to the present writing (Aug. 25), there have been two earthquake records.

I. On August 15, 1918, a long distance earthquake record with the following elements on the east-west line and none on the north-south line.

P1=5:6:53 a. m. S. P. T.
L=5:23:53 a. m. S. P. T.
C=5:46:53 a. m. S. P. T.
F=6:6:58 a. m. S. P. T.
D=5950.8 Kms=3697.8 St. mi.
Ae=0.75 mm.
Period=10.9 seconds in the maximum.
Azimuth=N 90° W.

This would place the epicenter near the Midway Islands in the Pacific Ocean.

II. On August 20, 1918, a short distance earthquake record with the following elements:

P1=10:43:55 a. m. S. P. T.
L=10:43:57 a. m. S. P. T.
M=10:44:00 a. m. S. P. T.
C=10:44:35 a. m. S. P. T.
F=10:45:17 a. m. S. P. T.
Ae=5.5 mm.
An=4 mm.
D=39.62 Kms=24.62 St. mi.
Direction=E 32° 28′ S.

Error of the clock 9″ in 48 hours. The clock had been corrected at noon, 120th meridian, August 19, and was again corrected at noon, same meridian, August 21. The following notice was clipped for the Observatory from the San Jose "Evening News":

Quake at Morgan Hill.

MORGAN HILL, Aug. 21.—A severe earthquake shock was felt here at 11:45 yesterday. No damage was done.

N. B. Both our distance and direction agree with the clipping. The only discrepancy is one of time. But it is, of course, clear that the time of the clipping is that of the 105th meridian (war time). As to the exact minute of the clipping, a serious doubt is entertained as to its correctness, the more so as many people are not scrupulous about the minutiae of time.

III. In the first week of March this year (1918), northern lights were seen as far south as southern Kansas. At Fredonia and Fort Scott in that state, they were as showy as any seen even as far north as southern Canada.

Weather conditions this year have been very changeable, mostly dry, as is seen by reading the papers. Crops have been greatly damaged. This is not due to a lack of clouds, but apparently to a lack of concentration. Every afternoon here in central Ohio, it has clouded up for the past month and looked rainy, but it has failed to rain, except in a few isolated spots. and when it does rain, it is usually accompanied by hail and wind. On the whole the weather is very peculiar. The weather has also been exceedingly hot beyond the average. The sun also sets in red as if surrounded by dust or smoke, and the moon also shows the same reddish, smoky-like cast at her rising and going down. Also, on some of our very hottest days, the sun is followed by "sun dogs", not so bright as in winter, but showy. Recently, also, in flying above Dayton, Ohio, around 25,000 feet in elevation (Aug. 12), there was encountered a genuine snow storm, and a temperature of only 12° above zero. Also that same night, northern lights were seen over a large part of the eastern United States, and there was a general electrical disturbance over the same area. The writer would suggest that the peculiar weather conditions of this year may possibly be due at least in part to the disturbed conditions of the atmosphere over the European battlefields.

By Albert B. Reagan.

Editor's Note......The dominant idea among the best accredited scientists is that the "Lightning and Thunder" at the Western front, has no connection whatever with our changeful weather conditions. True, a volcano can send dust several times around the world. But this is a natural agency, compared with which artificial causes dwindle into insignificance. At the bottom of our weather stand the indefinitely varying highs and lows which marvelously coincide with sunspots astride the Central meridian. Rain, lightning and thunder, heat and cold, go with the highs and lows which no human dynamism can produce. The utmost that can be said is that the winds carry battlefield dust where they blow. But, inasmuch as the general trend of the highs and lows is from west to east, so the winds must follow the same general direction, seeing that they result from the intershock of the highs and lows. It would seem, then, that European war dust should reach the United States by way of the Pacific. But, lo and behold, the sky of the Pacific States is as pure as ever! The intense cold in the higher atmosphere over Ohio, on Aug. 12, as well as the snow-storm were evidently due to the simultaneous approach of a high pressure area from the southeast and a low pressure area from the northwest. And both the northern lights and the cold wave in the upper sky of Ohio were, as usual, the result of a malignant group of tiny black spots astride the Central meridian during the night of Aug. 12-13.

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October, 1918

The Sunspot

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BY

J. S. RICARD

OBSERVATORY UNIVERSITY OF SANTA CLARA

SANTA CLARA, CALIFORNIA

U. S. A.

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VOL. IV. OCTOBER, 1918 NO. 8

The October Weather

For number and magnitude, the disturbances of October will certainly rival those of September just elapsed. This, however, does not mean that there will be as much rainfall, or thunderstorms of equal frightfulness, or hailstones of the same portentous size. For, as is well-known to weather observers, atmospheric disequilibria travel even as a train, but much faster, very seldom starting from the same point nor following the same route. Wherefore, a storm of no outward pretension in this or that locality and round about, might somehow prove colossal, less than a hundred miles away.

DISTURBANCES OF THE MONTH.

I. The areas of high barometer will succeed each other in the following order:

Oct. 1, 3, 5, 7, 12, 16, 19, 22, 26, 28, 31, Nov. 2, 5, 8, 11.

Notice once more how these dates lie pell-mell, without any outward semblance of mathematical law. There is only **one** series which is a near approximation, and within it there is still **another**;. but both these are infinitely removed from the view of the contemptuous. They have already been touched upon in previous papers, the full explanation being reserved to a future opportunity.

II. The areas of low barometer (storms) will arrive on

Oct. 4, 6, 8, 10, 15, 19, 22, 25, 29, 31, Nov. 3, 5, 8, 11.

THE HEAVIER DISTURBANCES OF THE MONTH.

Among and within the monthly disturbances, we signalize the following:

1. High, Oct. 1; low, Oct. 4.
2. High, Oct. 6; low, Oct. 9.
3. High, Oct. 8; low, Oct. 11.
4. High, Oct. 12; low, Oct. 15.
5. High, Oct. 18; low, Oct. 21.
6. High, Oct. 21; low, Oct. 24.
7. High, Oct. 28; low, Oct. 31.
8. High, Nov. 2; low, Nov. 5.
9. High, Nov. 5; low, Nov. 8.
10. High, Nov. 9; low, Nov. 12.

The Theory of the U. S. W. B Raingage

The Standard Raingage of the U. S. W. B. consists essentially of three parts: 1. A partly cylindrical and conical cap, called the receiver; 2. A large cylinder or overflow tube; 3. A smaller cylinder known as the measuring-tube.

The mathematical theory of the device is as follows: Let V and V′ be two cylinders of equal height, **h**, and **r**, **r′** the radii of their bases, we shall have

$$\frac{V}{V'} = \frac{\pi r^2 h}{\pi r'^2 h} = \frac{r^2}{r'^2}$$

For convenience, let

$$\frac{r^2}{r'^2} = 10, \text{ then } \frac{V}{V'} = 10, \text{ and}$$

$$V = 10V',$$

i. e., if cylinder V was full of rain, its content emptied into cylinder V′, supposed to be just as tall, would fill it 10 times. In other words, V′ would magnify the rainfall 10 times, such magnification being usually necessary in order to get a visible accurate measurement of small amounts of rainfall.

Now the foregoing reasoning holds good for any height whatever to which the rainfall may rise in the larger cylinder. Therefore, when the same amount of rainfall is made to flow directly into the measuring-tube, as happens with the W. B. device, the amount measured in the small cylinder **is always to be divided by 10.** Although dividing by 10 need not be regarded as a hard operation, the W. B. has been considerate enough to furnish a measuring-stick where the operation is ready made, so the operator can read with one eye open and the other closed or otherwise occupied.

The Phenomenal Storm of Sept. 11-14, 1918

Looking over the weather maps of the same period, we find the rainfall totals stand as follows for the area affected: Marshfield, 0.03; Roseburg, 0.30; Eureka, 1.00; Red Bluff, 6.84; Chico, 2.64; Sacramento, 3.58: Reno, 1.28; Santa Rosa, 2.42; Point Reyes, 1.96; Mt. Tamalpais, 2.84; San Francisco, 2.51; San Jose, 6.22; Santa Clara (not on the map), 6.19; Stockton, 1.50; Merced, 0.66; Paso Robles, 0.30; San Luis Obispo, 0.60; Santa Barbara, 0.50; Mt. Wilson, 0.58; Los Angeles, 0.10. Adding up and dividing by 20, which is the number of stations where records are taken and kept, we have an average,

A=2.10 inches, i. e., if the rainfall had been equally distributed at each station, the measured amount would have been that number of inches plus one-tenth of an inch.

Using now the scale of miles in the weather map, we find distance from Marshfield to San Francisco is 35 mm. and from San Francisco to Los Angeles 29 mm. 8 mm. on the same scale are 100 miles, so the mile is .08 mm. It follows that 35 mm. is 437.5 miles and 29 mm. 362.5 miles. It may be taken for granted without fear of much contradiction that the width covered by the rainfall from shore inland, was, say 100 miles, 8 mm. on the scale. Hence we have

$$437.5 \times 100 = 43750 \text{ sq. mi.},$$
$$362.5 \times 100 = 36250 \text{ sq. mi.},$$
$$\text{Total} = 80000 \text{ sq. mi.}$$

One mile=5280 ft.=63360 inches. Hence

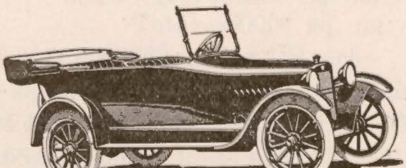
$$\text{One square mile} = 4,414,489,600 \text{ sq. in.}$$
$$4,104,489,600 \times 80000 = 321,159,168,000,000 \text{ sq. in.}$$
$$321,159,168,000,000 \times 2.1 = 674,434,252,800,000 \text{ cu. in.}$$

Allowing 277.027 cu. in. to the gallon, we have

2,434,543,393,965 gallons,

for the unprecedented rainfall yielded by the insignificant storm of September 11-14, 1918.

The wise men of the West ask for the cause of the great downpour and insist especially on what stood behind the deafening thunderstorm of Sept. 21. For this, we shall have to wait. The cost of printing is now worse than a thunderstorm!



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November, 1918

The Sunspot

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BY

J. S. RICARD

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VOL. IV. NOVEMBER, 1918 NO. 9

The November Weather

In the meteorological sense, November has a reputation to sustain. If wet, the year is sure not to run dry; if dry, there will be occasion to pray for rain. To tell which is which, is the task of the seasonal forecaster. Without intending to cut the Gordian knot of the difficulty, the Sunspot inclines to decide in favor of the first alternative. See Sunspot, September issue.

Likelihood of Rain.

Inasmuch as rain is mostly, if not wholly, an electrical phenomenon incidental to areas where the air pressure is losing or has already lost its usual equilibrium, and owing to the absence in most observatories of suitable apparatus to diagnose the electrical status of the atmosphere, it turns out to be an arduous operation to foretell long in advance **when** it will fall. For California in particular, the preference might be given to the low pressure areas scheduled to arrive on

November 8, 11, 14, 22, 27.

But it were hazardous to exclude any of the lows contained in the general list of November disturbances which follows.

November Areas of Low Barometer.

These will begin to make their appearance on the Coast on

November 3, 5, 8, 11, 14, 17, 20, 22 and 23, 25, 27 and 28, 30, December 3, 6, 9.

When a depression is scooping out a big valley in the atmosphere, the air which is thus thrown off cannot be removed from the general circulation. Hence, on the same day or at no distant date, there comes what, for short, is called a "high", by which is meant a mountain of air which makes the mercury rise in the Torricellian vacuum or presses harder than usual against the walls of the Ane. roid, and chases away the clouds by sheer driving or by the process of revaporization or both. It follows that the highs always either accompany or run abreast with the lows, as inseparable companions. Rains are fairly general round about the obscure line of demarcation, as a result of the mutual impact.

Schedule of the November Highs.

These fair weather producing areas will approach the Coast by

November 3, 5, 9, 11, 14, 17, 20, 22, 25, 27 reinforced on 28, December 1 reinforced on 2 and 3, 5 kept up on 6 and 7, 11 and 12.

Heliocentric Planetary Phenomena for November, 1918

1. Mercury and Jupiter come to opposition (☍ ☿ ♃) on Nov. 9.91.
2. Mercury and Mars come to conjunction (☌ ☿ ♂) on Nov. 18.68.
3. Mercury and Neptune come to opposition (☍ ☿ ♆) on Nov. 20.11.
4. Venus and Earth come to opposition (☍ ♀ ⊕) on Nov. 23.52.
5. Mercury and Saturn come to opposition (☍ ☿ ♄) on Nov. 24.21.
6. Mercury and Uranus come to conjunction (☌ ☿ ♅) on Nov. 25.52
7. Mars and Neptune come to opposition (☍ ♂ ♆) on Nov. 26.34.

Origins of Spots Produced by Said Phenomena

1.	☿ Spot,	$\phi=$	$-2^\circ\ 35'\ 11''$
		$\lambda=$	$130^\circ\ 35'\ 42''.1$=9.89 days E.
	♃ Spot,	$\phi=$	$-2^\circ\ 44'\ 57''$
		$\lambda=$	$-48^\circ\ 46'\ 5''.9$=3.60 days W.
2.	☿ Spot,	$\phi=$	$-1^\circ\ 25'\ 15''$
		$\lambda=$	$113^\circ\ 1'\ 45''.3$=8.56 days E.
	♂ Spot,	$\phi=$	$3^\circ\ 27'\ 40''$
		$\lambda=$	$113^\circ\ 26'\ 47''.5$=8.52 days E.
3.	☿ Spot,	$\phi=$	$-1^\circ\ 5'\ 56''$
		$\lambda=$	$110^\circ\ 8'\ 41''.4$=8.38 days E.
	♆ Spot,	$\phi=$	$-5^\circ\ 51'\ 53''.8$
		$\lambda=$	$-69^\circ\ 40'\ 29''.4$=5.27 days W.
4.	♀ Spot,	$\phi=$	$-0^\circ\ 50'\ 9''$
		$\lambda=$	$179^\circ\ 42'\ 23''.1$=13.62 days E.
	⊕ Spot,	$\phi=$	$1^\circ\ 42'\ 40''=1^\circ.71$
		$\lambda=$	$0^\circ\ 0'\ 0''$=0.00 day.
5.	☿ Spot,	$\phi=$	$-13^\circ\ 39'\ 26''$
		$\lambda=$	$100^\circ\ 21'\ 38''.1$=7.60 days E.
	♄ Spot,	$\phi=$	$-5^\circ\ 29'\ 34''$
		$\lambda=$	$-80^\circ\ 3'\ 1''.7$=6.06 days W.
6.	☿ Spot,	$\phi=$	$-0^\circ\ 1'\ 48''$
		$\lambda=$	$95^\circ\ 32'\ 1''.3$=7.23 days E.
	♅ Spot,	$\phi=$	$6^\circ\ 9'\ 18''.2$
		$\lambda=$	$96^\circ\ 21'\ 22''.7$=7.30 days E.
7.	♂ Spot,	$\phi=$	$-7^\circ\ 25'\ 48''.9$
		$\lambda=$	$116^\circ\ 39'\ 7''.4$=8.48 days E.
	♆ Spot,	$\phi=$	$-6^\circ\ 56'\ 49''.2$
		$\lambda=$	$-63^\circ\ 22'\ 53''.3$=4.80 days W.

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December, 1918

The Sunspot

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VOL. IV. DECEMBER, 1918 NO. 10

The December Weather

By northern spots alone, areas of low barometer or storms will reach British Columbia and Washington on

December 3, 9, 21, 24, 30, January 5,

with rain-bearing southeastward extensions, which may benefit the country south of Tehachapi, even as far as San Diego.

Northern spots, on reaching a certain solar meridian, seem to determine areas of low pressure over the Northwest, while their opposites, namely, the areas of high pressure, fall over lower latitudes and, displacing themselves to the eastward, permit the northern lows to follow in their wake, thereby causing generous rainfalls.

The wide gaps between the above dates are filled in by storms due to southern spots. The arrival of these at the Coast may be looked for on

December 5, 8, 12, 15, 17, 20, 26, 29, January 1.

It is characteristic of southern spots to cause the fall of heavy masses of air at the northwestward of our latitude and, contrariwise, to induce depressions to the southwestward of the same latitude.

According to a late study, the Central Meridian facing earthward, is the only line that deserves any attention, so far as sunspot weather causation is concerned.

Possibly, the clenching argument concerning such causation, is or may be the nearly demonstrated fact that **sunspots with left-**

handed rotations induce like rotations (cyclones) in our atmosphere; and, spots with right-handed rotations ever coincide with anticyclonic rotations in the same atmosphere.

Heliocentric Planetary Phenomena for December, 1918

1. Venus and Jupiter come to opposition (☍ ♀ ♃) on Dec. 17.86
2. Mercury and Earth come to conjunction (☌ ☿ ⊕) on Dec. 18.16.
3. Mercury and Jupiter come to conjunction (☌ ☿ ♃) on Dec. 20.36.
4. Mars and Saturn come to opposition (☍ ♂ ♄) on Dec. 20.64.
5. Mercury and Venus come to opposition (☍ ☿ ♀) on Dec. 21.19.
6. Mercury and Neptune come to conjunction (☌ ☿ ♆) on Dec. 25.10.
7. Mars and Uranus come to conjunction (☌ ♂ ♅) on Dec. 27.43.
8. Mercury and Saturn come to conjunction (☌ ☿ ♄) on Dec. 27.94.
9. Mercury and Uranus come to opposition (☍ ☿ ♅) on Dec. 28.75.
10. Mercury and Mars come to opposition (☍ ☿ ♂) on Dec. 28.94.

Origins of Spots Produced by Above Phenomena

1. ☿ Spot $\begin{cases} \phi = -4^\circ\ 23'\ 51'' \\ \lambda = 166^\circ\ 29'\ 23''.9 = 12.598 \text{ days E.} \end{cases}$

   ♃ Spot $\begin{cases} \phi = -3^\circ\ 2'\ 45'' \\ \lambda = -130^\circ\ 47'\ 49''.5 = 1.05 \text{ days W.} \end{cases}$

2. ☿ Spot $\begin{cases} \phi = 3^\circ\ 5'\ 40'' \\ \lambda = -0^\circ\ 33'\ 48''.8 = 0.042 \text{ days W.} \end{cases}$

   ⊕ Spot $\begin{cases} \phi = -1^\circ\ 25'\ 10'' \\ \lambda = 0^\circ\ 0'\ 0'' \end{cases}$

3.	☿ Spot	ϕ=	2° 18′ 12″
		λ=	—12° 5′ 45″.1=0.916 days W.
	♃ Spot	ϕ=	—3° 4′ 13″
		λ=	—11° 28′ 38″.2=0.866 days W.
4.	♂ Spot	ϕ=	—8° 41′ 41″.8
		λ=	125° 54′ 25″.4=9.54 days E.
	♄ Spot	ϕ=	—5° 29′ 52″
		λ=	—54° 27′ 39″.6=4.12 days W.
5.	☿ Spot	ϕ=	2° 12′ 22″
		λ=	—16° 19′ 11″.4=1.235 days W.
	♀ Spot	ϕ=	—5° 16′ 36″.6
		λ=	164° 29′ 11″.7=12.46 days E.
6.	☿ Spot	ϕ=	1° 5′ 30″
		λ=	—35° 9′ 42″.8=2.66 days W.
	♆ Spot	ϕ=	—5° 48′ 45″.9
		λ=	—34° 38′ 1″.5=2.62 days W.
7.	♂ Spot	ϕ=	—8° 44′ 38″.7
		λ=	128° 15′ 23″.5=9.72 days E.
	♅ Spit	ϕ=	—7° 39′ 7″.8
		λ=	128° 12′ 51″.9=9.71 days E.
8.	☿ Spot	ϕ=	0° 16′ 44″
		λ=	—47° 30′ 32″.6=3.60 days W.
	♄ Spot	ϕ=	—5° 17′ 24″.6
		λ=	—47° 15′ 32″.8=3.58 days W.
9.	☿ Spot	ϕ=	0° 1′ 51″
		λ=	—50° 51′ 10″=3.85 days W.
	♅ Spot	ϕ=	—9° 12′ 35″.2
		λ=	129° 38′ 45″.9=9.82 days E.
10.	☿ Spot	ϕ=	—0° 0′ 43″
		λ=	—50° 42′ 56″=3.84 days W.
	♂ Spot	ϕ=	—8° 46′ 17″.5
		λ=	128° 51′ 33″.6=9.76 days E.

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January, 1919

The Sunspot

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VOL. IV. JANUARY, 1919 NO. 11

The January Weather

By one set of factors, areas of low barometer, generally spoken of as disturbances and more specifically as storms, will arrive at the Coast on

January 15, 17, 20, 27, 29.

But many more atmospheric upheavals will be due during January. So, by another set of factors, which have predominated during December and will yet do so during the coming month, we should expect weather changes to become prominent on

January 2, 5, 8, 11, 15, 19, 23, 27, 30, February 2, 6, 10.

Their approach anywhere along the California, Oregon and Washington Coast, is rendered visible by the appearance in the sky of tiny wispy filaments of cloud, popularly called "mare's tails". If this first kind of cloudiness is followed up by a successive formation of other and lower clouds, lowest among which is the black nimbus or rain cloud, and, throughout the whole process of this obscuring transformation, the barometer keeps falling, the storm is surely heading toward the observer's locality.

But should the "mare's tails" put in a mere appearance and then vanish beyond the range of observation and the barometer rise or simply go through its usual semi-daily oscillation, it may be taken as a sure sign that the storm is either going directly eastward or taking such a southeastward course across the Plateau and the Rocky Mountains, as will leave untouched the whole district lying at the westward of the aforementioned southeastern course.

Notes on Jupiter's Opposition of January 1st, 1919

An event of great meteorological importance will be due on Jan. 1.70966, Greenwich mean time, or Jan. 1, 9:5:46.6 p. m., Pacific standard time. On that date, Jupiter, Earth and Sun will practically lie on a straight line drawn through their respective centers. The phenomenon is known as a geocentric opposition of Jupiter. But, heliocentrically speaking, it is simply a conjunction of Jupiter with the earth. On the same date, Jupiter will be nearer the earth than at any other time within its period and be proportionately brighter.

If, therefore, any secret force emanates from the planet, it will affect the earth also in proportion. It has been frequently noticed that such a force (electromagnetism?) exerts a powerful influence on the earth's atmosphere, causing in it great convulsions of one character or another. Witness the heliocentric conjunction of Jupiter with Venus last September when the floodgates of heaven were opened on California.

This is not Astrology, as some people have ventured to term it, but rather Astrophysics where the science of the future is going to take long strides.

In virtue of the above, the first week in January should be considerably disturbed.

Planetary Heliocentric Phenomena for January, 1919

1. Earth and Jupiter come to conjunction (☌ ⊕ ♃) on Jan. 1.70966.
2. Venus and Saturn come to opposition (☍ ♀ ♄) on Jan. 14.81995.
3. Venus and Uranus come to conjunction (☌ ♀ ♅) on Jan. 17.10653.

4. Earth and Neptune come to conjunction (☌ ⊕ ♆) on Jan. 28.39439.

5. Venus and Mars come to conjunction (☌ ♀ ♂) on Jan. 30.64836.

N. B. The above in Greenwich mean time (astronomical). For the Pacific States, subtract 0.33.

Origin of Sunspots Due to Above Phenomena

1.	⊕ Spot	$\phi=$	−3° 17′
		$\lambda=$	0° 0′ 0″
	♃ Spot	$\phi=$	−3° 11′ 12″
		$\lambda=$	−0° 0′ 14″.7=0.0003 days W.
2.	♀ Spot	$\phi=$	4° 9′ 27″
		$\lambda=$	149° 50′ 59″=11.35 days E.
	♄ Spot	$\phi=$	−6° 30′ 53″
		$\lambda=$	−29° 41′ 5″=2.25 days W.
3.	♀ Spot	$\phi=$	3° 42′ 33″
		$\lambda=$	148° 48′ 16″.7=11.27 days E.
	♅ Spot	$\phi=$	6° 12′ 20″
		$\lambda=$	148° 58′ 35″=11.29 days E.
4.	⊕ Spot	$\phi=$	−5° 79′
		$\lambda=$	0° 0′ 0″
	♆ Spot	$\phi=$	−5° 48′ 27″
		$\lambda=$	0° 0′ 3″=0.0008 days E.
5.	♀ Spot	$\phi=$	7° 12′ 9″
		$\lambda=$	141° 7′ 16″=10.69 days E.
	♂ Spot	$\phi=$	7° 11′ 48″
		$\lambda=$	140° 31′ 54″=10.64 days E.

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VOL. IV. FEBRUARY, 1919 NO. 12

The February Weather

It has been argued that, were it only by way of reaction, February, on the Pacific Coast, will be warmer than its predecessor. There is a natural heat in and on the earth which is bound to assert itself whenever external causes, such as radiation and the downward flow of cold air, are not powerful enough to counteract it.

Prof. Willis L. Moore has written somewhere that our main source of cold comes from on high, in the shape of falling huge masses of equatorial air that has been refrigerated and dried in its long voyage poleward, so much so that where their fall occurs, it is colder than in certain localities further up north.

This is no doubt true as a prominent fact in aerial circulation. But it might be supplemented by stating that the rate, the quantity and the geographical position of the fall of those air masses are largely determined by electrical currents of high potential, emanating from solar batteries which are brought face to face with the earth by solar rotation and have such a turn of their magnetic field as shall cause the right-handed rotation which observation has found in the fall of the aforesaid masses.

The February Lows.

The lows or stormy areas are those immediate factors which do the world most good, although, if they are low, they can do much harm. Hence meteorology is naturally most concerned with their prediction and the route they shall follow. The following schedule for their arrival at the Coast is submitted:

February 2, 6, 10, 12, 14, 16, 18, 20, 25, 28,
March 5, 9 10.

These dates are entirely based on spots in the northern hemisphere of the sun. The southern hemisphere has also its own story to tell. But the difference in the matter of dates is too small to deserve a separate mention. Let it suffice to say that the usual effect of such a difference is a reinforcement or prolongation of the storm on this side of the Rockies.

The February Highs.

For the benefit of those who grow citrus fruits, we have the following dates for the arrival of cool or cold waves:

February 3, 7, 10, 14, 18, 21, 24, 28, March 4, 7.

Main Storms of the Month.

These will start here on February 2, 13, 26.

A Retrospect

In our December issue, relying on a geocentric opposition of Jupiter with Earth Jan. 1.71, 1919, and the consequent solar disturbance, announcement was made of an unusual upsetting of atmospheric equilibrium during the 1st week or decade of January. It began even three days before, as Foster of Washington had foretold. The following results have been gathered from the Canadian Weather map:

Date.	Barometric Reading.
Dec. 28	30.2
Dec. 30	30.7
Dec. 31	30.4
Jan. 2	30.6
Jan. 3	30.9
Jan. 4	30.8
Jan. 6	30.4
Jan. 7	30.6
Jan. 8	30.7
Jan. 9	30.6

These enormous pressures brought down from the sky very low temperatures to the usually mild climate of California, which froze the ground, burned vegetation and wrought havoc to the citrus groves of the south. On the other hand, the lows forming part of the great barometric upheaval, offered only an insignificant contrast.

Here the question is asked, "**How long does it take for a solar disturbance to affect the earth?**" So far the only answer that we return is that **if a southern spot lies on Central today, say at 1:15 p. m., the high appears in tomorrow's map.** As to northern spots, it is better to wait for more study.

Planetary Heliocentric Phenomena for February

1. Mercury and Jupiter come to opposition (☍ ☿ ♃) on Feb. 8.51.
2. Earth and Saturn come to conjunction (☌ ⊕ ♄) on Feb. 14.07.
3. Mercury and Neptune come to opposition (☍ ☿ ♆) on Feb. 16.24.
4. Earth and Uranus come to opposition (☍ ⊕ ♅) on Feb. 16.90.
5. Mercury and Saturn come to opposition (☍ ☿ ♄) on Feb. 21.09.
6. Mercury and Uranus come to conjunction (☌ ☿ ♅) on Feb. 21.74.
7. Mercury and Earth come to opposition (☍ ☿ ⊕) on Feb. 23.39.

Origin of Sunspots Due to Above Phenomena

1.	☿ Spot	ϕ= —2° 7′ 31″	λ=—145° 15′ 27″=11.00 days W.
	♃ Spot	ϕ= —3° 31′ 34″	λ= 35° 19′ 7″=2.66 days E.
2.	⊕ Spot	ϕ= —6°.81	λ= 0° 0′ 0″.
	♄ Spot	ϕ= —5° 29′ 24″	λ= —0° 3′ 26″=0.0004 days W.
3.	☿ Spot	ϕ= —1° 4′ 30″	λ=—161° 31′ 24″=12.23 days W.
	♆ Spot	ϕ= —5° 48′ 58″	λ= 19° 0′ 25″=1.44 days E.
4.	⊕ Spot	ϕ= —6°.93	λ= 0° 0′ 0″.
	♅ Spot	ϕ= 6° 12′ 42″	λ=—180° 1′ 43″=13.63 days W.
5.	☿ Spot	ϕ= —0° 3′ 13″	λ=—173° 56′ 34″=13.17 days W.
	♄ Spot	ϕ= —5° 30′ 2″	λ= 9° 14′ 47″=0.70 days E.
6.	☿ Spot	ϕ= —0° 3′ 10″	λ=—175° 49′ 3″=13.32 days W.
	♅ Spot	ϕ= 6° 12′ 38″	λ=—175° 10′ 7″=13.27 days W.
7.	☿ Spot	ϕ= 0° 25′ 5″	λ= 170° 49′ 10″=12.90 days E.
	⊕ Spot	ϕ= —7°.13.	λ= 0° 0′ 0″.