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WEATHER

FOREKNOWLEDGE.

THEORETICAL AND PRACTICAL

CONTRIBUTIONS

TOWARDS ITS ACQUISITION.

LONDON:
HOULSTON AND WRIGHT, 65, PATERNOSTER ROW.
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PREFACE.

When an inquiry is instituted into the causes which obstruct the acquisition of Weather Foreknowledge, it soon becomes apparent that it is the vast number of the problems and their intricate complication which render the weather question so difficult of solution. But if the problem of weather foreknowledge is difficult, it is not a necessary consequence that it is impossible. There remains, therefore, the question concerning the possibility of weather foreknowledge still open for probable solution.

Knowing that scientific and observant minds have a certain amount of faith in weather prognostication, in so far as such can be obtained from the relative observations of the thermometer, barometer, and storm glass, the weather problem gradually assumed a geometrical aspect, and afforded amusement now and again for a leisure hour.

During the time devoted to this investigation, whatever was deemed of importance was gathered, and was continuously and carefully arranged until the following work was accomplished, and results obtained which prove that the problem of weather foreknowledge is capable of solution, and that the weather can be calculated for any given time, upon any part of the globe.

Somewhat of forbearance is entreated concerning the portions which relate to the animal and vegetable economy, because the time capable of being devoted to the working of these problems is, at present, very limited. It was therefore deemed better to risk the imputation of carelessness than to allow the problems to lie dormant for an indefinite period.

As regards the problem of weather foreknowledge, sufficient has been done to enable any one of average ability to obtain a glimpse of what kind of weather is due at the time and place required.

All what might be termed abstruse reasonings have been carefully avoided, because these the scientific reader can easily trace, whilst to the unscientific they are superfluous.

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WEATHER FOREKNOWLEDGE.

The study of meteorology discloses that the temperature, moisture, and wind motion of the atmosphere do not remain constant and unvariable over any one region of the earth, but that they are subject to fluctuations generated by seasonable, local, and accidental influences.

The seasonable variations are of two kinds. The first is caused by the continuous shifting of the radiant intensity of the sun's force during its progress north and south during the year. Thus, from the 21st December to the 21st June, the intensity of the sun's rays naturally declines in the southern hemisphere, and accumulates in the northern; whilst from the 21st June to the 21st December, the intensity decreases in the northern and increases in the southern hemisphere. Although these are the natural turning points of the sun's greatest intensity and laxity, still the actual positions of extreme heat and cold do occur after the dates given, because of induced motions in the earth's atmosphere, and by reason of the capability the earth has of slowly accumulating and of as slowly parting with its heat. The second seasonable variation is only a minutely fractional part of the first, and is due to the rotation of the earth upon its axis; and therefore as the year is the greater seasonable variation, the day is the relatively less. As the year hath its two points of greatest heat and cold, so hath the day. During the seasonable fluctuations of the year, the day continuously exhibits the exertion of a force which is relatively subordinate to the time of the year. The term seasonable is therefore appropriately applied both to the periods of the year and the hours of the day.

Local fluctuations of the atmosphere are those which have reference to the latitude, altitude, inclination, and combining harmony of a region. The latitude indicates the proportionately seasonable amount of heat, rain, or wind which ought to be natural to any given place. Altitude, as the height above the level of the sea, confers properties natural to a latitude further removed from the equator than the actual one where the known altitude really is. Inclination, which is the slope of a tract of land either to the north, south, east, or west, gives the power of retarding or accelerating the natural weather seasonably due to any given latitude, and of nullifying the true aspects, and therefore enforcing a tendency to generate others. The latitudes, altitudes, and inclinations of any portion of the globe being known, they then require to be proportionately balanced or harmonised, to indicate the general meteorological character of a country. In addition to the foregoing, the relation of the land to the sea and its internal distance therefrom, its geological structure, and its present productions, as likewise the balance which it bears to the whole globe, must be calculated, to sum up the perfect meteorology of a district.

This enumeration of those natural influences which cause variations in the atmosphere, gives a view of the amount of labour required before weather foreknowledge can be rendered truthful and reliable for each particular spot of earth. Although the above at first view seems to be the most difficult part of the work, yet, if we can discover those accidental influences which cause variations which are foreign to the true seasonable and natural weather of a place, they become simply a task for the inferior powers of the intellect.

The accidental variations of the atmosphere being as yet very imperfectly understood, it is here that the main difficulty lies. Now, if these occult influences can be idealised, traced to their source, and their principles of action displayed, the problem of weather foreknowledge is brought within the grasp of the geometer, and he becomes capable of solving it. The ideas being given to him, his first labour is to generalise, after which comes the subordinate one of particular localities and small tracts or portions of land.

Any attempt to discover and trace the influences with which the accidental fluctuations of the atmosphere are connected, presupposes that there exists a belief in ultimate success, and that there has been obtained some foundation on which to build. Knowing that the year in its monthly courses varies the state of the weather over the latitudes of the earth, and that the day produces fluctuations subordinate to the time of the year, we adopt the year and the day as the basis of our investigations.

The next portion of the work is to obtain and employ a familiar number, capable of being easily handled, which shall govern and harmonise all our calculations.

In meteorology it is not necessary to take the year in accordance with its strictly astronomical length, but only to consider it as composed of 365 days 6 hours. We must acknowledge the six hours because of the occurrence of the leap year, and must therefore consider the meteorological year as composed of 365 days 6 hours, with a cycle of four years, so as to work off the added day of the leap year, and to reduce such to a recurrent order.

The above number is too large, and is moreover inconvenient, because of its fractional tendency, to be employed as a governing number. Turning our attention, therefore, to the day, we find it to be divided by the hour into 24 equal parts. This number will suit our purpose, because it is familiar; it is an equal number, and is easily divisible; and is composed of a convenient number of units.

To guard against error, and to simplify the work as much as possible, it becomes requisite to discard the A.M. and P.M. system of hourly notation; and to adopt the 24 o'clock system of computation in its stead. Neithercan the starting point be placed in noon so as to conform with astronomical usage, because this would introduce a discordance in the work. In meteorology the starting place must be midnight, as zero point of the hours, to enable such to coincide with the shortest day, as zero point of the year, and with the new moon, as zero point of a lunation.

In working with this 24 o'clock method, all the numbers from 1 to 12 will remain as in the common A.M. half of the day; it will only be in the P.M. half that there will be any alteration. Therefore, 1 P.M. will be termed 13; 2 P.M., 14; 3 P.M., 15; and so on up to 12 p.m., which becomes 24 as the termination of one day, or 0 as the beginning of another.

The day having been appropriately divided into 24 equal parts, it now becomes requisite to divide the year into a similar number of equal parts, so as to render the year relatively harmonious to the day. For such purpose it is necessary to consider the moment of midnight of the 21st December as the starting point of the meteorologically numerical cycle of four years. Dividing, then, 365 days 6 hours by 24, we obtain 15 days 5 hours 15 minutes as the 24th part of a year; and as the 24th part of a day is termed an hour, so we may use the word period, in a similar sense and call the 24th part of a year one meteorological period of such year. Therefore, 24 hours make one day, and 24 periods make one year; and harmonically arranging the hours of the day with the periods of the year, the first year after leap year will stand thus:—

Hours or periods.		Days.	Hours.	Minutes.
1	will coincide with January	5	5	15
2	,, ,,	20	10	30

Hours or periods.			Days.	Hours.	Minutes.
3	will coincide with	February	4	15	45
4	,,	,,	19	21	0
5	,,	March	7	2	15
6	,,	,,	22	7	30
7	,,	April	6	12	45
8	,,	,,	21	18	0
9	,,	May	6	23	15
10	,,	,,	22	4	30
11	,,	June	6	9	45
12	,,	,,	21	15	0
13	,,	July	6	20	15
14	,,	,,	22	1	30
15	,,	August	6	6	45
16	,,	,,	21	12	0
17	,,	September	5	17	15
18	,,	,,	20	22	30
19	,,	October	6	3	45
20	,,	,,	21	9	0
21	,,	November	5	14	15
22	,,	,,	20	19	30
23	,,	December	6	0	45
24	,,	,,	21	6	0

Although in the above enumeration the fractional parts of the day are given with the monthly dates, yet as a general rule it will be found convenient to discard the fractional parts, and amply sufficient only to acknowledge the monthly dates as co-relative to the hour numbers or periods. Concerning the lunar month and its division by 24, all that is necessary to be observed, at present, is that the moment of the new moon corresponds with 12, that of the first quarter with 18, the full moon with 24, and the third quarter with 6.

The year, the day, and the lunar month having been rendered consonant to the requirements of our theme, the next portion of the work is to take cognizance of the atmosphere of the earth. Investigation proves that the atmosphere of the earth is an aërial fluid, a compound substance, and a complex mixture. It is an aërial fluid because it possesses properties which the laws of matter assign to such condition: one of these is the almost total want of cohesive action, and therefore the allowance of perfect penetrability throughout its mass in any direction. Another is the existence of a repulsive energy inherent in the particles constituting such mass, and which affords a foundation for the belief that the chemical particles of the atmosphere are surrounded by vacua which separate particle from particle.

The atmosphere of the earth is a compound substance, because it is composed of oxygen and nitrogen. To these, in meteorology, we must add hydrogen, and therefore we must consider the atmosphere as a compound of oxygen, nitrogen, and hydrogen.

The atmosphere of the earth is a complex mixture, because the components are not locally separated, but are intermixed and intermingled throughout its whole mass.

These are the essential possessions of the atmosphere of the earth, and are all well known, and have been perfectly investigated. It is however very different when we come to enquire concerning the amount of knowledge relating to the accidental properties which the atmosphere is continuously acquiring, and as continuously changing. Let such accidental properties be numerous as they may, we can, nevertheless, reduce and classify them under the three headings of variable temperature, variable moisture, and variable locomotion. There is certainly a vast amount of knowledge accumulated concerning the variable temperature, the variable moisture, and the variable locomotion of the air: much, however, remains to be done.

Concerning the temperature of the atmosphere, we know, as a general rule, that it is hottest at the equator, and coldest at the poles; and that, in reference to height, the air above is colder than that which is beneath. We likewise know that there is a gradual decrease of mean heat from the equator to the poles, and a gradual increase of mean cold from the surface of the earth to the confines of the atmosphere. Connected with these there is the system to isothermal, isotheral, and isochimenal lines; which lines link together places of equal annual, of equal summer, and of equal winter temperature. The natural direction of an isothermal line is to run through and connect together all places of the same latitude. The patient accumulation of data discloses, however, a state of things widely differing from the natural supposition, and there exist various causes which tend either to lower or to raise the mean temperature of a place.

In the northern hemisphere, among the causes which lead to an increase in the mean annual temperature of a place, we may enumerate the occurrence of a western coast in the temperate zone, and the intersection or dividing of the land by bays or inland seas; the prevalence of southerly or westerly winds; the power of mountain ranges to act as a protecting wall against winds from colder regions; and the vicinity of a warm oceanic current. In the torrid zone, the increase in the extent of the land favours the increase in the amount of heat.

A decrease in the mean proper temperature of a latitude is caused by elevation above the level of the sea; the vicinity of an eastern coast in the temperate zone, and the absence of littoral indentations of the sea; mountain chains which arrest the progress of warm winds; the frequency of swamps and marshes; the abundance of wooded country; and the occurrence of much land in the higher latitudes. Much sea in the tropical zone tends on the other hand to lower the mean annual temperature.

It is on account of these causes that Ireland and the south of England present such a striking contrast to the interior of the continent of Europe; and therefore rules which may be discovered to forecast the weather of such places must have their values increased or diminished when under the same parallels of latitude we find differences in the mean annual temperatures. Besides the connecting of places of equal mean annual temperature, we require, for practical meteorological purposes, to classify and proportionately arrange the mean spring, summer, autumn, and winter temperatures of various places, so that when variations of heat, humidity, or wind is predicted for any one place, the calculation may be referentially reduced for any other required place.

The distribution of the humidity of the atmosphere is mainly dependent upon the changes of temperature and the direction of the wind; the distance of a place from the equator and its height above the level of the sea; and upon the relative amount of liquid surface and of dry land.

The primary causes of the locomotive or wind force of the atmosphere consist in the unequal heating of the various latitudes of the earth, and in the rotation of the earth upon its axis. The air at the equator being considerably hotter than the air at the poles, there is therefore induced a low cold raking wind from the poles to the equator, and a high warm soothing wind from the equator to the poles. Upon these due north and south currents the rotatory motion of the earth exerts an ever varying influence, because the solid surface of the earth at the equator hath a diurnal speed of about 1000 miles an hour, and this is gradually reduced with the increase of latitude, until the speed of rotation sinks and declines into zero, or nothing, at the poles.

To understand perfectly this portion of the subject, let any one take a watch in his hand, and stand with his face to the north, in this our northern hemisphere. Looking at the watch, as he stands with his face to the north, and the number 12 on the dial plate also pointing to the north, he will observe that the apparent course of the sun, in its daily aspect, coincides or goes along with the actual and proper movement of the hands of the watch. A movement similar to this we will call a solar motion or progression. Now the diurnal rotation of the earth upon its axis is known to consist of a revolution exactly contrary to the apparent motion of the sun; therefore the daily motion of the earth is performed in a direction contrary to the proper movement of the hands of the watch. This movement we will term a terrene motion or progression. A solar progression, in accordance with this view, is perfectly opposite to a terrene progression.

The unequal heating of the latitudes causing a low surface current from the poles to the equator, and a high circumferential flow from the equator to the poles, there is obtained, in the northern hemisphere, the naturally low north wind, and the high, as regards altitude, south wind. Now, this north wind or current coming from the poles is naturally cold, and it becomes constantly warmer as it flows towards the equator. But we know that any portion of the air, when it is becoming warmer, acquires a greater power of absorbing moisture; therefore this current from the poles to the equator is a dry wind. On the other hand, the flow in the upper regions of the atmosphere from the equator to the poles naturally contains a vast quantity of moisture, because of its heat, and other concomitant circumstances, needless to enumerate at present. As the north current in its progress southwards gets warmer, so in a similar manner doth the south flow of the upper regions of the atmosphere get colder in its progress northwards to the poles. Again, as air in its transition from cold to warm absorbs moisture, and is therefore drying, so air when becoming colder loses the property of absorbing moisture, and gradually becomes more and more humid until it is forced to discharge its superabundance in the form of rain. The flow from the equator to the poles naturally becoming colder, the south wind of the northern hemisphere is naturally a rainy or humid wind, that is, the south wind natural to the higher regions of the atmosphere.

If there were no rotation of the earth upon its axis, the low dry cold north wind, and the high warm humid south wind, would both continuously maintain undeviating currents from north to south on the surface of the earth, and from south to north in the upper regions of the atmosphere. The turning of the earth upon its axis is the first great cause which deviates the natural flow of the atmosphere from due north and south. This revolving force of the earth imparts to the air a similar revolving motion to that which it has at its immediate surface. That is, the air at any part of the earth's surface naturally acquires the proper amount of speed due to such portion of the earth's surface; and if it is capable of maintaining such it appears to the observer as a body of air in a state of rest, or to state this more particularly, there will not be perceptible any wind motion either towards the east or the west. Now if this air of the earth acquires a diurnal or terrene speed greater than that of the surface, there will be felt a west wind, and this west wind will have a ratio of strength intermediate between the real speed of the air and the natural motion of the solid surface of the earth. After a similar manner, when the air is deficient in the natural speed of the surface, then an east wind is perceptible.

We have now obtained the north and south winds as due to the latitudes, and an approximation as to how the east and west winds are originated; and the next progressive step is to endeavour to assign particular and natural latitudes for the perceptible origination of the north, south, east, and west winds of the northern hemisphere.

The polar flow, in accordance with what is now required, may be at first roughly estimated as in a state of mean acquired heat when it reaches the latitude of 45°; and that the equatorial flow when it attains the same latitude inversely reaches its mean state of heat. Therefore as 0° is torrid, and 90° frigid, the latitude of 45° is the mean or temperate. Now as we know that water about the temperature of 44° Fahrenheit is in its state of greatest density, we may from this reasonably suppose that the most rainy latitudes will be found a little north of the mean temperate latitude of 45°, and such is actually the case. We must not, however, deviate to reason concerning this at present, because we now require the particular and natural places of the east and west winds.

Air, in its progress from the equator to the poles becomes continually deficient in its power to maintain its position over the same longitude as that from which it started. Thus the natural speed of air at the equator is about 1000 miles an hour; this is the rate at which the equatorial air must travel to maintain a state of relative calmness over the torrid longitudes. Now this south wind, or equatorial flow of the upper regions, starting with an initial velocity of 1000 miles, doth in its progress northwards gradually depart from the state of an actual south wind to that of one which is due west. This is easily seen to be true when we consider that, if the air of the equator, with its 1000 miles an hour eastward speed, were suddenly transferred to the latitude of Britain, where the speed is only about 600 miles an hour to the eastward, there would then be a deficiency of 400 miles an hour, and a west wind having that acquired velocity would be felt over the British Isles. Again, the north and south winds originate at opposingly distant places on the globe, and the force of the one is null where the other is begotten. Therefore there is no south wind natural to the place where the north wind originates, nor no north wind natural to that locality which is the peculiar starting point of the south wind. Now the circumstances which give birth to the south wind of the upper region of the atmosphere, is the superheating of the air in contact with the surface of the earth. This superheating expands its volume and causes it to become specifically lighter than what belongs to its normal condition; it therefore rises, and the first symptoms of a wind which shall flow from the equator to the poles consists in the rising of the air from the surface of the earth towards the higher regions of the atmosphere. The heated air in the act of rising tends to create a vacuum, and this the cold air from the north rushes to fill up, and if we trace this up until we reach the north pole, where the north wind is begotten, we attain a point where there is seemingly no more north wind to be obtained. There is therefore the fact of the transference of the vacuum from the surface of the equator to the surface of the poles. Now air at rest has a natural tendency to rush in and fill any vacuum presented to it, and by this means the upper air of the polar region is dragged towards the ground, and the first symptoms of the natural north wind consists in a downward motion of the air at the pole.

The fact of the air at the poles descending, gives a cause for the air of the upper regions of the atmosphere flowing from the south; and thus the heating of the air at the surface in the torrid zone firstly causes an upward flow, secondly, an under flow from north to south; thirdly, a downward flow at the poles; and fourthly, a current from south to north in the upper regions of the atmosphere.

Again, air travelling from the poles to the equator becomes more and more deficient in easterly speed; it therefore inclines more and more towards the west; and the north wind by this means gradually acquires characteristics which change it from due north, through north-east, to due east. When it obtains the position of a wind which is directly east the heating power of the sun begins to tell upon it and to drag it back from east to north again.

In the same manner the flow of the upper equatorial regions, which is at first a south wind, gradually changes to south-west and then to west, after which it returns to north again; this is in the northern hemisphere.

The figure of the earth being that of an oblate spheroid causes it to interfere with and obstruct the natural action of the current from the poles, whilst it allows the perfect exhibition of the current from the poles to the equator. The reason of this is that the natural current of the upper regions can flow in a direct line from south to north, whilst that of the north is continuously obstructed until it reaches the latitude of 45°, as the point of its mean obstruction, and cannot be perfectly liberated from the bulging obstruction of the earth until it reaches the equator. The level of the sea at the latitude of 45° is a mean position in reference to the distance from whence the north and south currents flow; it likewise, because of the spherical form of the earth, attains a mean altitude in relation to the upper south-westerly current and the under north-easterly wind. The natural latitude of 45° is therefore a position of natural calm, as its assumed altitude causes it to be placed between two forces which, because of the converse nature of their actions, create a calm where their forces balance.

Here, then, we have three positions of comparative calm, one is at the equator. another at 45°, and the third at the pole; and also that, in regard to the winds in these positions, the south and west winds of the upper regions are not obstructed by the earth's outline, but that in reference to altitude their strength decreases with decrease of altitude, because of the opposing nature of the north and south winds, until a zero point is attained, which is referentially indicated by the latitude of 45° at the level of the sea.

Another point of importance is that although 45° is the horizontal mean of referential calm, we must declare 90° and 0° as the vertical extremes of referential calm. Also, that as we ascend from the latitude of 45° to that of 90°, we enter more and more within those influences engendered by equatorial flow of the upper regions; and that as we descend from 45° to 0° the power of those actions which are begotten from polar impulses are rendered more and more apparent.

Dividing the distance between 45° and 90°, we obtain 67° 30′ as a rough approximation to the latitude where the west wind should be most perfect; and between 45° and 0° there is the mean position of 22° 30′ as the proper place of the due east wind, in its greatest natural strength.

Having indicated how the south, west, and south-westerly winds are natural to the north temperate and the frigid zones, and also how the east, north, and north-east winds claim kindred with the south temperate and torrid regions, we now come to enquire concerning another circumstance which causes them to deviate from their natural flow.

If the axis of the earth were perpendicular to the plane of the ecliptic, then the poles and planes of atmospherical revolution would coincide with the poles and latitudes of the earth; but the plane of the ecliptic is inclined to the plane of the earth at an angle of about 23° 28′; therefore the axis of atmospherical revolution departs from the true diurnal axis of the earth to the extent 23° 28′.

The atmospherical axis is in the same line as the axis of earth, and the atmospherical equator is parallel to the earth's equator. The only effect is that during the northern winter the atmospherical pole and equator are depressed to the extent of 23° 28′, and that during the northern summer the same pole is elevated above the true polar point of the earth's surface 23° 28′. It is only on the 21st March and the 21st September that the atmospherical polar points and equatorial plane do perfectly coincide with the polar points and equatorial plane of the earth.

The radiant intensity of the sun's rays travelling from the vernal equinox of March until the midsummer of June, to the extent of 23° 28′ northwards, all the latitudes of the northern hemisphere change in an inverse ratio. Thus the natural latitude of 45° north, which is true at the equinox, gradually, as summer progresses, assumes characteristics natural to lower latitudes until it acquires in June those of the latitude of 21° 32′; after which it returns again, and regains its natural aspect during the autumnal equinox of September. Again, the sun going exactly as far south of the equator as it comes north, this same latitude of 45° north continuously acquires functions which are natural to higher latitudes until in December the natural latitude of 68° 28′ stamps its impress upon it.

To render a meteorological problem perfect, the meteorological latitudes can only coincide with the geographical at the vernal and autumnal equinoxes. At all other times they vary; and whatever the latitude concerning which the meteorologist desires to enquire, he must always add or subtract in ratio with the time elapsed since the equinoxes.

During the northern summer the latitudes of the northern hemisphere gradually decrease, whilst those of the southern increase in numerical value, until the northern midsummer point is attained; after which they as gradually retire to their normal position at the equinox. The reverse is the case during the northern winter. As a general rule, the northern latitudes require numerical subtraction in accordance with the day's distance either from the vernal or autumnal equinox up to midsummer point; and they require a similar and relative addition to coincide with the day's distance from the equinoxial points down to midwinter; also, that where the northern latitudes require subtraction, the southern require addition; and when the northern are added to, the southern are subtracted from. Shortly, add up to midwinter, subtract up to midsummer; and the daily quantity required to be added or subtracted amounts to a little more than one-fourth of a degree.

To harmonise the ecliptical variations of the latitudes with the year as before divided into 24 periods, we require to allow 3° 51′ 48″ for each of the six divisions or periods from March and September to June; and from September and March to December. This part however will be more clearly comprehended afterwards.

We previously divided the year and the day into 24 equal and harmonic parts, and we now require to divide the latitudes by the same number and to harmonically apportion them. Dividing 90° by 24 we obtain 3° 45′ as the 24th part of the distance of the equator from the poles, from which number the relative periods and latitudes can be easily deduced.

Again, the yearly and the daily action progressing in a circle, we require to extend the latitudinal quadrant of 90° to the semicircular amount of 180°, so as to harmonise with the gradual increase or decrease of heat during the day and the year. Dividing, therefore, 90° by 12 we obtain

7° 30′ as the perfectly harmonic coincidence of the 24th part of a latitude with the 24th of a year and day.

Longitudes are very easily harmonised because they move continuously in a circle, and 15° are equal to one hour.

Altitudes now require division and referential arrangement. This is more difficult to accomplish than any of the others, because of our ignorance as yet of the exact height of the atmosphere, and of the really natural place of the snow line above the equator. An approximation can therefore only at present be given.

Taking the mean natural height of the snow line at the equator at 15,000 feet, and allowing for the curvature of the earth and the influence of the equatorial and polar flow of the atmosphere, we obtain 10,000 feet as the altitude of the mean natural snow line at the latitude of 30°, and 5,000 feet at that of 60°, whilst it sinks to 0 or the level of the sea at 90°. Therefore the snow line naturally rises in altitude from the poles to the equator, and weather fluctuations in reference to altitude are propagated in lines parallel to the snow line from the equator to the poles. To accord with this theory, the point of mean temperate heat ought to be found at the height of 7,500 feet at the equator, and ought to coincide with the mean temperate heat of latitude 45° at the level of the sea.

The year, the day, the lunar month, the latitudes, the longitudes, and the altitudes having been referentially apportioned, we come now to enumerate and to proportionately arrange and connect the aspects of the weather.

Clear and cloudy being subordinately related to dry and humid, we do not include these within our primary enumeration.

The weather hath six principal aspects; and these are hot, cold, dry, moist, calm, windy. If we take these six aspects and render them subordinate to the number 24, we obtain four periods or hours for each of the six.

The middle point of heat being naturally claimed by 12, or the 21st of June, such middle point is accordingly placed thereto; and the middle of cold is similarly put in conjunction with the 21st of December, for the northern hemisphere. To render this more clear, and to shew the mutual connection of the six aspects, describe a circle and divide it into 24 equal parts, numbered from 1 to 24. Mark N. over 12, E. over 18, S. over 24, and W. over 6, as defining the four points of the compass; then the four divisions from 22 to 2 must be assigned to cold; from 2 to 6, to windy or stormy; from 6 to 10, to humid or moist; from 10 to 14, to hot; from 14 to 18, to calm; and from 18 to 22, to dry. This completes the enumeration of all the general arrangements required.

A more particular or subordinate arrangement requires, that as the year, the day, the lunation, the latitudes, the longitudes, the altitudes, and the weather aspects, have been proportioned in ratio to the number 24, so ought these to be rendered subordinate to the six weather aspects.

The hours of the day, the periods of the year, and the day longitudes (which must be reckoned from the midnight of a place), do not require to be harmonised with the weather aspects by us here, as their relative proportions can be so easily deduced from prior statements. It is only the latitudes and altitudes which require particular mention here.

To harmonise the weather aspects with the latitudes, it is necessary to place the middle of heat at 0° latitude, and the middle of cold at 90°, to enable us to spread the cold over the poles and the heat over the equator. Dividing 90° by 6, we obtain 0° to 15° as the zone of heat; from 15° to 30° as that of dry; from 30° to 45°, calm; from 45° to 60°, moist; from 60° to 75°, wind; and from 75° to 90°, cold. Remember that the middle or point of greatest drought, calm, rain, or storm is indicated by a number between their two extremes. Thus, the natural storm latitudes are between 60° and 75°; therefore the true storm point is 67° 30′; and as this latitude has 23° 28′ added to it during our summer, it ascends towards the poles and is elevated above the British isles. During our winter the reverse of such condition is the case, for the natural exhibition of force which clings to this same latitude descends as far as 44° 2′, and of course the British isles experience its effects. This is the proper solution of what meteorologists call the great December wave.

Concerning altitudes, assimilate the 15,000 feet at the equator with the 90° of latitude, and divide accordingly.

We now commence that portion of the work which relates to the practical application of the subject. Theory is all very well for the few: it is utility that the masses care for. Show me that it will benefit my pocket or add to my bodily comfort, and I will listen to you—is the general cry, and right too; for the creation of a theory and the reduction of it to practical utility is a labour few care to undertake and fewer live to complete. We have therefore as much as possible expunged theoretical considerations from this portion of the work.

Oxygen, nitrogen, and hydrogen constitute the meteorological atmosphere of the earth, and are individually of very different characteristics. For the purposes of meteorology, oxygen may be connected with the radiant force of heat; nitrogen with the globular property of fluids; and hydrogen with the inflammatory nature of storm power. Oxygen and hydrogen likewise combine and form water; oxygen and nitrogen coalesce and become nitric acid; and nitrogen and hydrogen unite in the well-known condition of ammonia.

Again, the natural inclination of oxygen is to follow the course of the sun, whilst that of nitrogen is to retire from it; therefore, the disposition of oxygen is to follow the course of the sun during the year and the day, whilst the nitrogen lags behind. Likewise, the natural inclination of nitrogen is to revolve spirally against the sun, or similar to a terrene progression; whilst that of oxygen is with the sun, or after the manner of a solar progression. The intensity of the concentrative energy of the sun's rays increasing from above downwards, the motion of oxygen is downwards, whilst that of nitrogen is upwards. The natural place of nitrogen is the centre of a vacuum, but such is not natural either to oxygen or hydrogen. Therefore nitrogen is naturally most abundant in the zone of calm caused by the confliction of the polar and equatorial currents; the polar or under current being likewise of a terrene nature, this inclines the nitrogen to be most abundant in latitudes somewhat lower than 45°; and also gives a reason for the origination of those plagues which decimate the animal kingdom. Hydrogen indifferently curves either to the right or the left; but as during the day of a place the oxygen descends and the nitrogen ascends, and during the night the nitrogen descends and the oxygen ascends, one portion of hydrogen descends with the oxygen during the day, and ascends with it during the night; whilst another portion of it descends with nitrogen during the night, and ascends with it during the day.

We have thus oxygen and nitrogen imbued with two converse motions, whilst separate portions of hydrogen indifferently follow whatever is presented to them. From this it is easily seen how any interruption to this natural course of action leads to the formation of rain.

After the same manner it is perceived how a revolving motion is constantly maintained during the day in the atmosphere, and that such motion is completed in a circle of 24 hours. It can likewise be proved that a similar motion is connected with the seasons, and is accomplished in the cycle of a year; and that, as during the day the portions of the air presented to the surface of the earth are plus or minus in actions co-related to oxygen, nitrogen, or hydrogen, so during the year the same place is relatively plus or minus; and that these are both subordinate to the meteorological latitude of the place. This weather formula runs proportionately throughout the whole latitudes and altitudes of the earth.

We have used the term meteorological latitude: this is to enable us to define the proper meteorological aspect of a place as related to the continual shifting of the sun's force in its progress north and south during the year. A meteorological latitude is therefore constant to a number but is not constant to a place, whilst the geographical latitude is constant both to place and number. To illustrate this, the geographical latitude of 45° is always the same in a geographical point of view; but when we come to consider it in a meteorological aspect, we find that it only coincides with the geographical at the equinoxes, and that at all other times it is changed and must have either a higher or a lower geographical value attached. Therefore what we call meteorological latitudes are artificial latitudes which correspond with the weather aspects of the geographical latitudes only at the equinoxes.

The progressive state of our investigations now enables us to construct tables for the purposes of weather prediction, and of knowing what has been the weather of the past.

Firstly,—Describe a circle of any convenient size, and divide it into 24 equal parts.

Secondly,—Indicate each of the division points with one of a series of numbers running in order from 1 to 24; remembering to have the number 12 always at the top of the page, or in a similar condition to the 12 on a watch face, 6 to coincide with the number 9 on a watch, 18 with the number 3 on the watch, and 24 with the watch number of 6. The other numbers are then easily apportioned.

Thirdly,—Describe a circle from the former centre, a little less than the first circle, so as to allow of linear markings of the divisions as is done upon the watch, and have the numbers from 1 to 24 written without the first circle, and not within.

Fourthly,—Take another piece of paper, and, with the smaller radius, describe another circle, with one within it in ratio to the first diagram; then divide this into 24 equal parts, and cut out the circle along the circumference of the larger curve. This circle will exactly fit the smaller circle of the first diagram. As the numbers of the larger diagram were written without the circumference of its larger circle, so the numbers of the smaller diagram must be written within the circumference of its smaller circle. But. as this smaller diagram is to be continually turned within the larger, we must not write the numbers the same as on the page of a book, but as they are inscribed upon a watch dial, which considers each number, for the nonce, uppermost. It is best, however, to write the numbers upon the larger diagram as we would read them upon the page of a book.

Fifthly,—Write January between 1 and 2 of the smaller diagram, February between 3 and 4, March between 5 and 6, April between 7 and 8, May between 9 and 10, June between 11 and 12, July between 13 and 14, August between 15 and 16, September between 17 and 18, October between 19 and 20, November between 21 and 22, and December between 23 and 24.

Sixthly,—Attach the centre of the smaller diagram to the centre of the larger one, in such a manner as to be capable of turning easily within, and of perfectly coinciding with the larger diagram.

Seventhly,—Upon the larger diagram write Ox., for oxygen, in conjunction with its noontide number of 12; Ox.N., for oxy-nitrogen, over the afternoon number 16; N., for nitrogen, over the evening number 20; N.H., for nitro-hydrogen, in unity with the midnight number 24; H., for hydrogen, over the morning hour of 4; and H.Ox., for hydro-oxygen, over the forenoon number 8. We have termed oxygen Ox., so as not to confound it with the numerical 0.

The table, as now constructed, is capable of indicating the natural aspect of the weather for any required hour of the day and time of the year, for any given place on the surface of the globe. But before proceeding further, it becomes necessary to show why the hour number of the internal circle must continually vary throughout the year, and why the smaller circle only perfectly coincides with the larger at noon on the 21st of June.

We have previously seen how that the atmosphere is in a natural state of up and down balanced revolution during the day and during the year. We say balanced, because as the oxygen descends the nitrogen ascends, and *vice versa*. This likewise shows how the relative proportions of oxygen and nitrogen are capable of maintaining their referential quantitative values; and that it is only in the year and day variations of depth in the atmosphere, and in the relatively acquired impetus in the flow of oxygen or nitrogen to or from the surface of the earth, that there is a qualitative value. It is from this portion of the subject that the science ought to start, and be capable of showing how and where diseases are originated by atmospheric influences, and how and where they become quelled. Heat, cold, wind, calm, rain, and drought are however the present objects of pursuit: we must therefore keep in their tract.

The year, as a force controlling the whole atmospherical power of the air, is vastly superior to the day; and, as an effect of such, it causes the hours, which are naturally connected with the day's divisional influence, to revolve in a circle. Thus the hour number, which indicates the greatest determination of oxygen towards the surface of the earth upon the 21st of June, is 12; and, as we have placed oxygen in alliance with 12, the hours of the day can only coincide with the periods of the year upon the 21st of June.

In proportion to the departure from this date, so doth the 12th hour of the day leave the 12th period of the year; and the interior circle gives the number 12 as coinciding with the number 6 on the larger circle upon the September equinox; and then travels to coincide with 24 upon the midwinter day of December, and with 18 upon the March equinox. It is thus that we perceive how the meteorological noon continually varies from the actual noon of the day, and can only attain to perfect harmony upon the 21st of June.

To illustrate the practical working of the table now constructed, let it be required to find the natural aspect of the weather for the 6th August, at 8 P.M. The 6th of August is found to be allied with the number 15, therefore 15 on the smaller circle is to be turned to 12 on the larger; and, as 8 P.M. of the common day is claimed by 20 of the meteorological day, the number 20 on the smaller is found to coincide with 17 of the larger circle. This number 17 indicates that the proportionate influence of oxygen to that of nitrogen is as 3 to 5, because 17 is 5 divisions distant from Ox., and only 3 from N. In the table oxygen is not placed opposite nitrogen, because hydrogen claims one-third of the circle; and referring to the two halves of the circle, the hydrogen on the oxygen side is to that on the nitrogen as 11 to 13. Again, 4 and 16 indicate the plus and minus portions of hydrogen, 20 and 8 those of nitrogen, and 12 and 24 those of oxygen. In harmony with this, an inflammable or wind storm occurring at 16 is a local storm, whilst that at 4 is a general; likewise a globular or rain storm is more abundant and general at 20 than at 8, and the effects of heat penetrate more deeply when actions develope such at 12 than they are able to do at 24.

To take another instance to illustrate the manner of using the natural meteorological table: let it be required to find the aspect of the weather for the 10th of November, at 9 A.M. This common hour number of 9 A.M. corresponds with the meteorological hour number of 9; and, knowing that the 5th of November has been connected with the number 21, we turn 21 to 12, and from this we discover that 9 coincides with 24; but it is the 10th of November which is required, and as 1 day is equal to nearly 4 minutes, we must subtract 20 minutes from 9, and this gives 8 hours 40 minutes as the weather aspect of the 10th of November at the 9 A.M. hour. Again, the 10th of November occurs during a period which is very defective in oxygenic influence, therefore the whole of the 10th of November is deficient in ratio therewith. In the same manner we might run over the whole table, but sufficient has been said to explain the principles of action.

At the present stage in our progression, all is perfect; there is, as yet, no discord to disturb the harmony. We perceive the upper equatorial current flowing towards the poles with an eastward inclination, and therefore causing a west wind to be perceptible, which gradually increases until it reaches the latitude of 67° 30′, from which point it gradually turns, and as it approaches the poles acquires more and more the character of a south wind again. We observe underneath this a current from the poles to the equator, the one half of which is almost entirely impeded by the outline of the earth, and is naturally imperceptible until it reaches the latitude of 45°, where it gradually begins to become apparent, and in its approach to the latitude of 22° 30′ it acquires the characteristics of an east wind, which gradually changes again to its normal condition of a north wind. In unison with the above, we discover that the weather aspects of the latitudes do not remain constant, but that they travel northwards and southwards in the tract of the sun; and we likewise find that two revolving motions are natural to the atmosphere, and that the one is completed in a day and the other in a year. If we pursue our investigations a little further, we can trace where points or positions of greatest depth, weight, and density occur, and ally them with the latitudes, with the day, and with the year.

If there were no disturbing forces, all the above motions would continue constant and invariable. Knowing, however, that such is not the case, and that the state of the weather is fickle and inconstant, we must endeavour to discover what is the cause of the discordance.

All disturbances of the natural weather of a place can be traced to actions begotten from lunar influence. And the manner of applying such to indicate weather fluctuations is in accordance with the following instructions.

The principal reason why the moon exercises a disturbing influence upon that harmonious condition of things which can be traced to the intermutual action of the sun and earth, is that one revolution of the moon round the earth is not completed in the same time as that occupied from one new moon to another. The time of new moon in relation to one longitude of the earth, as time of the day, is not constant, but is subject to great variation; the relation of the force of the moon to that of the sun, in their joint action upon the earth, or, to state the thing more particularly, any one longitude of earth, is not constant, it is variable. Moreover, the lengths of the lunar quarters vary, and arouse still greater disturbance because of the unequal arrangement of the orthogonal forces.

The questions which now require to be answered are,—What is the number of the classes into which the general disturbances of the moon can be gathered? And—What is the nature of those disturbances?

The period of a lunation, as the time occupied by the moon in its progress from one new moon to another, is divided by astronomers into four parts. The moment of new moon occurs when a straight line connecting the centres of the sun and the earth perfectly coincides with a vertical plane connecting the centres of the sun, earth, and moon, having the moon intermediate. The moment of full moon fulfils similar conditions, only the moon is then external, and the earth is between the sun and moon. The instant of what is called first and last quarters of the moon, is when the centres of the sun, earth, and moon form in each case a right angle, by means of planes connecting their centres.

Here, then, we have four points in perfect harmony with the geometrical division of a circle into four equal parts; and, if the time which the moon takes in passing from one to another of these points were all perfectly equal, then there would be less disturbance of the weather. Now, when we discover that the quarters of the moon, although perfectly according with geometrical balance, yet are unequal in regard to the times taken by them individually; and also that the moments of the actual occurrence of the changes of the moon are not tied to any particular longitude of earth, we obtain information which we can use for the practical purposes of our inquiry.

We have now the geometrical quarters of the moon perfect, whilst the length of the times and the earthly latitudes vary.

As this enquiry aims only at general directions at present, we will not refer to the astronomical variations of the lunar orbit, but will simply accept the phases of the moon and the times of their occurrence as a basis for the acquisition of knowledge concerning the fluctuations of the weather.

The geometrical division of a lunation being allowed, for the present, to be perfect, the phases of the moon will rule our investigations; and, as the hour distances of the phases are various and fluctuating, these will form the subject of our inquiries. Referring to our tables of the circular arrangement of the hours, we there perceive that 12 is furthest removed from 24, 8 from 20, and so on with all the other numbers. We mention this because in passing from one number to another we must take the shortest route, and thus the passage between two numbers consists of two progressions which are opposingly different.

To illustrate this, when it is required to move from 6 to 9 we travel with the numbers, or in a solar direction; but when we go from 9 to 6 our course is against the numbers, or in a terrene direction. The reason for this consists in the relative amount of the forces connected with the hours of the day.

This is the first of the causes of accidental disturbance; and the distance of the occurrence of one phase of the moon from that of the other affords a middle point which we shall term a mean tension point; as example, let the moment of new moon happen at 12, and that of first quarter at 6, then the number 9 is found to be intermediate between 12 and 6; this 9 is the mean tension point, and 12 and 6 are the two extreme tension points.

A second of the causes of accidental disturbances in the atmosphere caused by lunar irregularities, relates to the actual distance of the occurrence of the changes of the moon as reduced to the longitudes of the earth, which longitudes are co-related to, let us say, Greenwich time; as instance, a phase which happens at 10 is two hours distant from one which takes place at 12; its amount is therefore 2, as distance between 10 and 12.

A third classification consists in observing how much increase or decrease there is between the amounts of two lunar phases, as they are arranged in their progressive order during the year. Thus, if one lunar phase occurs at 6 and another at 10, the distance amount is 4. Then, if the next phase occurs at 19, the increase is 5; because the distance from 10 to 19 is 9; and 4, the first difference, subtracted from 9, the second difference, leaves 5. The difference is in this instance a difference of increase, because the antecedent is the least, and the consequent is the greatest. If the first of these lunar quadrants had been the greatest, and the second the least, the difference would be a difference of decrease.

Direction, distance, and difference are, in accordance with the foregiven explanations, the three great causes which force the moon to change and vary the aspects of the weather. To state the thing as distinctly as possible,—direction is the shortest mode of passing from one number to another in a circular arrangement of the hours; if the passage is with the hours, then the progression is in a solar direction; if against, it is in a terrene direction. Distance is the number of hours and minutes contained in a lunar quadrant, this quadrant being the shortest longitudinal or hour distance of two phases of the moon. Difference is the proportionate length of one distance to that of another, and is either a difference of increase or a difference of decrease.

To show the method of working up to the present stage of our inquiry, let us take the quadrants of the moon, and let the first change of the moon occur upon 1st June, at 8 hours 22 minutes A.M. As the A.M. half of the day corresponds with our meteorological 24 o'clock arrangement of the hours, no change is here required. Turning to our double circular arrangement of the hours, we find that the 6th of June requires 11 on the smaller circle to be made to coincide with 12 on the larger, and therefore $8^h\ 22'$ on the smaller perfectly indicates $9^h\ 22'$ on the larger. But it is the first of June which is required; and as $4'$ are nearly equal to one day, we have to add $20'$, because the 6th of June is five days before the 1st. The perfect meteorological time is $9^h\ 42'$. The next phase of the moon, which occurs on the 9th June, at $9^h\ 41'$ A.M,, is found to coincide with $10^h\ 29'$; and the last phase, which happens on the 16th, at $11^h\ 53'$ A.M.. to point to $12^h\ 13'$.

Here then we have three numbers referring to two quadrants of the moon, and the shortest method of passing from 9 to 10 and from 10 to 12 is in a solar direction. Again, $9^h\ 42'$, subtracted from $10^h\ 29'$, leaves $47'$ for the first quadrant distance; and $10^h\ 29'$, subtracted from $12^h\ 13'$, leaves $1^h\ 44'$ for the second quadrant distance.

Now, the amount of the second quadrant distance is greater than that of the first, therefore the difference is a difference of increase.

In a terrene progression, the method is in many respects the opposite to that in a solar. As example, let the meteorological numbers be $12^h\ 13'$ for the first, $7^h\ 49'$ for the second, and 1^h for the third. The direction is terrene; and the measure of the first distance is $4^h\ 14'$, or $4°\ 14'$, whilst the second is $6°\ 49'$. In this case the difference is one of increase.

It has been necessary to be thus explicit here, to save labour in the future; and when a change of the moon is mentioned hereafter, it will be supposed to have been rendered subordinate to our meteorological requirements. Therefore we will not give the 4 P.M. of the 6th of August as we have now written it, but simply write it as 19^h of the 6th of August.

We have now to construct tables of direction, distance, and progression; and not to weary with too much troublesome minutiæ, we shall only give the tables and show how to use them.

The tables which we require are two: the first is allied with a series of twelve equal divisions, and the second with twenty-four equal divisions. Each table consists of two parts, the one with the numbers on it, and the other with the wording. The numerical cipher must always be placed to coincide with the true natural period or date of the month. The monthly dates must be doubled, so as to allow the numbers always to embrace a perfect space. In the tables given, the cipher is put opposite the 21st December, and the cold coinciding with 0 is simple extreme cold, whilst that opposite 12 is the extremes of heat and cold.

After a similar manner we obtain a simple storm exercise and its extremes during February; simple moisture and its extremes during April; and during June heat plays us the same tricks as the cold of December; calm in August adopts a converse range to the windy February; and the drought of October pranks it like the moisture of April.

In addition to this, the atmosphere of the northern hemisphere is deepest in October, and shallowest in April; it is most expanded in December, and most contracted in June —that is, the molecules lie nearer together in June than they do in December; and it is striated in August, and lamellated in February, in reference to the altitudes.

A knowledge of these atmospherical conditions is of great importance, as when reduced to their relative meteorological latitudes it shows how a wind storm is intense and local in August, whilst the February winds, as a rule, affect a large district. It leads also to an understanding of the diseases which afflict animal and vegetable life; and in conjunction with the powers of the number 12, on the tables now to be given, proves that the simple act of taking a glass of water at a certain temperature, is a suicidal act in some peculiar conditions of the atmosphere; and that if we must have liquid on these occasions, it must be altered from its pure oxy-hydrogenic proportions. As this, however, is somewhat of a digression from the strict line of our course, we must turn our attention to our tables of direction, distance, and difference. [These tables will be found at the end of the book.]

Direction is of two kinds, solar and terrene; distance admits of only one reading; and difference gives us the two of increase and decrease.

We have now two species of tables constructed: the first, which is arranged in a circular form, enables us to find the true meteorological aspect of the day and the hour; the second, whose order follows that of the straight line, gives us an approximate perception of irregularities in the weather caused by the distance, difference, and direction of the moon's changes, as read from the circular table. Thus we have one circular table and two straight-lined; and distance, difference, and direction may by those desirous of brevity, be designated by ds. for distance, df. for difference, and di. for direction.

Having obtained the true meteorological times from the first table, and written the lunar phases in the order of their occurrence; it is better to construct another circular table, so as to obviate, as much as possible, any confusion, and to calculate from this the distances, differences, and directions.

This second circular table is constructed in the following manner:—Describe a circle with any convenient radius, and divide it and apportion it similarly to the large circle on the first table, with Vertical written over 12, Horizontal under 24, Acute at the side of 16, Obtuse at that of 4, Shallow in conjunction with 8, and Deep with that of 20. This simple table is the table of reference, and the wording relates to the density, intensity, and depth of the atmosphere, for the day and hour.

Before proceeding to illustrate the application of these tables for the purposes of weather foreknowledge, it behoves us to request that the following general considerations have particular attention paid to them.

A circle, which is divided into 24 equal parts, allows 6 of those parts as the perfect length of a lunar quarter; that is, if new moon were to fall upon the twelfth hour, the first quarter ought to take place upon the eighteenth hour, to enable the moon to have a perfect effect during the period.

The numerical values of distance, direction, and difference of the moon's quarters varying, as a general rule, the largest numerical value has the greatest influence during the period; the second, next; and the lowest, third.

One direction from beginning to end includes as many quarters of the moon as uninterruptedly coincide with it.

One distance relates to only one quarter of the moon.

One difference takes cognizance of the numerical value of one distance in comparison with that of the preceding.

Numerical amount relates to the number of degrees contained in any given distance, difference, or direction. Numerical value has reference to the quantity of the heat, wind, or rain which direction, distance, and difference indicate as due during any given quarter of the moon. To exhibit this as plainly as possible, let it be remembered that in the circle of 24 equal parts, heat is directly opposite to cold, calm to wind, and dry to moist. The circle is by these names divided into six equal parts, and therefore each name claims four divisions. Where any name occurs, the value attains its maximum of four, whilst on each side it decreases in value, and feels the influence of its neighbour.

Thus, if the index points to a place between hot and moist, which is only one division or part removed from hot, it becomes three parts removed from moist, and is written 3h. 1m.

Hot, calm, dry, cold, wind, moist, being the six great aspects of the weather, their abbreviations are,—h. for hot, a. for calm, d. for dry, c. for cold, w. for wind, and m. for moist or rain.

Quantity, quality, and propinquity are considerations intimately connected with weather knowledge. Quantity relates to amount of heat, wind, or rain for any given quarter of the moon. Quality to the kind of heat, wind, or rain during the same quarter: thus, the heat of the day may be very fitful, the wind gusty or steady, and the rain drizzling or heavy showers. Propinquity shows when and where the greatest amount of heat, wind, and moisture is due during a lunar quarter, and likewise when and where their opposites are exhibited.

Changeable weather results from any opposing indications given by direction, distance, or difference. Weather of only one kind appears when they all assimilate. Distance and difference always have the effect indicated; but direction only has an effect in proportion to the ground traversed. Thus, if a direction has little or no distance to travel, it loses its force; but if it embraces six parts or dimensions in its course, it then has full power during such distance of six.

The geographical latitudes at the equinoxes are thus divided: from 0° to 15° is hot, from 15° to 30° dry, from 30° to 45° calm, from 45° to 60° moist, from 60° to 75° windy, and from 75° to 90° cold. This gives 0° as the centre of extreme heat, 22° 30′ as the centre of drought, 37° 30′ for the maximum of calm, 52° 30′ for that of moisture, 67° 30′ the wind centre, and 90° that of cold.

Because of the sun ascending 23° 28′ above the equator in summer, and descending to the same extent in winter, the geographical latitudes vary in a meteorological sense as the sun ascends or descends. During winter the latitudes must be added to, and during summer they require to be subtracted from.

The amount to be added or subtracted for one meteorological period of the year is 3° 54′ 40″, and the amount for one day 9′ 46″.

Until the inclinations, altitudes, and incidental properties of different localities are tabulated in ratio with the meteorological latitudes, the general characteristics of the weather for a country can only be given.

Direction in full force has the power of separating heat from cold; that is, of causing the amount of heat indicated by distance and difference, to be divided in accordance with its course, having the heat one way and the cold another; in the same manner it elects moisture and drought, and separates calm from wind.

As water expands both with heat and with cold, and as it is the main object of one department of meteorological inquiry, a thermometer, to perfectly coincide with the requirements of the meteorologist ought to have its zero to indicate the most dense point of water, as the mean referential condition of water to heat and cold.

It must not be imagined that the tables at the end of the book are ultimate and definite conclusions—because they are merely a first approximation for the discovery of the truth. As instance, suppose that the tables indicate for the middle of the month of January a distance amount of dry, and a difference of moist and windy; whilst the direction is calm with a small advance towards hot, and the tension is situated in the zone of moisture.

Here we have the calm of direction conflicting with the wind of difference, and the dry of distance opposed to the moisture of tension and difference. Because of the first confliction we may reasonably expect a storm of wind, and by reason of the second we may naturally look for a storm of rain or snow.

Again, because the directive force has a slight progression towards hot, the coldest part of the quarter is at the beginning, and the warmest at the end.

Ruling all, the influencing power of tension asserts its sway, for both January and the present tension are on the borders of wind, and are both progressing towards the wind centre, and thus increase the amount of the wind due.

At the first view, the above conflicting arrangement appears a mass of confusion, but when carefully investigated the truth is rendered apparent; and it shows us how the time of the year has an important bearing upon all weather calculations.

There is still another point which requires attention, and that is the relative value of two quarters of the moon as regards their individual amount of heat. To explain this, let it be supposed that the quarter preceding that which we have been investigating has been a little warmer, then the amount of rain due for the latter quarter is increased because of its relative decrease of heat. If the preceding quarter had been colder than the succeeding, then the rain would have been less.

The period which we have been alluding to is not an imaginary one, but occurs in January, 1866.

The comparison of two quarters of the moon, and the relative value of the time of the year, are here shown to be of paramount importance in divulging the state of the weather; and let those who are inclined to grumble because the subject has not been reduced to a simple easy rendering, remember that this work is not issued as a perfect whole, it is only a claim for inquiry; and it ought to be allowed that the importance of the subject is far superior to any merely individual interest, and that it is only by the attention of the many being directed towards a means by which the weather maze may be threaded, that a simple and easy pathway can be discovered. That if it be allowed to one to perceive the working of the wheels within wheels of the machinery of the weather, to another, whose powers are more elastic than those of the mere geometer, it may be allotted to discover a more easy and simple reading of the problem.

When investigating the weather connected with one complete latitude of the globe, it will be perceived that at times a similar grade of weather seems to be associated with the whole of one latitude. This can only occur when circumstances sink the distance and difference to an almost zero station. When distanee and difference are somewhat large in amount, then the opposing longitudes for the same latitude present different weather aspects than that which is natural to the whole given latitude for the required time of the year. And, from geometrical reasonings, which time but not inclination prohibit from being at the present time entered into, it can be proved what is the real and natural average of the amount of heat, rain, or wind for any latitude for any time of the year, and thus test if the average amount for any series of years is in accordance with the geometrical assay. By the average of wind is meant that locomotive property of the atmosphere which meteorologists term the daily movement of wind—as the number of miles, or rate at which the wind travels.

For the discovery of the state of the weather we have obtained approximation tables as a first guide, and for a second the value of the comparison of the forces of tension, direction, distance, and difference has been particularly insisted, as likewise the comparison of at least three progressive quarters of the moon; we have now to draw attention to another peculiarity, for which no better name can at present be given than that of contractile energy. This is a power which bears us to the confines of animal life, so like is it to that living force which rules and separates the animal gradations; and, if this had not been solved, the weather of many quarters of the moon would have been discovered to be very different from that indicated by the approximation tables, and by comparison; but when contractile energy is brought to bear its influence upon our labours, it shows us what is right.

The circular reference table having hot, calm, dry, cold, wind, moist, associated with determinate points in its circumference, contractile energy consists in the total value of the approach of the forces of tension, distance, difference, and direction to any one of the weather names on the table, as compared with that of the preceding and succeeding phases of the moon. This will be plainly perceived by the production of an example.

Meteorologists inform us that when the atmosphere is cooling it has a tendency to precipitate rain. This is a principle which admits of extension, and accordingly we have discovered that an atmosphere which is becoming saturated, acquires the power of generating wind; and that a windy aspect begets heat; whilst a warming influence favours drought, a calm one cold, and a dry, calm; and these give us the firstling perceptions of contractile energy.

Now for the illustration; and, as we have previously alluded to the period from the 8th to the 16th of January, 1866, let us carry such forward to the 23rd. Having constructed a circular diagram of the first of these quarters with the values of distance and difference indicated on the circumference, as likewise the two extremes of tension and direction, we must draw another diagram, like unto the first, of the second of these quarters, and compare the two; as also distinctly balance the season of the year with the contractile energy given. Upon comparison it will be found that tension and distance have advanced towards wind, whilst difference has passed across it towards cold, without any material receding from the wind centre; and as January is likewise approaching towards wind, these all favour the contractile energy upon the wind centre. Now a contractile windy aspect begets heat; it is therefore a warmer quarter than what the approximation tables would at first lead us to believe. Besides this, because the approach is towards cold, the precipitation of rain is indicated; and this is increased in amount by means of the contractile energy of the windy heat, conflicting with the approximate indication of cold.

To take another illustration; if any one examines the cold of November, 1858, he will find that the contractile energy of calm produces an intensely cold period from the 19th to the 26th of the month; and by the investigations it will be seen how this peculiar power, which we have termed contractile energy, has the property of delaying, intensifying, or annulling those indications which the approximation tables afford.

As moisture is the foe as well as the friend of the agricultural interests, if we investigate the July and August of 1860, how easily is the disastrous rain of that period rendered apparent. It is here that the weather problem is of importance to the farmer, in so much as he can reduce it to the three grades of favourable, doubtful, and unfavourable: and therefore when he knows of the approach of bad weather, to spur him on to the accomplishment of the work which is required.

Owing to the combined influences of inclination, altitude, and association, the generality of places vary from the natural weather character due to the particular latitude of such place during the year. At first this would seem to be a very difficult problem to solve, but the solution is comparatively easy when we consider that if any one place has a record of the weather for one year, there is abundant material afforded for the working off of all variations from the natural latitude proper to that place.

To render all as plain, distinct, and terse as possible, it will be better to give a concise view of the whole work to be accomplished in order to declare the actual state of the weather.

1st. Reduce the changes of the moon to the requirements of the circular meteorological table.

2nd. Indicate the extreme tension points of the quarter required, and notice in what direction the force travels.

3rd. Obtain the amount of the distance and its value upon the distance table.

4th. Ascertain the distance amount of the preceding quarter, and compare it with the distance amount of the present; if the former amount is the largest it is a difference of decrease, if it is smaller it is a difference of increase; and the relative value of such difference take from the difference table.

5th. Enquire concerning the directive force, whether it is solar or terrene, and apportion such, from the direction table, in accordance with the quarter required.

6th. Notice the contradiction or concordance of the progressive motions of tension and direction.

7th. Compare the positions of distance, difference, tension, and direction for the one quarter, so as to know whether there is confusion or harmony, intensification or laxity. This is a part very important to the understanding of changeable weather.

8th. Balance at least three lunar quarters, so as to obtain the actual value of the present quarter.

9th. Take particular notice of the contractile energy of a quarter, and its relation to the time of the year.

The foregoing is all that is required for ordinary observation, but to make the problem complete we require to work off the meteorological latitudes, altitudes, inclinations, and associations; and this, as we have previously remarked, is accomplished by taking the recorded state of the weather for one or a series of years and carefully comparing it with the weather which calculation gives as correct for the time and place required. Thus it is that any foreign or artificial assumptions are more easily rectified than they at the first glance could be imagined.

Our labours are now sufficiently advanced to enable us to show how the problem of weather foreknowledge is capable of being solved; and for this purpose let the following extract from "Glaisher's Meteorology of England" be the given proposition:—

"The year 1863 closed with very fine weather for the season all over the country, and which had continued for several weeks. At the beginning of January, 1864, the weather completely changed, and till the 9th the weather was exceedingly cold, averaging a daily deficiency of $8\frac{1}{2}°$ of temperature; on the 6th the deficiency was as large as 15°, and exceeded 13° on the 7th, and the temperature on grass at night was as low as 6° and 7°, checking the advance of vegetation. The frost broke up on the 10th, and a period of warm, damp, and foggy weather set in, and till February 3rd there was an average daily excess of 3¼° of temperature. On February 4th a cold period set in, snow fell in many parts of the country, and till the 11th day the deficiency of daily temperature was 7½°; on some days within this period it exceeded 10°; a period of five days followed, ending the 16th, during which the weather was warm; the average daily excess was 6¾° nearly. From February 17th the weather was altogether of a wintry character, with frost, snow, and sleet in all parts of the country. The wind blew from the north and east, and the average daily deficiency of temperature for 16 days ending March 3rd was 4½°. From March 4th to the 15th the weather was generally warm, there being an excess of 2¾° daily; and from March 16th to the end of the quarter there was a daily deficiency to the average amount of 2°. During the three months there was an unusual number of alternations in temperature, and change of weather from frost to thaw."

The 2nd day of January, 1864, is the beginning of a progression in a terrene direction, and is therefore suitable for the purpose in view. Three-quarter moon happens upon the 2nd, and full moon upon the 9th; and the time of their occurrence, as reduced to the requirements of our circular meteorological table, is respectively, $18^h\ 51'$ and $18^h\ 30'$: these are the extreme tension points of the quarter, and as they are both near to the word deep, on the referential circle, the atmosphere requires a deal of moisture and heat to raise it above the average.

Again, the terrene force has little power, because the direction during the quarter amounts only to 21′; this is likewise the amount of the distance and it bears its value. Taking, therefore, the distance table in hand, and placing 0 as nearly as possible opposite to the 2nd of January, we find it to indicate extreme cold, slightly tinged with dryness; and 21′ is very little removed from the zero of our scale, therefore the distance is extreme cold tinged with dryness.

The amount of the distance of the phase of the moon prior to the one we are now investigating is 7^h 43′, therefore the difference is a difference of decrease, and amounts to 7^h 22′; and this, on the difference table, gives calm, very slightly tinged with heat.

Now the natural aspect of the weather for this time of the year for the geographical parallel of 52° of north latitude is cold tinged with wind; because this latitude, in a meteorological point of view, acquires properties which are natural to the 75° of north latitude at the March equinox.

The sum of the whole is that this quarter of the moon is intensely cold and very calm, and the moon having a moist aspect causes fog to prevail.

The next quadrant of the moon, which is from new moon to first quarter, gives for its amount the sum of 8^h 54′, and the influence of the terrene direction runs from 3 ho through moist, to 1 wind, whilst the position of the extreme tension point carries the rainy preponderance towards the end.

The distance gives 1 moist to 3 wind, and the difference, which is a difference of increase, is $7^h\ 53'$ is 3 moist and 1 hot. The lunar aspect is calm, and as the last quarter was very cold, and this inclines so very much towards heat, the air is capable of absorbing a very deal of moisture, and is therefore colder and not so rainy as the natural indications afford. The quarter is mild and dull because of the air becoming saturated with vapour.

Upon the 15th of January another change of the moon takes place, that of the first quarter, which gives us the second quadrant of the moon; and the terrene progression still continuing, the terrene influence is windy. The amount of the distance is $1^h\ 35'$, and this is dry inclining to calm; the difference is a difference of decrease to the extent of $7^h\ 9'$, and this is calm. The heat in accordance with this decreasing to nearer the average causes the atmosphere to be unable to retain its moisture, much rain is therefore the result, the more so as both the extreme tension points are situated within the moist zone. The terrene force is here again of little influence, because the distance is so small.

The change which takes place upon the 23rd takes us up to the 31st of January, and the direction is now turned from terrene to solar. The amount is $1^h\ 43'$, and because of such small amount direction has a little windy influence; distance gives us an intermediate position between calm and dry, and the difference of 12′ increase leads to a dry aspect.

Between the 31st of January and the 7th of February, the amount is 6^h 15′, and the progression again turns to a terrene direction. Direction has here its proper influence, because the amount is about the quarter of a circle; and its run is from a position a little above moist, through moist and windy, to a position between windy and cold. Now the last direction being somewhat windy, and this present one giving a revolution or turn which takes us up immediately to above moist, we are led to expect wind before it extracts the rain due to the quarter from the influences of distance and direction. We may therefore at first expect wind, then rain, after which wind, this to terminate in cold.

The distance, being 6^h 15′, indicates moist slightly tinged with heat; and the difference, which is a difference of increase, being 4^h 32′, is warm.

On account of such, the moisture, in its condition of either rain or snow, is greater, and the wind and cold less, than what the direction would naturally lead us to expect. The extreme tension points being situated, the first a little above 9, the second a little above 3, favours the exhibition of warmth at the beginning and cold at the end.

The next progression takes us on to the 14th of February; and the terrene direction still continuing, it, starting from the end of the last, carries the influence onwards. The amount being 5^h 34′, direction exerts a due influence, and only fails a little at the end because of its being a little less than 6. Its run is from between wind and cold, through cold, to dry; and because the last termination was cold there is little change, and the frost is allowed to continue. The distance, which is always the same as the amount, and needless to repeat, indicates a position between warm and moist; there is therefore a change during the quarter from cold to warm, and the moisture has a mean position because of the direction terminating in dry. The difference, which is a difference of decrease, is only 41′, and this indicates much wind slightly tinged with cold. The wind is not allowed to appear at first, because the direction is continuous and it is leaving wind and approaching cold, and moreover the last terminus was cold; we may expect, therefore, the greater intensity of wind at the end, as the proper amount is prohibited at the beginning. Again, as the end approaches there is a struggle between the moist of distance and the dry of direction, and as the extreme tension point favours dry at the end, it gains the ascendant at the last.

The 22nd of February gives us an amount of 3^h 45′, with a change of the direction from terrene to solar, but this has not above one half of its proper influence, and its progression is from wind to moist. The distance gives us calm and warm, and the difference, which is a difference of increase, to the extent of 1^h 49′, indicates calm. Now the calm of distance and difference is antagonistical to the wind of the direction, therefore, although there is less than the average amount of wind for the period, yet the intensity is greater during the day: that is, in accordance with direction, near to the beginning of the period is more windy than the end, and in antagonism to distance and difference the intensity is greater at the beginning than the end; a short and somewhat severe blast is thus natural to a day at the beginning of the quarter. On the other hand, calm being favourable to the precipitation of vapour and also to the exhibition of cold, a cold downfall is imminent, and this occurring in the moist of direction favours the formation of snow. This shows how quantity and propinquity have to be worked.

The next change of the moon brings us up to the 1st of March, and the amount is 3^h 49′, with a change from solar to terrene direction. Shifting the sliding scale of numbers until 0 coincides with the 1st of March, or, to be strictly correct, a position intermediately between the 22nd of February and the 1st of March, it is apparent that the direction starts from a little below moist, and terminates between moist and windy, with wind preponderance. The direction is therefore moist as a whole, and because cooler at the end the rain is most abundant towards the end. The distance gives hot inclining to calm; and the difference, which is a difference of increase, is only 4′, and this is dry tinged with calm. The tension points we may state roughly as 17 and 13. Here the tension inclines to warm, whilst the direction seeks cold, in their relative progressions from beginning to end; there is therefore a confusion and confliction of their forces, and therefore very unsettled weather.

The 8th of March gives for its amount 9^h 45′; and the terrene direction still continuing leads us from beneath wind, through cold and dry, to dry and calm. The distance indicates cold; and the difference, which is a difference of increase, is 5^h 56′ points to moist and slightly warm; and the tension points progress from dry to warm and moist, there is therefore again confliction, and the only place where the forces really separate is when, as we approach the end of the quarter, dry and moist are in opposition, and therefore dry claims one part of the day and moist the other, and of course this has to be worked off in ratio with the latitudes. The cold, after a similar manner, is seen to be in greatest force a little removed from the beginning.

From the foregoing it is easily seen how changeable weather can be generated by reason of the confliction of tension and direction; and from the dissimilarities of distance and difference.

From the 8th of March to the 30th is one continuous solar progression; and the run, from its revulsion with terrene at the beginning, to that at the end, is from the windy side of moisture on the 8th, to a slight advance towards it on the 15th, from whence it traverses through the middle of moisture and reaches a position between moist and warm on the 23rd, after which the course is through hot, calm, and dry, to cold, on the 30th. The distance for the first of these three lunar quarters is 1^h 40′, for the second 3^h 45′, and for the third 11^h 28′. The difference of the first from the relative amount of the quarter preceding is a difference of decrease to the extent of 8^h 5′, whilst the difference of the first amount from the second is 2^h 5′ of increase, and that of the second from the third is also a difference of increase to the extent of 7^h 43′.

The distances are, the first, calm; the second, warm; and the third is dry and calm, and because of the distance, tends towards the exhibition of extremes.

The first difference points to dry and cold, the second to calm and warm, and the third to dry fringed with cold.

The tension points are warm and moist on the 8th, warm on the 15th, calm on the 23rd, and windy on the 31st.

The weather of the quarter preceding the 8th of March being very changeable, is not easily subdued by that succeeding it, because direction, on account of its little extent, lingers about moist and windy, and therefore does not rule the weather with a vigorous hand. There is likewise the dry and cold of difference conflicting with the moist and warm of tension, and the calm of distance. The quarter is on the whole warm, because direction, tension, and distance weigh against difference, although the daily temperature fluctuates because of the cold of difference and the warmth of the others.

Upon the 15th of March direction exerts its mean influence, and enables the warmth of distance and the warm and calm of difference, aided by the tension stretching from warm to calm, to rule; and we have therefore fine weather till the 23rd—as a general rule—although a little more motion would have enabled the air to take up more of the moisture of the previous wet quarters, and have thus enabled the atmosphere to maintain a higher degree of warmth. There is here a perception of those minor calculations which it is no use bothering the general reader with, because they require a peculiar education to solve, and few will care for anything but the general characteristics of the weather; moreover, this is only a rough sketch, and not a finished production.

There are two considerations connected with wind to which we may appropriately call attention here, and these are locomotion and rotation. We term a wind a locomotive wind when the centre of its force travels from place to place; whilst a perfect rotatory wind has the centre of its force stationary. To exhibit this in a familiar manner, let any one observe the wheel of a coach whilst the coach is travelling from one place to another: he will observe that the wheel turns on its axis during the time occupied in traversing the given distance; therefore the wheel both turns round and goes along; the first motion represents a rotatory wind, the second a locomotive. Again, put the drag to the wheel so that it is unable to turn round, and then pull the coach along, this represents a simple locomotive wind. Lastly, stop the coach and spin the wheel round without allowing the coach to progress, and this gives the idea of a simple rotatory wind.

Now what we have termed direction claims kindred with locomotion in its power of 6, and with rotation in its low or minimum amounts; therefore when direction is in a minimum it allows the formation of rotatory winds, and in its mean state favours the production of a wind having both locomotive and rotatory faculties. The last wind, because of its nature, carries the moisture and deposits it here and there up and down the country, like a playful child with its watering pan in the garden.

The quarter of the moon which is inducted upon the 23rd of March and terminates upon the 30th of March, gives for its extreme tension points, the first a very little below calm, and the second a very little below wind. The amount, which is $11^h\,28'$, takes the solar direction through hot, calm, dry, to dry and cold. The distance is dry and calm; the difference, which is a difference of increase, is $7^h\,43'$, and this is wind with a cold inclination.

As diversity is pleasing, we will now give another mode of solving the problem of weather foreknowledge; and this will consist in the construction of a diagram for the present lunar quarter under consideration. We believe that it will be found to be by far the easiest manner of conducting a general inquiry; and it is likewise most appropriate to the simple geometrical style of this work.

Describe a circle, and divide the circumference into 24 equal parts; write hot over that point which is related to 12 on the reference table, and which is at the top of the circle, calm in conjunction with 16, dry with 20, cold with 24, wind with 4, and moist with 8. Draw a diameter or line passing through the centre of the circle whose ends shall be equally distant from hot and cold; this is the line of mean heat: in the same manner draw a diameter equally distant from moist and dry, and this gives the line of the average amount of moisture due to the given period; also draw the mean diametrical line of wind; as a line equally distant from wind and calm, this indicates the natural amount of wind due to the given period of the year.

In looking over meteorological tables we find that the average amount of temperature and rain is carefully given and compared, whilst it is not so with the wind. To make the tables perfect the average amount of wind experienced requires to be compared with the average amount of wind natural to the period.

Returning to the consideration of our diagram, first take the extreme tension points which indicate the beginning and the end of the lunar quarter, and draw a line connecting them—this part of the process had better be done in red ink, the better to distinguish it from the mean lines of heat, wind and rain. Second, do the same with the terminal points of the solar progressive direction, and imagine a convergent series of lines drawn from every point of its circumferential progress to the end of its force; third, take the distance and difference points and join these, and the diagram is completed. It will be seen from this diagram that the solar line cuts the tension line a little below the mean line of heat, a little above the mean line of wind, and a very little on the dry side of mean moisture. That the distance and difference line cuts the solar line at a point nearly half way between mean heat and extreme cold, a little on the windy side of mean wind, and moderately far advanced into the dry half of mean moisture. For these reasons the average of this lunar quarter ought to be a little more windy than its true average, the heat somewhat less—and also the rain—than the average amount.

Having worked off the average amount, we have now the quality and propinquity to contend with. The heat, because of the warming influence of the direction and tension points at the beginning, favours heat propinquity; and because there is no contradiction of forces between the tension and direction progressions, there will be the greater variation between the day and night temperatures. The cold will gradually increase as it approaches the end, where it will become again a little warmer because of the solar directive force, and the terminal tension point. The cooling influence of direction will give forth moisture in its descent and absorb it in its ascent. In regard to the wind, this will be found to be most boisterous in the cold, because the atmosphere is then at its least density for the quarter.

The above seems to be sufficient for any person of ordinary ability to obtain a glimpse of the coming weather, and we may now take a glance at the troubles of earth, in its mineral, vegetable and animal kingdoms, caused by fluctuations of the weather.

As a beginning, let us date to troubles of the mineral kingdom, to too great expansion on the one side, and too much contraction on the other, and therefore productive of earthquakes and auroras as due to the abundance or absence of heat; those of the vegetable world as caused by superfluity of wind or electrical intensity; and those of the animal creation by the absence or superabundance of moisture in the atmosphere they breathe.

It is to these points that those interested in tracing the origin of the cattle plague ought to pay attention, and to discover from meteorological data whether the disease originated from a deficiency or superabundance of spiral activity in the vegetables they consumed—that is, whether the atmospherical status indicates a diseased condition of the grass, and therefore the cause of disease in the internal structure of the animal; or if the atmosphere gave the vegetative influences as healthy, and intense droughts generated disease in the animal economy. The cow, as a hydroganic animal, can stand less deprivation of hydrogen than either the sheep or the horse.

The whole theory rests upon these conditions: the first is to dread an earthquake when the expansive energy of heat reaches its extreme and there is a sudden change, or *vice versa*. In the vegetable world health is maintained by varieties of minute spiral action pervading all plants. Now if an electrical state of the atmosphere, which is a species of balanced antagonistical rest, is slowly induced, it stops the spiral activity of the vegetable; and if at the change of the moon an extreme amount of spiral or anti-electrical activity is developed, the sudden change is so utterly discordant with the preceding, that internal disease is the result. In the same manner sudden changes from dry to wet, or from wet to dry, produce disease in the animal economy.

And the whole aim of medical meteorology must be either preventative or curative, that is, having forecalculated when these sudden changes take place, to tell what ought to be taken to counterbalance the detrimental force, or when the disease has obtained a hold upon the system, to declare what will be the means of balancing the evil and restoring health.

A practical investigation of the actual state of the weather always affords three separate problems. The first is heat, the second wind, and the third moisture. Such being the case, the best method of obtaining the most correct results is at first to work each of the three problems separately, and then compare them for proportionate effect.

To do this correctly for a whole year, it is best to construct a circular diagram of all the lunar tension points for that year, and thus obtain at one glance a first idea of the nature, force, and flow of the atmosphere for the whole period. Let it be remembered that lunar tension points are those longitudes or hours where a change of the moon occurs in reference to any given longitude. The longitude of Greenwich is the referential longitude.

In the above circular diagram it is better to indicate the extreme points of the six weather aspects, and to draw the lines of mean heat, wind, and moisture. It will then be seen how and where the air over any one region rises to or falls from heat; approaches or recedes from moisture; and acquires or loses a windy influence.

If the solar progressions are drawn with black ink, and the terrene with red, it will afford an idea of the ratio of each, and a first indication of sudden changes in the weather. This, however, must be worked off from the approximation table; as instance, if we refer to the 22nd of July, 1865, it will be found that the directive force has then a revulsion from terrene to solar, with a sudden rise towards heat; and therefore the days immediately succeeding this date are drier and hotter than the approximations obtained for the other forces indicate. This solar direction continues from the 22nd of July to the 7th of August, and as it is continuously falling from the point of extreme heat, we are led to expect both coolness and rain towards the end; the more so as the tension from the 30th of July to the 7th of August is very depressive. Upon this latter date both direction and tension brace up the weather again, and again allow it to fall on the 13th. Tension and direction continue to fall till the 21st; after which, whilst direction continues to fall, tension continues to rise, and does not agree with direction again until about the 29th, when it also begins to rise; and both continue in accord up to the 5th of September. From the 5th to about the 10th direction continues to rise, whilst tension falls about the 12th; then tension rises whilst direction falls. But tension falls along a line which indicates increase of volume; tension is therefore absorbing moisture even whilst it is falling from heat; and this is likewise aided by the September influence. Again, the indications of distance and difference for the period from the 5th to the 19th September, are more heat than cold, more calm than wind, and more drought than moisture; and thus we obtain hot, calm, dry, as the general indications of the weather from the 5th to the 19th September, 1865. Moreover, if we investigate the contractile energy, it will be found that the first of these centres towards heat, and the second towards drought.

It will be seen from these statements that by far the easiest method of working the weather problem is, firstly, to investigate and apportion the forces of tension and direction, and then to bring the influencing powers of distance and difference to bear upon the question.

The proposed nature and intended limits of the present treatise forbid an entrance into all the minutiæ of detail which the perfect appreciation of the subject requires. The problem therefore has only been treated under its general aspects, and methods indicated for the discovery of sudden changes in the weather and its extreme or storm aspects; as likewise how discordant relations in any lunar quarter produce fitful or changeable weather.

Diagrams have not been appended, because we have been reasoning concerning the weather of the past. That of the future is the next labour proposed; and the weather of the year will be tabulated in accordance with a still easier method, only thought of whilst the present work was in the press.

Who will say that over haste has been indulged, when he considers the stormy aspects of the present January? Even if no more were accomplished than the capability of foretelling when periods of great heat, cold, wind, or rain were imminent, it would be sufficient to establish a claim upon those interests which relate to health, business, or pleasure; and will sustain the spirit under which the problem was attempted; and this was, Geometry *versus* Meteorological Instruments, and the aid which it is capable of affording them. Science is continuously progressive; and it is only by the cumulative labours of the many that its truths are defined.

APPROXIMATION TABLE.

ALLIED WITH 24.

Numbers or Amount.	Direction. Solar.	Terrene.	
0	Cold	Hot	21st December.
2			20th January.
4	Windy	Moist	19th February.
6			22nd March.
8	Moist	Windy	21st April.
10			22nd May.
12	Hot	Cold	21st June.
14			22nd July.
16	Calm	Dry	21st August.
18			20th September.
20	Dry	Calm	21st October.
22			20th November.
24	Cold	Hot	21st December.
	Windy	Moist	
	Moist	Windy	
	Hot	Cold	
	Calm	Dry	
	Dry	Calm	
	Cold	Hot	

The first column to be detached and moved along, with 0 in harmony with the dates.

APPROXIMATION TABLE.

ALLIED WITH 12.

Numbers or Amount.	Distance.	Difference. Increase.	Difference. Decrease.	
0	Cold	Cold	Cold	21st December.
1				20th January.
2	Dry	Dry	Windy	19th February.
3				22nd March.
4	Calm	Calm	Moist	21st April.
5				22nd May.
6	Hot	Hot	Hot	21st June.
7				22nd July.
8	Moist	Moist	Calm	21st August.
9				20th September.
10	Windy	Windy	Dry	21st October.
11				20th November.
12	Cold	Cold	Cold	21st December.
	Dry	Dry	Windy	
	Calm	Calm	Moist	
	Hot	Hot	Hot	
	Moist	Moist	Calm	
	Windy	Windy	Dry	
	Cold	Cold	Cold	

The first column to be detached and moved along, with 0 in harmony with the dates.

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