UNIVERSITY OF ARIZONA.

Arizona Agricultural Experiment Station.

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Arizona Weather and Climate.

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Arizona Agricultural Experiment Station.

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EXPERIMENT STATION,
Tucson, Arizona.

ARIZONA WEATHER.

METEOROLOGICAL TABLES AND GENERAL DISCUSSION.

SYNOPSIS.

LOCATION.

The Meteorological data herein recorded were gathered at Station No. 1 of the Arizona Agricultural Experiment Stations. This is located on the grounds of the University of Arizona, in Latitude 32 degrees, 14 minutes N., Longitude 110 degrees, 53 minutes W. (Greenwich). The site is on the open mesa, about one and one-half miles northeast of the business center of the city of Tucson, at an elevation of 2430 feet above sea level. The situation is arid and surrounded on all sides by unimproved land.

ORGANIZATION.

This branch of the work of the Station was organized by Professor Vasa E, Stolbrand, Irrigation Engineer and Meteorologist, and was conducted by his successors, Professors Chas. B. Collingwood, Edward M. Boggs and Nathan H, Barnes, and their assistants.

About the time the work was being organized, the office of the Observer of the United States Weather Bureau, who is also the Director of the Arizona Weather Service, an organization of volunteer observers, was located in the University Building, To avoid repeating the observations of the Weather Bureau the equipment of the Station omitted a number of instruments usually found at a Meteorological Station, making use of the records of the Weather Bureau. The observations of the Weather Bureau at the University were commenced in September, 1891, and continued until July, 1894, when the location was changed from this place to the Orndorff House in the business portion of Tucson, The date of the removal is plainly indicated by the sudden change in the recorded observations of certain elements; others show little or no difference, Except in the case of precipitation the records of the Weather Bureau are continued in the following tables until June 80, 1895, when the office at Tucson was discontinued. Acknowledgments are due to Mr. William Brown, Observer United States Weather Bureau, for his courtesy in permitting access to the records of his office.

At the beginning, the instruments belonging to the Station were exposed within an inclosure some thirty feet square at a distance of one hundred yards from the main building, adjoining the eastern boundary of the grounds, and consisting of a light woven-wire fence. Very little vegetation of any kind surrounded the inclosure, the principal growth being a light stand of alfalfa on the north and west sides. At this place the mesa is smooth and rolling, sloping gently towards the southwest. The inclosure was at the bottom of a slight depression or swale. On September 19, 1894, the instruments were removed to a new inclosure about forty yards south of the University build-

ing, and one hundred yards from the former one. This situation is on the summit of a slight swell of land a few feet higher than the former location. The Weather Bureau instruments were exposed according to the accepted standards of that organization.

Tables I to VI contain the data derived from these observations, extending over a period of seventy-four months.

TEMPERATURE.

Table I —*The mean maximum* temperature for the month is the average of the highest daily temperatures during the month. Likewise *the mean minimum* is the average for the month of the lowest daily temperatures The mean of the temperatures at every hour of the day is the *mean daily* temperature, but as hourly observations are taken at only a few of the most scientific observatories of the world, it is customary to take the average of the highest and lowest daily readings as the mean for that day. The average of the daily means for the whole month is called the mean monthly temperature, and the average of the twelve monthly means gives the mean annual temperature.

The highest and lowest temperatures noted by self-registering instruments are given in this table. The daily range is the difference between the highest and lowest temperatures for the day. The greatest and least daily range of each month are also given in this table.

VAPOR PRESSURE.

Table II contains further details pertaining to maximum and mimimum temperatures; also vapor pressure, dew point and relative humidity up to July, 1895, when those records appear to have been discontinued

If water be introduced drop by drop into a vessel from which the air has been exhausted, the water will apparently disappear. It has changed to vapor. This evaporation will continue until a certain pressure of vapor is reached, after

which any additional water will remain liquid. The vessel is then said to contain saturated vapor. The pressure of saturation depends upon the temperature, the higher the temperature the higher the pressure of saturation, If, instead of a vacuum, the vessel had contained dry air, it would have evaporated precisely the same amount of water,

Water vapor is always present in the air to some degree, although invisible until it condenses into minute particles of water, when it is seen as fog, or cloud. Whatever the vapor pressure at any time, if it remains constant while the temperature is lowered, a point will be reached where condensation commences. This temperature is called the dew point. Any further reduction of temperature causes a visible fog or deposit of dew. If the temperature be raised, the dew is again evaporated and disappears from view. If the temperature rise still higher, there is no moisture to supply the evaporation. The vapor is then said to be dry, or super-heated. If the number expressing the vapor pressure in the air at the time of observation be divided by the number expressing the pressure of saturation due to the temperature at that time, the quotient obtained is a fractional part of saturation. This fraction is called relative humidity, saturation being 100 and absolutely dry air 0, Vapor pressure is expressed in terms of inches in height of a mercury column that will balance it. Absolute humidity, or the quantity of water contained in a given unit of air, is nearly proportional to the vapor pressure. It is stated in number of grains of weight contained in a cubic foot of air. The dew point is expressed in degrees Fahrenheit. as are other temperatures.

Since relative humidity is a fraction of temperature it does not constitute a means of comparison as to the quantities of moisture actually present in the air at different places and times. However, it is not the absolute humidity, but the percentage of saturation which makes the extremes of temperature most annoying to animal life. Statements of relative humidity, therefore, in connection with those of temperature, give information concerning the comparative discomfort of life in different climates.

PRECIPITATION.

The total monthly and annual precipitation, with details as to distribution, are stated in Table III. Although the distance of this Station from Tucson is very short, there is a noticeable difference in the amount of rainfall as observed at the two Stations. This is apparently due to the greater distance of the University from the low range of mountains lying west of the city. In general the rain clouds follow closely the mountain ranges, even when the latter are seemingly of insignificant size. The distribution of rainfall is exceedingly variable. During the six months ending June 30, 1895, there was a total precipitation of only 0.68 inch, and for the eighteen months ending on the same date a total of only 7.39 inches.

SUNSHINE.

Sunshine is recorded by an instrument which photographs on a sheet of sensitized paper the unclouded sun during the day. The method is not wholly satisfactory for the reason that for a considerable time after rising and before setting the sun's rays have not sufficient actinic power to plainly mark the sensitized paper. Still, it furnishes a more accurate measure of the duration of sunshine than can be obtained otherwise, except by instruments too delicate and costly for common use, Cloudiness is recorded from personal estimates by the observer. In the scale used a perfectly clear sky is called 0, and when wholly obscured it is called 10. When compared with automatic sunshine recorders it is found that the personal estimates of observers usually rate the cloudiness too high.

EVAPORATION.

The rapidity of evaporation depends on the temperature of the water at its surface, the dryness of the air, and the velocity of the wind. It is difficult to compute with accuracy the amount of evaporation by mathematical formulas. It is best ascertained by direct measurement

At this Station measurements of evaporation have been

taken in a galvanized iron tank six feet long, four feet wide and four feet deep, sunk **in** the ground, its edges flush with the surface. The water level is kept as high in the tank as it can be safely held. always within a few inches of the top Elevations are read by means of a Boyden hook-gage, reading directly to one one-thousandth of a foot, and readily estimated to one ten-thousandth of a foot As originally placed the hook-gage was in the tank itself, but after the change of location in September, 1894, the gage was placed in a small chamber about ten inches from the tank and connected therewith by a pipe of small diameter. This arrangement was designed to avoid the fluctuations of the water surface due to the small ripples nearly always present in the tank. The tank is in an inclosure formed by a light woven-wire fence. No trees or other obstructions offer material resistance to the passage of the wind. It should be noted in this connection that the wind velocities given in Table V are from an anemometer on the roof of the main building some forty feet above the ground. At this elevation the velocity is much greater than at the surface of the ground.

A second tank, an exact duplicate of the first, placed by its side, and provided with a similar gage, was planted with water lilies of the genus *Nymphæ*. Measurements were commenced in September, 1892, when the leaves well covered the surface of the water. They were continued until April, 1894, when the gage was needed for another use. A comparison of results is shown in parallel columns in Table IV. It will be seen that the monthly totals of the two tanks are in substantial agreement. The differences are usually small. The excess changes so often from one tank to the other as to lead to the conclusion that differences are clue to accumulations of errors incident to observation. But it is not easy to apply this explanation to the difference 0 75 inch in favor *of* the lily tank occurring in June, 1893, However, the idea that the leaf covering has diminished the evaporation to any considerable extent is dispelled by the fact that for the eighteen months of the record the difference amounts to 1.52 inches only, a divergence of about one per cent.

As the tank is situated, the measurement of evaporation at

this Station probably represents the maximum for the surrounding region, and may be considerably in excess of that from the surface of a large body of water. The mean annual evaporation at this place for three years of the record is 77.7 inches. This depth is somewhat less than that commonly attributed to this region.

Table V contains a record of the total wind movement for each month, with details of velocities and prevailing direction. The total monthly movement is fairly uniform throughout the year. The abrupt fall in the number of miles, caused by removal June 21, 1894, from the University to Tucson, is noticeable. In the latter situation the anemometer is sheltered to some extent by the small mountains west of the city. Although the wind occasionally reaches a high velocity, it is very rarely destructive. Tornadoes, so numerous throughout the States of the Mississippi valley, are unknown. This record was discontinued in July, 1895, but will be resumed.

The relation between weather and climate is by some not clearly understood. It may be well to state that by weather is meant the condition of the atmosphere at any one time with regard to its temperature, humidity, motion, etc. This is observed at stated times and a record made of each set of observations, which shows what may be that particular weather. Climate is rather the condition of a place with regard to its varying weather, and the effect that has upon both animal and vegetable life, their growth, salubrity and development. The climate of a place could be well determined from a large number of *complete* weather observations extending through all the varying circumstances of the seasons, day and night, sunshine and cloud, wind and calm, and accompanied by complete health and crop reports, A complete record of all these conditions is, however, rarely made, and people are often loth to consider conditions unfavorable to the reputation of their own particular climate, and the weather records. when complete, are not fully and fairly considered.

The records given herein show that the climate of this Station is decidedly arid; the temperature is high in summer and

by no means low in winter; the summers are long and winters short; the precipitation is for the most part during one of two periods — one near midsummer, the other near midwinter. At no time is the rainfall sufficient to be of any perceptible agricultural value. Wind storms of severity are unknown, and high winds are rare.

But there is much more that should be told of this climate if we would not deceive. On a clear, bright day, in the sunshine, even in midwinter, the air is balmy and mild, but filled with ozone and delightfully exhilarating At the same time, in rooms having a northern exposure, or on the shady side of the street, the cold is very penetrating. The difference in temperature between day and night is often as much as fifty degrees Fahrenheit, and that between the bright sun and shade, or a strong wind, frost-laden from the snow-clad mountains, and a calm, is scarcely less trying. These great differences seem to make the climate harsh and severe for delicate invalids, who should protect themselves from them. Even those well acclimated are troubled with colds, and pneumonia is a prevalent and very fatal disease.

On the other hand, the air of the mesas is pure and invigorating, and dews are unknown. Those having pulmonary troubles are often most benefitted by living in the open air, sleeping under no shelter but the broad canopy of heaven, but well protected from the cold night air by an abundance of bedding.

While the elevation is not great, it is sufficient to cause serious disturbance to those who have heart trouble, even in the vicinity of this station. Yuma or Phoenix, being much lower, would offer a much better climate for such. In other respects the climate of this Station is typically that of the Territory,

CLIMATE OF ARIZONA.

In a State which embraces 114,000 square miles and ranges

in altitude from a few feet above the sea to almost 13,000 feet on its highest mountains, it is natural that there should be a wide diversity of climates It is so in Arizona. Therefore, to attempt to describe in detail the climates of the various localities would be a task not only far beyond the scope of our present work, but also largely beyond the range of statistical data. There are, however, certain climatic features common to nearly the whole of the Territory, and it is our purpose to consider these.

Speaking generally, the climate of Arizona is arid; that is to say, there is a notable deficiency of moisture. This in itself implies a clear atmosphere, a low degree of humidity, sunshine strong and almost continuous. Consequently, the days are hot, the nights cool and refreshing. These are prominent features of Arizona's climate.

The following tables have been compiled from all available sources. principally the publications of the Signal Service of the United States Army, and its successor, the Weather Bureau of the Department of Agriculture.

TEMPERATURE OF ARIZONA.

In any inquiry regarding Arizona the question usually the first to be raised is that of temperature. The general interest in this element has a scientific foundation on the fact that temperature is the most important of all climatic factors, since all others depend directly or indirectly upon it. The popular curiosity in this element, however, proceeds not from this scientific fact, but from the generally accepted misinformation as to the torrid heat experienced in this region. The widely circulated tales of the would-be humorists have done more than all other causes to give Arizona the name of being uninhabitable. Generations of actual residents will have passed away before the harmful effects of these thoughtless tales will have wholly disappeared, and the knowledge secures general recognition

that this region is not the hopeless desert it has been represented.

The simple thermometer, no matter how accurate it may be, does not measure temperatures as felt by animal life. Its records must be considered in connection with certain other data in order to afford a mode of comparison with the climates of other portions of the earth. We may term the reading of an accurate thermometer the *actual*, and the sensation of heat or cold as felt by the higher orders of animal life the *sensible* temperature. Neither of these is a measure of the other. The fact is well known to meteorologists that the thermometer alone can not indicate the sensible temperature, but that the humidity of the air must be considered in connection with the actual temperature. This fact is also known to dwellers in the arid region, but it is not known to the majority of otherwise intelligent people throughout the world. The reputation of Arizona has long suffered from the prevalent ignorance on this point. Records of maximum temperatures enable comparisons to be made which appear unfavorable to Arizona, and lead to the belief that the heat of this so-called desert region must be almost, if not wholly, unendurable.

Where the percentage of atmospheric moisture is high, both extremes of temperature are felt to be greater than the thermometer indicates. Everybody knows something about that condition of the weather which is variously termed "sultry," "close," or "muggy." These terms describe the result of a combination of heat and moist air. This is the condition which exists commonly in the tropical regions of the world where the rainfall is heavy, and in the same way, though *in* a smaller degree, throughout the United States outside of the arid region. It is especially noticeable in the States bordering upon large bodies of water, such as the Gulf of Mexico or the Great Lakes, and is conspicuously absent from the greater portion of Arizona.

In the dry air of this territory "sunstrokes" are unknown, while in the Mississippi valley and the States lying eastward whole columns of the newspapers are filled with accounts of

prostrations from heat, and fatalities are numerous whenever the thermometer indicates 90 degrees or upwards. At many places along the sea coast where the humidity always remains near the point of saturation a temperature of 85 degrees brings excessive discomfort, and exertion or exposure to the sun is extremely hazardous. Men and the lower animals perform in safety their customary duties beneath the cloudless skies of Arizona under the highest temperatures ever experienced here. The dry air induces exceedingly rapid evaporation of the abundant perspiration, thus keeping the body at a comparatively low temperature As a matter of course the supply of fluid must be maintained, hence the great thirst so often experienced by travelers in desert regions, and the imperative necessity for an adequate supply of drinking water. Of all the lives lost on the desert stretches of Western America—and their number is not small—not one is directly attributable to heat, but to thirst. The experienced traveler provides an ample supply of water and fearlessly invades the worst desert yet discovered.

An amount ranging from 15 degrees to perhaps 30 degrees, according to the humidity, should be subtracted from the records of maximum actual temperatures during the hot season in Arizona to indicate the sensible temperatures. In like manner the dry air of the arid region enables extremely low temperatures to be endured without discomfort. The winter cold of the Canadian Northwest Territory is much less disagreeable than that of the United States immediately south of the Great Lakes. The lowest temperatures known on the high plateau of Arizona bring less discomfort than a "chilly" day in New Orleans.

The University of Arizona, near Tucson, is situated in Latitude 32 degrees 14 minutes N., Longitude 110 degrees 53 minutes W., elevation 2430. Its climate is fairly representative of a large portion of Southern Arizona, which must always remain the chief agricultural portion of the Territory. For purposes of comparison of the climate of Southern Arizona with that of other localities ten Stations of the Weather Bureau have been chosen which form with Tucson a continuous circuit of the

United States, starting from Florida, crossing the Grulf States to the Pacific Ocean; thence eastward across a more northern tier of States to the Atlantic Ocean, at Boston.

Tables VII to XII inclusive enable comparisons to be made regarding temperature and certain elements closely related thereto. They have been compiled from the report of the Chief of the Weather Bureau for 1893 The report for this year was taken because it is the latest annual statement at hand.

From an inspection of these tables it will be seen that the maximum winter temperatures of Southern Arizona are very nearly the same as those of the Gulf States, Those of summer are considerably higher, but Table VIII, showing the relative humidity at the same Stations, shows unmistakably why the summer climate of Arizona is far less trying than that of the States bordering on the Grulf of Mexico. Thus the June temperature of 107 degrees at Tucson with relative humidity at only 22 per cent is far preferable to that of any other city in the list with temperature of 85 to 95 degrees and humidity at 65 to 83 per cent.

The annual range of temperature at Tucson is somewhat greater than that of the Gulf and Pacific States, but is remarkably less than that of the Stations in the Northern States.

Table XI shows the number of days in each month on which precipitation of 0,01 inch or more fell, and the total depth in each month and for the year. From this table it will be seen that not only is the rainfall of Southern Arizona very light, but that it occurs on very few days of the year. The winter months are especially free from rainy days. The six months from October to March inclusite contained but fifteen rainy days, whereas at Los Angeles there were thirty-seven, and at Jacksonville fifty-seven rainy days during the same period.

In common with the arid region in general, Arizona usually experiences a large daily range in temperature. What would otherwise be a serious tax on human endurance, especially that of weak constitutions, is mitigated to a great extent by the prevalent low degree of humidity. As before stated, this feature modifies both extremes of temperature, and makes the sens-

ible temperature much more uniform than the thermometer readings would indicate. Instead of being a heavy disadvantage this high range of temperature even becomes a blessing, Insuring as it does cool nights and refreshing sleep.

In Table XII it was found necessary in a few instances to select other Stations than those used in the five preceding tables, for the reason that not all of them reported sunshine observations during the year 1893.

In such cases the nearest Weather Bureau Stations reporting this element in that year were chosen. It is readily seen that Tucson ranks far above the other Stations in the amount of life-giving sunshine. It may be stated further that its percentage is higher than that of any of the 24 Stations reporting this element in 1893; also that in this year the percentage at Tucson was considerably below the normal. If the solar engine is ever made a practical machine it will find its best field of operations here in Southern Arizona. The beneficent results of this large measure of sunshine are seen in many ways, notably in its rapid and permanent curative effects upon invalids, in the longevity of the inhabitants, and in the yield and quality of the agricultural and horticultural products of the Territory,

PRECIPITATION.

The measurement of precipitation, whether in the form of rain or snow. has been more generally observed than any other branch of meteorology. Throughout the civilized world there are large numbers of observers who keep no other record than that of this element. The term *arid region* itself shows that the natural supply of moisture is insufficient for the growth of most of the useful forms of vegetation. For purposes of agriculture it is necessary to make up by artificial means this deficiency in the natural water supply. All other industries are dependent upon agriculture for their own success. Statistics concerning precipitation. therefore, are to the majority of the inhabitants of the Territory the most important of all meteorological data. Statements giving simply the observed annual

or mean annual rainfall in any given locality are of little value and oftentimes misleading. The distribution throughout the year, and its irregularities, must also be taken into account.

In this region rainfall is more variable and uncertain than any other climatic element, and observations must extend over long periods of time to secure reliable data. In a Territory as sparsely settled as Arizona it would hardly be supposed that any extensive series of observations have been recorded. Fortunately, the establishment of military posts has enabled valuable records of some features of the weather to be kept. The most important of these is that of rainfall. We thus have a considerable number of carefully formed official records of rainfall, extending through long terms of years and covering the Territory in a comprehensive manner. Interspersed with these are a larger number of voluntary Stations whose records commence at a later date, although not a few of these cover many years. Within the last few years the abandonment by the government of nearly all the army posts has reduced to a very few the number of official Stations keeping meteorological records. This important work is thereby committed to the people of the Territory, who should not permit it to lapse. The future of this coming State is largely dependent upon reliable data regarding water-supply possibilities, and thus directly upon systematic measurements of precipitation. Series of observations covering the higher mountain ranges, the principal drainage areas of the Territory, and including the depth and persistence of the snowfall are especially to be desired. The Director of the Arizona Weather Service, located at Phoenix, is prepared to equip with the necessary instruments a considerable additional number of voluntary Stations, and it is hoped that the full quota of observers will offer themselves for this work, the importance of which can not be overestimated.

A large majority of the rainfall records in Arizona are taken in the great valleys, where agriculture will ultimately reach its highest development. In such localities the precipitation is probably a minimum, being much lower than that of the surrounding mountains. These data are of value

in that they show the amount of rain which the adjacent cultivated lands would receive, but they are not so useful in the solution of questions pertaining to the surplus waters available for storage.

In general the mean depth of precipitation varies nearly directly as the altitude above sea, the isohyetal curves being in nearly all cases closely parallel to the contours of elevation.

The deficiency of rainfall in Arizona finds partial compensation in the fact that the precipitation occurs in two distinct seasons The summer rains usually appear about the first of July and increase in frequency until August, the wettest month of the year. They then gradually decrease to a minimum in October. From this time the winter rains are liable to commence. reaching a maximum in December and ceasing altogether about the end of March May and June are almost everywhere very dry, the latter having the least rainfall of any month.

In Table XV is given a list of 115 Stations in Arizona from which precipitation records are available. The geographical positions of these stations are given, together with important facts regarding the history and continuity of the records.

Table XVI contains a condensed abstract of the principal features noted in the individual tables of precipitation recorded at the 115 Stations of Table XV It shows for each month the number of years in which the rainfall for that month was measured, the mean for the month, the maximum and minimum for that month, and the years in which they occurred. Annual summaries of the same kind are also shown. This table extends from the earliest recorded dates to the close of the year 1894, and is believed to be the most extensive table of rainfall data pertaining to Arizona yet published. The importance of the subject is thought to justify the large amount of time and labor devoted to its compilation and computation.

Many interesting facts appear from an examination of this table, a few of which may be noted here.

As was to be expected, the extreme west and southwest portions of the Territory are found to receive the minimum rain-

fall. The lowest mean annual precipitation is recorded at Camp Colorado, 2.05 inches; Stanwix, 2.68 inches; Yuma, 8.05 inches: Texas Hill, 309 inches; Burke's. 3.88 inches; Fort Mohave, 5.32 inches; and Maricopa, 5 50 inches. The records of the first two of the above named Stations cover periods too short to insure a fair average. It will be observed that these Stations are mainly along the railways or the Colorado river. Were the region well covered by observers it is possible that still lower means might be reported.

Those Stations having the lowest maximum annual rainfall are Camp Colorado, 2,46 inches, in 1869; Burke's, 4,52 inches, in 1879; Texas Hill, 5.02 inches, in 1884; Yuma, 5.86 inches, in 1884; Gila Bend, 7.11 inches, in 1893; Buckeye, 7.90, in 1894.

Maricopa is distinguished as the Station having the lowest minimum annual rainfall, only 0.38 inch having fallen during the year 1882. Others reporting totals of less than one inch during any year are Buckeye, 0,63 inch in 1891; Yuma, 0.74 inch, in 1880; Texas Hill, 0,98 inch. in 1880; and San Simon, 0.99 inch, in 1887.

The heaviest precipitation occurs at places along the southwestern rim of the great plateau or on the abrupt slope from it to the plain.

Stations reporting the highest mean annual rainfall are Cooley's Spring. 30.01 inches; Tip Top, 28.70 inches; Flagstaff, 27.49 inches; Strawberry, 26.59 inches; and Camp Goodwin, 25.57 inches.

The highest maximum annual rainfall occurred at the following places: Breckenridge (old Camp Grant), 35.21 inches, in 1871; Natural Bridge, 30,45 inches, in 1890; Camp Goodwin, 27.92 inches, in 1867; Camp Date Creek, 27.84 inches, in 1868; Port Verde, 27.58 inches, in 1876; Antelope Valley, 27,53 inches, in 1890,

WIND,

The consideration of this element will be confined wholly

to an examination of the extent to which it can be used as a prime mover.

The windmill is one of the earliest forms of motive power, Long before the invention of the steam engine it had become an important factor of industrial life. Although excelled in many respects by the steam engine and other modern rivals it will always possess some advantages peculiar to itself. It has reached the highest development, numerically, at least, in Holland and the other low countries of Northern Europe, where it is extremely common The large numbers in use in those countries show that the climate is favorable. The fact that they are comparatively scarce in certain portions of the United States does not prove that windmills can not be profitably employed. The American people are apt to regard such a source of power as too slow and uncertain for their purposes. This belief is well grounded in many cases, but there remain certain uses to which windmills may be profitably put. In recent years many firms in the United States have engaged in their manufacture, and their sale and use have greatly increased. As in the case of other mechanical inventions, American genius has developed the wind engine to a high degree of efficiency. The wheels now being put forth by builders possessing experience and reputation are models of beauty and mechanical perfection. In the United States a very large majority of all windmills in use are employed in pumping water. This fact will doubtless always remain true here in Arizona where water is in such great demand, but there are many other classes of light farm work, such as chopping or grinding feed, churning, etc., to which they may be applied.

The strongest objection to the use of the windmill is its unreliability, since the wind is commonly considered an emblem of fickleness, The problem of the sufficiency of the wind movement is the main question to be considered. There are many localities where the fact that the wind will blow from some direction with considerable force during a large majority of the days of the year is one of the most certain of future events. There are other places where the wind fails only occasionally.

In such situations it is not unusual to supplement the windmill by animal power when necessary

The usual effect of a windmill comes only from the excess of wind velocity above that required to keep the wheel moving This required velocity is from about four to six miles per hour. The pressure or force of the wind varies as the square of the velocity. A velocity of ten miles per hour, therefore, exerts one hundred times as much pressure as that of one mile per hour, The velocity of the wind increases rapidly with elevation above the surface of the ground. It is, therefore, desirable to erect the mill on a tower of the greatest practicable height

Where windmills are used for pumping water for domestic use, watering live stock, and for irrigation, the maximum effect is secured when the water is delivered into a large tank or reservoir.

Table XVII shows the average daily and hourly wind movement at the five Signal Service Stations in Arizona from which data covering a term of years were available. In some instances the average is disappointingly low. It should be noted, however, that the anemometers from which these results were obtained were located in towns or among groups of buildings of military posts, and these in turn are situated in sheltered valleys where the wind movement is apt to be a minimum. Frequently a change of a short horizontal distance is sufficient to bring about a large increase of wind. An illustration of this is seen in the case of the removal of the Weather Bureau Station from the University to the city of Tucson. The air-line distance is less than one and one-half miles, and the vertical difference only about forty feet lower. Yet for the twelve months preceding the change the total movement was 66,400 miles, and for the 12 months following the change the total was 43,000 miles, a reduction of 35 per cent.

The fact should also be borne in mind that the useful energy of the wind throughout its range of velocities is much greater than if it blew steadily at an average low velocity. The very highest wind velocities, of course, can not be used to any great extent. All wheels are so arranged for their own safety they

go out of action automatically when the wind exceeds a certain velocity, which differs in different makes of wheels. The pressure of wind varies with the density of the air. The density varies with the elevation above sea level, temperature, etc* In a high altitude and high temperature the pressure may be very considerably below that at sea level in a colder climate.

Although there are localities where the wind movement is insufficient or too irregular for large results, there are others where it will be found great enough to be an important help to the farmer

The great valleys of Arizona are almost everywhere underlaid with water, usually at a moderate depth. Where irrigation has been practiced some years the level of this water has risen quite near the surface. While it is too much to expect that large tracts of land will be successfully irrigated by wind-pumping, examples are not wanting where a single windmill has raised enough water for domestic use and the irrigation of a small vegetable garden. Where the wind movement is considerable and the lift small, a number of windmills grouped about a reservoir may be able to irrigate an orchard or other small area. Under intense cultivation a surprisingly large quantity of agricultural and horticultural products can be grown on a small piece of ground.

TABLE I.

RECORD OF TEMPERATURES

AT UNIVERSITY OF ARIZONA, NEAR TUCSON.

Month.	Mean.			Highest.	Lowest.	Absolute Range	Greatest Daily Range	Least Daily Range
	Maximum.	Minimum.	Monthly.					
1891.								
October	87.1	54 6	70 8	91	35	56	47	9
November	76.5	41.3	58 9	89	30	59	43	16
December	60.0	28.8	44.4	77	11	66	48	11
1892.								
January	64 2	34.3	49 2	75	17	58	44	12
February	64.9	40 7	52 8	78	30	48	37	6
March	70.4	43 6	57 0	83	32	51	45	8
April	79.0	44.7	61.8	91	32	59	45	14
May	86.2	52.9	69.6	100	38	62	47	22
June	97.2	61.1	79 2	107	39	68	47	20
July	99 0	76.1	87.6	106	67	39	30	14
August	97.8	72.3	85.0	107	65	42	34	15
September	96.0	66.2	81.1	102	60	42	37	16
October	81.6	52 2	66.9	94	35	59	46	9
November	74.3	42.8	58 6	83	33	50	46	14
December	61.0	31.6	46.3	76	16	60	41	10
1893.								
January	68.9	38.7	51.3	73	23	50	46	7
February	68.5	39.4	54 0	80	31	49	44	9
March	70.3	41.8	56.0	92	30	62	43	10
April	81.0	46 3	63.6	91	36	55	45	20
May	87.8	54 6	71 2	98	42	56	43	16
June	101.4	65.7	83.6	107	55	52	46	26
July	96.9	73.2	85 0	107	64	43	37	14
August	93.5	70 2	81 8	102	62	40	33	14
September	92.9	61.0	77.0	99	50	49	44	20
October	84 5	46 5	65 5	92	38	54	46	12
November	70.1	38.0	54.0	84	29	55	44	11
December	66.6	34.3	50.4	76	22	54	46	10
1894.								
January	61 0	29.5	45 2	75	18	57	47	11
February	61.5	33.1	47.3	75	20	55	40	14
March	69.8	40.0	54.9	86	24	62	43	5
April	81.3	48.1	64.7	91	34	57	45	12
May	90 6	54.0	72.3	100	43	57	47	20
*June	95.6	58 4	77.0	104	48	56	44	27
July	98.8	71.5	85.2	106	66	40	35	20
August	93.9	71.2	82.6	100	64	36	32	12
September	92.2	63.2	77.7	100	46	54	41	11
October	86 0	53.4	69.7	97	38	59	45	15
November	81.6	43.4	62.5	87	35	52	45	27
December	64.3	43.6	54.0	78	30	48	37	7

*Location changed to Tucson on June 21.

TABLE I. (CONTINUED).

Month.	Mean.			Highest.	Lowest.	Absolute Range	Greatest Daily Range	Least Daily Range
	Maximum	Minimum.	Monthly.					
1895.								
January	62 3	39.1	50.7	72.0	28.0	44.0	39.0	6.0
February	67.2	37.7	52.4	82.0	29.0	53.0	40.0	12.0
March	74 5	42 4	58.4	92.0	30.0	62.0	45 0	15.0
April	82 8	47.4	65.1	95.0	33.0	62.0	47.0	10 0
May	89.5	58.2	73.8	101.0	48.0	53.0	42.0	15.0
June	97.4	63 2	80.4	106.0	46.0	60.0	45.0	20.0
July	100 3	73.0	86.1	106.5	63.0	43.5	36.5	17.3
August	96 5	69.1	82.8	106 0	61.3	44.7	37.8	18.8
September	96 4	65.2	80.8	107.0	50.5	56.5	42 6	22.1
October	85 2	52.4	68.8	92.6	38.5	54.1	42.5	13.8
November	70 4	36.6	53.5	83.1	27.1	56.0	41.8	19.3
December	63.4	30.4	40.9	85.0	13.9	71.1	52.8	19.2
1896.								
January	74.4	38.7	56.6	89.4	23.3	66.1	63.2	24.2
February	70.8	42.5	56.6	83.2	25.7	57.5	41.1	21.5
March	78.3	44.0	61.2	94.1	27.0	67.1	47.8	16.9
April	82.5	45.0	63.7	93.0	31.0	62.0	50.0	20.8
May	92.6	55 0	73.8	105.7	40.2	65.5	43.7	21.6
June	101.0	70.3	85.6	110.3	58.8	51.5	42.8	15.2
July	96.1	78.0	85.0	104.2	26.7	77-5	37.9	14.9
August	95.6	72 0	83.9	104.0	69.0	35.0	30.4	12.2
September	93.2	68 1	80 6	102.7	52.1	50.6	39.0	13.7
October	81.3	56.3	68.8	91.1	41.6	49.5	34.2	13.3
November	73.3	42.9	59 1	83.2	30.3	52.9	40.4	16.8
December	69.8	38.2	54.0	90.2	26.7	63.5	46.2	14.1
1897.								
January	63.4	36.8	48.4	71.1	25 7	45.4	42.7	12.3
February	67.7	36.1	52.6	80.1	25.1	55.0	42.6	13.1
March	72.4	35.8	51.0	80.4	21.6	58.0	51 5	16.7
April	84.2	46.5	61.9	93.8	30.0	63.8	48.8	38.4
May	78.0	58.2	74.4	97.0	51.8	45.2	43.6	21.5
June	97.5	64.8	77.4	105.1	49.7	55.4	46.1	23.3
July	97.8	78.2	83.8	102.7	64.9	37.8	33.4	21.4
August	94.4	71.7	83.6	101.1	66.2	34.9	31.5	10.3
September	91.8	68 5	80.5	99.0	62.0	37.0	35.4	14.3
October	84.3	50.8	67.6	92.3	29 0	63.3	45.0	19.0
November	79.0	41.8	60.4	89.0	28.0	61.0	49.0	22.0
December	67.1	30.6	48.8	80.0	16.0	64.0	46.0	13.0

TABLE II.

TEMPERATURE (CONTINUED), DEW POINT, RELATIVE HUMIDITY AND VAPOR PRESSURE

AT UNIVERSITY OF ARIZONA, NEAR TUCSON.

Months.	Number of Days With— Max. Below 32°	Max. Above 90°	Min. Below 32°	Mean. Below 32°	Mean. Above 41°	50°	59°	68°	77°	90°	Dew Point. Monthly.	Relative Humidity. Monthly.	Vapor Pressure. Monthly.
1891.													
October	0	.....	.....	...	...	...	...	...	...	...	27.8	25.4	.....
November	0	.....	.....	...	...	...	...	...	...	...	23.4	32.0	.....
December	0	.....	.....	...	...	...	...	...	...	...	16.0	40.2	.....
1892.													
January	0	.....	.....	...	...	...	...	...	...	...	25.8	50.2	.....
February	0	.....	.....	...	...	...	...	...	...	...	39.0	68.0	.....
March	0	.....	.....	...	...	...	...	...	...	...	34.7	58.0	.....
April	0	.....	.....	...	...	...	...	...	...	...	28.2	38 0	.....
May	0	.....	.....	...	...	...	...	...	...	...	28.6	27.2	.....
June	0	.....	.....	...	...	...	...	...	...	...	30.8	20.1	.....
July	0	.....	.....	...	...	...	...	...	...	...	52.5	36.2	.....
August	0	.....	.....	...	...	...	...	...	...	...	50.4	37.8	.....
September	0	.....	.....	...	...	...	...	...	...	...	44.8	34.6	.....
October	0	.....	.....	...	...	...	...	...	...	...	33.7	35.6	.....
November	0	.....	.....	...	...	...	...	...	...	...	28.4	38.0	.....
December	0	.....	.....	...	...	...	...	...	...	...	26.4	53.9	.....
Annual Mean											35.3	41.0	
1893.													
January	0	0	15	0	31	19	1	0	0	0	19.7	35.4	0.118
February	0	0	4	0	26	21	6	0	0	0	30.1	48.0	0.170
March	0	2	1	0	31	23	10	2	0	0	34.0	54.1	0.198
April	0	1	0	0	30	30	23	5	0	0	26.1	30.6	0.146
May	0	12	0	0	31	31	31	21	2	0	32.8	31.2	0.201
June	0	30	0	0	30	30	30	30	27	0	36.2	22.2	0.218
July	0	29	0	0	31	31	31	31	30	0	57.8	47 8	0.494
August	0	25	0	0	31	31	31	31	30	0	64.0	64.2	0.608
September	0	22	0	0	30	30	30	30	12	0	47.6	45.0	0.362
October	0	6	0	0	31	31	26	8	0	0	28.5	31.6	0.157
November	0	0	3	0	29	22	5	0	0	0	29.5	49.2	0 165
December	0	0	11	0	29	16	2	0	0	0	25.2	44.6	0.138
Annual Mean											36.0	42.0	0.248

TABLE II (CONTINUED).

Month.	Number of Days With—										Dew Point.	Relative Humidity.	Vapor Pressure
	Max.		Min.	Mean.									
					Above:								
	Below 32°	Above 90°	Below 32°	Below 32°	41°	50°	59°	68°	77°	90°	Monthly.	Monthly.	Monthly.
1894.													
January....	0	0	21	0	22	5	0	0	0	0	22.2	49.0	0.122
February.	0	0	15	0	23	7	0	0	0	0	22.8	43.7	0.126
March.....	0	0	5	0	28	20	12	1	0	0	26.4	43.8	0.146
April.....	0	1	0	0	30	30	26	5	0	0	20.8	21.8	0.112
May	0	19	0	0	31	31	31	24	4	0	22.7	18.5	0.124
*June.....	0	27	0	0	30	30	30	29	13	0	25.7	18.0	0.163
July	0	31	0	0	31	31	31	31	31	0	54.9	44.3	0.442
August	0	26	0	0	31	31	31	31	29	0	58.1	53.5	0.502
September	0	20	0	0	30	30	30	29	19	0	45.0	39.2	0.317
October...	0	11	0	0	31	31	29	21	1	0	39.1	42.5	0.254
November.	0	0	0	0	30	30	25	1	0	0	27.4	33.4	0.150
December..	0	0	1	0	31	22	6	0	0	0	40.5	68.9	0.268
AnnualMean											33.8	39.7	0.226
1895.													
January....	0	0	4	0	30	15	0	0	0	0	34.2	62.4	0.204
February .	0	0	7	0	27	16	3	0	0	0	27.9	45.4	0.155
March.....	0	3	2	0	31	27	9	4	0	0	23 3	30.5	0.128
April	0	2	0	0	30	30	26	9	0	0	20.8	22.0	0.116
May	0	14	0	0	31	31	31	25	10	0	30.3	25.1	0.172
June.....	0	27	0	0	30	30	30	28	21	0	29.6	19.4	0.178
July.	0	30	0	0	31	31	31	31	31	0	.....	.....	.....
August	0	30	0	0	31	31	31	31	30	0	.....	.....	.....
September.	0	25	0	0	31	31	31	31	26	0	.....	.....	.....
October	0	8	0	0	31	30	19	2	1	0	.....	.....	.....
November.	0	8	2	0	30	24	12	0	0	0	.....	.....	.....
December..	0	0	17	0	25	14	1	0	0	0	.....	.....	.....
1896.													
January ...	0	0	9	0	31	27	5	0	0	0	.....	.....	.....
February..	0	0	5	0	29	26	21	19	0	0	.....	.....	.....
March.....	0	4	3	0	31	28	21	5	0	0	.....	.....	.....
April	0	5	1	0	30	30	25	4	1	0	.....	.....	.....
May	0	20	0	0	31	31	31	23	8	0	.....	.....	.....
June.	0	30	0	0	30	30	30	30	30	11	.....	.....	.....
July	0	28	0	0	31	31	31	30	29	1	.....	.....	.....
August	0	26	0	0	31	31	31	31	30	1	.....	.....	.....
September	0	25	0	0	30	30	30	30	20	0	.....	.....	.....
October....	0	2	0	0	31	31	28	18	0	0	.....	.....	.....
November.	0	0	1	0	30	28	17	0	0	0	.....	.....	.....
December..	0	0	3	0	31	26	5	0	0	0	.....	.....	.....

*Location changed to Tucson on June 21.

TABLE II (CONTINUED).

Months.	Number of Days With—										Dew Point.	Relative Humidity.	Vapor Pressure.
	Max.		Min.	Mean.									
	Below 32°	Above 90°	Below 32°	Below 32°	Above: 41°	50°	59°	68°	77°	90°	Monthly.	Monthly.	Monthly.
1897.													
January	0	0	5	0	30	16	0	0	0	0	.....	.....	.....
February	0	0	9	0	27	12	3	0	0	0	.....	.....	.....
March	0	0	6	0	31	25	5	0	0	0	.....	.....	.....
April	0	8	2	0	30	30	26	12	0	0	.....	.....	.....
May	0	31	0	0	31	31	31	31	12	0	.....	.....	.....
June	0	30	0	0	30	30	30	30	23	0	.....	.....	.....
July	0	30	0	0	31	31	31	31	30	4	.....	.....	.....
August	0	26	0	0	31	31	31	31	29	1	.....	.....	.....
September	0	20	0	0	30	30	30	30	29	0	.....	.....	.....
October	0	4	0	0	31	31	27	18	5	0	.....	.....	.....
November	0	0	0	0	30	29	15	3	0	0	.....	.....	.....
December	0	0	0	0	27	17	2	0	0	0	.....	.....	.....

TABLE III.

RECORD OF PRECIPITATION

AT UNIVERSITY OF ARIZONA, NEAR TUCSON.

Month.	Total Amount.	Greatest amount in 24 consecutive hours.	Number of Days With—									Snow; total depth in inches.
			Less than 0.01	0.01 to 0.10	0.11 to 0.25	0.26 to 0.50	0.51 to 1.00	Over 1.00	Total.	Snow.	Hail.	Fog.	
1891.	Inches	Inches.											
October	0.00	0.00	.....	.....	.....	.....	.....	...	0	...	...	...	0
November	*(T)	(T)	.....	.....	.....	.....	.....	...	0	...	...	...	0
December	0.25	0.24	.....	.....	.....	.....	.....	...	2	...	...	...	0.10
1892.													
January	1.52	1.03	.....	.....	.....	.....	.....	...	5	...	...	...	0
February	2.63	0.71	.....	.....	.....	.....	.....	...	11	...	...	...	0
March	0.98	0.44	.....	.....	.....	.....	.....	...	8	...	...	...	0
April	0.18	0.18	.....	.....	.....	.....	.....	...	2	...	...	...	0
May	0.17	0.14	.....	.....	.....	.....	.....	...	4	...	...	...	0
June	0.10	0.10	.....	.....	.....	.....	.....	...	1	...	...	...	0

*(T) Trace only.

TABLE III (CONTINUED).

Month.	Total Amount.	Greatest amount in 24 consecutive hours.	Number of Days With—									Snow; total depth in inches.
			Less than 0.01	0.01 to 0.10	0.11 to 0.25.	0.26 to 0 50	0.51 to 1.00	Over 1.00	Total.	Snow.	Hail.	Fog.	
1892.	Inches	Inches.											
July	1.00	0.46	.....	.....	.....	.....	.....	...	5	...	...	...	0
August	2.14	1.89	.....	.....	.....	.....	.....	...	5	...	...	...	0
September	0.37	0.30	.....	.....	.....	.....	.....	...	5	...	...	...	0
October	0.27	0.27	.....	.....	.....	.....	.....	...	1	...	...	...	0
November	*(T)	(T)	.....	.....	.....	.....	.....	...	0	...	...	...	0
December	0.25	0.18	.....	.....	.....	.....	.....	...	3	...	...	...	0
Total, year	9.61												
1893.													
January	0.27	0.27	2	1	1	0	0	0	4	0	0	0	0
February	0.82	0.54	1	1	2	1	0	0	5	1	0	0	0
March	1.16	0.40	0	5	1	2	0	0	8	0	1	0	0
April	(T)	(T)	1	0	0	0	0	0	1	0	0	0	0
May	0.75	0.40	1	0	2	1	0	0	4	0	3	0	0
June	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
July	2.78	1.11	4	7	2	1	1	1	16	0	0	0	0
August	5.40	1.96	1	3	2	2	3	2	13	0	0	0	0
September	1.02	0.41	2	1	1	2	0	0	6	0	0	0	0
October	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
November	0.43	0.43	0	0	1	1	0	0	2	0	1	0	0
December	0.49	0.49	2	0	0	1	0	0	3	0	1	0	0
Total, year	13.12												
1894.													
January	0.11	0.06	1	2	0	0	0	0	3	0	0	0	0
February	1.04	0.60	0	2	0	1	1	0	4	2	0	0	3.70
March	1.17	0.64	0	3	2	2	0	0	7	2	0	0	1.00
April	(T)	(T)	1	0	0	0	0	0	1	0	0	0	0
May	0.05	0.03	0	3	0	0	0	0	3	0	0	0	0
June	(T)	(T)	1	0	0	0	0	0	1	0	0	0	0
July	1.21	0.32	3	10	3	1	0	0	17	0	0	0	0
August	0.95	0.25	5	7	4	0	0	0	16	0	0	0	0
September	(T)	(T)	4	0	0	0	0	0	4	0	0	0	0
October	0.47	0.35	1	5	0	1	0	0	7	0	0	0	0
November	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
December	1.71	0.49	3	7	3	2	0	0	15	0	0	0	0
Total, year	6.71												

*(T) Trace only

TABLE III (CONTINUED).

Month.	Total Amount.	Greatest amount in 24 consecutive hours.	Number of Days With—									Snow: total depth in inches.
			Less than 0.01	0.01 to 0.10	0.11 to 0.25	0.26 to 0.50	0.51 to 1.00	Over 1.00	Total.	Snow.	Hail.	Fog.	
1895.	*Inches*	*Inches.*											
January.....	0.56	0.12	6	4	3	0	0	0	13	0	1	1	0
February...	*(T)	(T)	2	0	0	0	0	0	2	0	0	0	0
March.....	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
April.....	(T)	(T)	1	0	0	0	0	0	1	0	0	0	0
May.....	0.09	0.07	2	2	0	0	0	0	4	0	0	0	0
June.....	0.03	0.02	2	2	0	0	0	0	4	0	0	0	0
July.....	0.11	0.03	0	5	0	0	0	0	5	0	0	0	0
August.....	4.48	1.40	3	9	3	2	1	1	19	0	0	0	0
September.	0.75	0.41	0	5	1	1	0	0	7	0	0	0	0
October.....	3.68	0.25	1	3	3	0	0	0	7	0	0	0	0
November..	4.30	1.83	0	4	1	2	2	0	9	0	0	0	0
December...	0.08	0.05	0	3	0	0	0	0	3	0	0	0	0
Total, year	11.08												
1896.													
January.....	0.53	0.46	0	2	0	1	0	0	3	0	0	0	0
February....	0.08	0.05	1	3	0	0	0	0	4	0	0	0	0
March.....	0.27	0.22	1	2	1	0	0	0	4	1	1	0	T
April.....	0.12	0.12	1	0	1	0	0	0	2	0	0	0	0
May.....	(T)	(T)	1	0	0	0	0	0	1	0	0	0	0
June.....	0.19	0.17	2	1	1	0	0	0	4	0	0	0	0
July.....	3.44	0.65	6	7	5	3	1	0	22	0	0	0	0
August.....	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
September...	1.13	0.39	3	3	2	2	0	0	10	0	0	0	0
October.....	3.31	0.97	0	4	1	0	4	0	9	0	1	0	0
November...	0.30	0.25	0	1	1	0	0	0	2	0	0	0	0
December....	0.76	0.38	0	1	0	1	0	0	2	0	0	0	0
Total, year	10.13												
1897.													
January.....	1.79	0.51	0	4	4	2	0	0	10	0	0	0	0
February....	0.08	0.08	0	1	0	0	0	0	1	0	0	0	0
March.....	0.13	0.08	0	4	0	0	0	0	4	0	0	0	0
April.....	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
May.....	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
June.....	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
July.....	1.98	1.29	4	4	1	1	0	1	11	0	0	0	0
August.....	3.42	1.52	2	0	3	1	1	1	8	0	0	0	0
September...	2.71	1.88	2	4	2	3	1	0	12	0	0	0	0
October.....	0.54	0.30	0	0	1	1	0	0	0	0	0	0	0
November...	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0
December....	0.11	0.11	1	0	1	0	0	0	0	0	0	0	0

*(T) Trace only.

TABLE IV.

RECORD OF SUNSHINE, CLOUDINESS AND EVAPORATION

AT UNIVERSITY OF ARIZONA, NEAR TUCSON.

Month.	Sunshine: Perc. of Actual to Possible.	Mean Cloudiness Monthly. Estimated	Number of Days			Evaporation.	
			Clear.	Partly Cloudy.	Cloudy.	Open Tank. Depth in Inches.	Lily Tank. Depth in Inches.
1891.							
October		1.7	24	4	3		
November	83	2.6	19	9	2		
December	85	3.0	18	9	4	3.48	
1892.							
January	76	3.4	18	7	6	2.68	
February	70	4.1	14	6	9	2.47	
March	74	3.9	16	7	8	4.29	
April	88	2.4	21	5	4	6.32	
May	92	2.6	21	8	2	9.81	
June		1.4	25	2	3	11.02	
July	73	6.0	7	12	12	10.43	
August	77	3.6	17	9	5	10.35	
September	86	2.3	23	5	2	8.37	
October	83	2.4	23	5	3	7.14	7.22
November	82	2.5	22	4	4	4.44	4.27
December	80	3.1	22	2	7	2.65	2.54
Annual	Mean, 80	Mean, 3.1				Total, 72.47	
1893.							
January	86	2.5	20	8	3	3.04	3.05
February	73	4.5	12	9	7	3.51	3.58
March	72	3.7	17	7	7	4.87	4.89
April	84	1.8	24	5	1	7.73	7.86
May	81	2.0	25	4	2	9.17	9.03
June	87	1.4	27	3	0	11.32	10.57
July	61	5.3	7	17	7	9.72	8.98
August	64	5.7	7	13	11	6.68	6.58
September	78	3.0	19	8	3	6.46	6.90
October	85	1.5	25	6	0	5.24	5.28
November	79	1.4	27	0	3	3.57	3.49
December	70	3.1	19	7	5	2.82	2.76
Annual	Mean, 77	Mean, 3.0				Total, 74.13	72.97
1894.							
January	77	3.4	21	6	4	2.56	2.46
February	82	3.6	19	6	3	3.03	2.90
March	74	4.1	17	5	9	4.47	4.47
April	86	2.2	23	7	0	6.81	
May	89	2.2	23	7	1	8.69	
June	99	0.8	27	3	0	10.53	
July	82	4.5	12	18	1	10.14	
August	66	5.4	10	12	9	9.58	
September	89	2.5	19	10	1	9.90	

TABLE IV (CONTINUED).

Month.	Sunshine: Perc. of Actual to Possible.	Mean Cloudiness Monthly. Estimated	Number of Days			Evaporation.	
			Clear.	Partly Cloudy.	Cloudy.	Open Tank Depth in Inches.	Lily Tank. Depth in Inches.
1894.							
October.	87	2.3	23	6	2	6.80	
November	96	1.4	28	2	0	5.09	
December	36	6.8	6	10	15	1.89	
Annual,	Mean, 80	Mean, 3.3				Total, 79.49	
1895.							
January	66	5.0	12	9	10	2.52	
February.	79	3.6	14	11	3	4.14	
March	80	3.6	16	10	5	6.62	
April	93	2.3	20	10	0	8.68	
May	87	3.5	18	12	1	11.84	
June	88	2.7	22	6	2	12.89	

Observation discontinued.

TABLE V.

RECORD OF WIND MOVEMENT

AT UNIVERSITY OF ARIZONA, NEAR TUCSON.

Month.	Total Movement. Miles.	Prevailing Direction and Percentage.		Maximum.		Mean Velocity. Miles per Hour.	No. of Observed Velocities equal to—	
				Velocity. Miles per h'r	Direction.		25 to 39 Miles p'r hour	40 Mls. p'r hour & over.
1891.		DIREC.	P'R CT					
October	6157	S. E.	26	34	S. E.	8.3	4	0
November	4999	N. W.	35	34	N. W.	6.9	4	0
December	6158	S. E.	31	40	S. W.	8.3	9	1
1892.								
January	4914	S. E.	29	39	W.	6.6	5	0
February	4693	S. E.	31	34	S. W.	6.7	7	0
March.	5733	S. E.	31	38	S. W.	7.7	11	0
April	5658	S. E.	23	33	S. W.	7.8	9	0
May	6114	S. E.	23	42	E.	8.2	5	1
June	5713	N. W.	22	39	S. W.	7.9	7	0
July	5784	S. E.	32	54	E.	7.8	12	3
August	5521	S. E.	31	47	N. E.	7.4	10	2
September	5083	S. E.	27	35	S.	7.1	5	0
October	6560	S.	27	40	S. E.	8.8	7	1
November	5640	S.	27	34	S. E.	7.8	6	0
December	4442	N.	29	36	N.	6.0	4	0
Annual. Total	65,855					7.05		

TABLE V (CONTINUED).

Month.	Total Movement. Miles.	Prevailing Direction and Percentage.		Maximum. Velocity. Miles per h'r	Maximum. Direction.	Mean Velocity. Miles per Hour.	No. of Observed Velocities equal to 25 to 39 Miles p'r hour	No. of Observed Velocities equal to 40 Miles per hour & over.
1893.		DIREC.	P'R CT					
January.....	4668	S.	27	33	E.	6.3	1	0
February....	4994	N. W.	34	48	S. W.	7.4	5	1
March.....	5946	N. W.	44	44	S. W.	8.0	6	1
April	5743	N. W.	37	30	S. W.	8.0	5	0
May.....	6319	S. E.	32	36	S. E.	8.5	6	0
June.....	5542	N. W.	40	32	S. W.	7.7	4	0
July.....	6358	S. E.	37	38	S. E.	8.5	15	0
August.....	4847	S. E.	35	38	N. W.	6.5	6	0
September...	5382	S. E.	32	47	N. E.	7.5	4	2
October	4817	N. W.	29	34	S. W.	6.5	1	0
November ...	5802	N. W.	37	42	S. W.	8.0	4	2
December....	5172	N. W.	31	36	N. E.	7.0	4	0
Annual, Total	65,590					7.5		
1894.								
January.....	4998	N. W.	31	34	S. W.	6.7	3	0
February	5794	N. W.	39	60	S. W.	8.6	5	2
March.....	6174	S E.	27	51	S.	8.3	6	1
April.	5835	N. W.	35	40	S. W.	8.1	3	1
May.....	5672	S. E.	32	34	S. W.	7.6	7	0
*June.....	5280	S. E.	35	37	S W.	7.3	6	0
July.....	3635	N. W.	29	36	S. E	4.9	7	0
August.	3675	S. E.	52	34	S. W.	4.9	4	0
September...	3879	S. E.	38	26	S. W.	5.4	1	0
October	3167	N. W.	34	24	S. E.	4.3	0	0
November ...	3000	S.	27	20	E.	4.2	0	0
December....	2927	N. W.	26	20	S.	3.9	0	0
Annual, Total	54,084							
1895.								
January.....	3312	N. W.	31	29	S.	4.6	1	0
February....	3606	N. W.	36	34	E.	5.4	2	0
March.....	3777	S. E.	24	24	S. W.	5.1	0	0
April.	3676	S. E.	33	30	S. W.	5.1	2	0
May.....	4846	S. E.	26	30	S.	5.8	2	0
June.....	3980	S. E.	22	28	S. W.	5.5	2	0

*Location changed to Tucson on June 21.

TABLE VI.

RECORD OF BAROMETRIC PRESSURE

AT UNIVERSITY OF ARIZONA, NEAR TUCSON.

Month.	Pressure.							
	Actual.				Reduced.			
	Mean. Monthly.	Highest.	Lowest.	Absolute Range.	Mean Monthly.	Highest.	Lowest.	Absolute Range.
1891.								
October	27.494	27.680	27.179	0.501	29.968	30.141	29.609	0.532
November	27.516	27.679	27.365	0.314	30.044	30.249	29.845	0.404
December	27.551	27.887	27.244	0.643	30.138	30.557	29.774	0.783
1892.								
January	27.524	27.818	27.259	0.559	30.090	30.438	29.806	0.632
February	27.483	27.649	27.185	0.464	30.032	30.189	29.725	0.464
March	27.428	27.642	27.257	0.385	29.956	30.242	29.767	0.475
April	27.438	27.756	27.242	0.514	29.948	30.326	29.792	0.534
May	27.397	27.567	27.197	0.370	29.887	30.107	29.637	0.470
June	27.363	27.513	27.103	0.407	29.788	29.934	29.496	0.468
July	27.433	27.613	27.308	0.305	29.832	30.003	29.688	0.315
August	27.419	27.553	27.280	0.273	29.826	29.993	29.660	0.333
September	27.451	27.582	27.307	0.275	29.878	30.045	29.727	0.318
October	27.443	27.610	27.212	0.398	29.934	30.131	29.682	0.449
November	27.514	27.689	27.320	0.369	30.042	30.229	29.813	0.416
December	27.526	27.725	27.227	0.498	30.108	30.345	29.797	0.548
1893.								
January	27.526	27.719	27.298	0.421	30.084	30.248	29.833	0.415
February	27.492	27.679	27.128	0.551	30.035	30.284	29.678	0.606
March	27.480	27.719	27.164	0.555	30.015	30.299	29.654	0.645
April	27.421	27.586	27.210	0.376	29.924	30.088	29.700	0.388
May	27.372	27.584	27.218	0.366	29.839	30.103	29.666	0.437
June	27.342	27.502	27.157	0.345	29.754	29.922	29.581	0.341
July	27.398	27.556	27.215	0.341	29.808	30.026	29.595	0.431
August	27.404	27.535	27.292	0.243	29.831	29.955	29.692	0.263
September	27.368	27.545	27.159	0.386	29.812	30.001	29.909	0.392
October	27.488	27.632	27.355	0.277	29.980	30.157	29.816	0.341
November	27.540	27.717	27.296	0.421	30.087	30.297	29.816	0.481
December	27.602	27.801	27.401	0.400	30.162	30.381	29.941	0.440
1894.								
January	27.551	27.797	27.296	0.501	30.136	30.437	29.849	0.588
February	27.539	27.833	27.165	0.668	30.112	30.433	29.775	0.658
March	27.473	27.729	27.127	0.602	30.010	30.449	29.617	0.732
April	27.443	27.636	27.221	0.415	29.940	30.146	29.700	0.446
May	27.374	27.528	27.216	0.312	29.836	30.028	29.656	0.372
*June	27.422	27.551	27.220	0.331	29.822	29.977	29.610	0.367
July	27.484	27.632	27.339	0.293	29.858	30.022	29.699	0.323
August	27.480	27.610	27.349	0.261	29.866	30.009	29.699	0.310
September	27.442	27.639	27.253	0.384	29.846	30.029	29.643	0.386
October	27.484	27.702	27.313	0.389	29.926	30.202	29.743	0.459
November	27.594	27.737	27.411	0.326	30.074	30.227	29.891	0.336
December	27.590	27.750	27.329	0.421	30.094	30.262	29.849	0.413

*Location changed to Tucson on June 21.

TABLE VI (CONTINUED).

Month.	Pressure							
	Actual.				Reduced.			
	Mean. Monthly.	Highest.	Lowest.	Absolute Range.	Mean. Monthly.	Highest.	Lowest.	Absolute Range.
1895.								
January	27.532	27.837	27.268	0.569	30.054	30.387	29.808	0.579
February	27.561	27.950	27.286	0.664	30.072	30.530	29.776	0.754
March	27.513	27.687	27.335	0.352	29.994	30.213	29.807	0.406
April	27.476	27.737	27.265	0.472	29.929	30.257	29.695	0.562
May	27.405	27.525	27.208	0.317	29.822	29.971	29.608	0.363
June	27.433	27.544	27.263	0.281	29.822	29.981	29.684	0.297

TABLE VII.

MAXIMUM TEMPERATURES IN 1893.

Stations.	Elevation above Sea.	Jan.	Feb.	Mar.	Apr	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	Feet	°	°	°	°	°	°	°	°	°	°	°	°	°
Jacksonville, Fla.	43	72	89	84	90	93	95	100	95	96	88	84	77	100
New Orleans, La	54	72	72	79	84	90	94	94	98	95	86	80	79	95
Galveston, Tex.	42	70	72	78	80	86	90	92	91	92	86	79	74	92
University of Arizona—Tucson	2,432	78	80	92	91	98	107	107	102	99	92	84	76	107
Los Angeles, Cal	330	84	79	88	84	90	90	89	92	90	91	86	88	92
San Francisco, Cal.	153	60	69	78	72	74	90	74	72	72	79	74	72	90
Denver, Colo.	5,287	64	60	80	77	87	94	93	92	89	81	71	65	96
St. Paul, Minn.	850	33	37	51	72	79	91	98	97	94	82	74	40	98
Chicago, Ill.	824	43	46	69	84	83	85	94	95	95	81	67	58	95
Albany, N. Y.	85	45	51	52	72	88	96	92	94	79	75	58	54	96
Boston, Mass.	126	53	53	58	68	88	94	91	93	80	79	68	57	94

TABLE VIII.

RELATIVE HUMIDITY IN 1893.

Complete saturation is 100 per cent.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Jacksonville	90	80	72	72	74	78	74	81	82	78	82	81	77
New Orleans	71	79	70	79	77	89	77	74	77	71	83	79	77
Galveston	79	91	83	89	84	83	78	78	80	70	83	86	82
University of Arizona—Tucson	36	48	54	31	28	22	48	65	45	32	50	45	42

TABLE VIII (CONTINUED.)

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov	Dec.	Annual.
	%	%	/	°	%	%	°	/	°	%	°	/	%
Los Angeles	69	73	79	71	75	75	77	77	77	73	74	63	74
San Francisco	81	70	82	80	76	75	82	87	79	77	82	81	79
Denver	31	54	52	43	49	38	45	48	35	38	43	43	44
St. Paul	75	73	75	75	60	65	60	63	65	71	67	79	69
Chicago	83	84	80	77	74	74	72	66	66	71	76	83	76
Albany	84	85	78	71	73	74	71	74	79	79	79	81	77
Boston	71	73	71	69	73	83	66	75	77	73	69	74	73

TABLE IX.

MINIMUM TEMPERATURES IN 1893.

The Annual Range is between the Maximum and Minimum of the year.

Stations.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.	Annual Range.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Jacksonville	24	41	28	53	57	68	68	69	61	45	32	35	24	76
New Orleans	29	39	31	55	60	69	73	72	66	48	36	33	29	66
Galveston	37	37	39	53	59	70	71	70	66	59	43	37	37	55
University of Arizona, Tucson	23	31	30	36	42	55	64	62	50	38	29	22	22	85
Los Angeles	35	38	31	39	45	48	50	54	48	46	39	37	31	61
San Francisco	36	39	40	40	46	47	47	47	50	47	44	37	36	54
Denver	13	- 2	13	13	28	38	54	50	35	23	8	8	- 2	98
St. Paul	-23	-26	- 9	19	32	47	56	43	31	18	-10	-16	-26	124
Chicago	-16	- 9	9	27	37	48	60	54	39	26	4	- 6	-16	111
Albany	- 5	- 6	9	24	40	51	51	50	38	28	16	- 3	- 6	102
Boston	- 4	- 1	13	26	38	52	54	53	43	30	20	0	- 4	98

TABLE X.

MEAN MONTHLY TEMPERATURES IN 1893.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Jacksonville	49.2	61.6	60.6	72.6	75.3	80.0	83.6	81.4	78.9	70.9	62.0	58.8	69.8
New Orleans	50.2	61.2	60.8	71.6	75.8	80.2	83.1	82.0	79.8	69.1	60.3	58.4	69.4
Galveston	53.4	57.6	61.8	71.2	75.7	80.4	84.0	81.9	81.0	72.0	63.7	60.4	70.3
University of Ariz., Tucson	51.3	54.0	56.0	63.6	71.2	83.6	85.0	81.8	77.0	65.5	54.0	50.4	66.1
Los Angeles	57.2	55.0	53.5	57.8	62.6	66.1	69.6	71.4	66.1	63.4	57.3	57.9	61.5

TABLE X (CONTINUED).

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
San Francisco..	47.4	50.3	51.2	52.4	55.8	56.5	56.6	56.6	59.3	57.6	55.6	52.4	54.3
Denver.....	28.3	31.4	38.0	45.1	54.3	68.6	73.4	70.0	63.4	51.4	39.0	38.2	50.9
St. Paul	8.2	9.1	23.0	39.0	53.8	71.4	73.4	69.0	61.8	49.0	30.0	12.4	41.3
Chicago.....	12.0	21.5	33.2	44.3	52.4	67.8	73.8	69.8	64.1	52.6	36.0	25.4	46.1
Albany.....	16.8	21.6	31.1	44.0	58.4	70.5	72.0	72.0	69.2	55.7	38.7	25.7	47.0
Boston.	20.7	26.8	33.8	44.4	58.3	64.8	71.4	69.6	60.0	54.8	42.2	30.4	47.9

TABLE XI.

PRECIPITATION IN 1893.

The upper number in each monthly datum shows the number of days in that month having 0 01 inch or more of precipitation; the lower number gives the total depth in inches for the month.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	9	10	15	3	11	13	12	19	11	10	7	6	126
Jacksonville.....	0.98	6.87	8.90	2.07	4.18	4.66	4.54	10.02	6.09	4.48	1.76	3.08	58.23
	7	10	9	2	7	13	12	12	11	6	9	4	102
New Orleans.....	2.50	4.92	3.49	3.70	2.66	5.30	3.72	4.56	4.38	4.24	6.24	2.31	48.02
	7	14	6	7	9	8	8	11	3	1	13	7	94
Galveston	0.54	1.99	0.88	5.70	2.98	7.45	2.96	5.02	1.72	0.55	3.92	1.72	35.43
University of Arizona, Tucson	2	4	6	0	3	0	12	12	4	0	2	1	46
	0.27	0.82	1.16	T	0.75	0.00	2.78	5.40	1.02	0.00	0.43	0.49	13.12
	7	5	12	1	1	1	0	0	0	4	3	6	40
Los Angeles.....	6.29	2.27	8.52	0.19	0.06	0.03	0.00	0.00	T	0.75	0.20	3.65	21.96
	6	9	16	7	2	1	1	0	3	8	13	8	69
San Francisco..	3.05	2.75	7.08	1.03	0.15	0.03	0.02	0.00	0.21	0.16	4.18	2.25	17.91
	2	8	4	5	9	2	8	6	2	4	6	7	63
Denver...	0.05	0.83	0.23	0.87	3.09	0.13	1.14	0.35	0.05	0.84	0.55	0.35	8.48
	13	10	12	11	11	6	8	8	5	11	6	12	113
St. Paul.....	0.73	1.87	1.96	5.30	2.66	2.00	1.68	2.40	2.70	1.49	0.81	2.35	25.95
	13	14	15	16	10	9	6	2	9	7	7	14	122
Chicago.....	2.08	2.44	1.69	4.16	1.93	3.59	3.08	0.18	1.98	1.75	2.45	2.14	27.47
	10	15	13	14	13	9	11	9	11	7	6	15	133
Albany.....	1.31	4.63	2.00	2.10	5.08	2.92	1.82	7.21	3.20	1.67	0.91	2.54	35.39
	12	16	9	14	14	10	11	13	12	5	6	16	138
Boston.....	2.56	6.22	2.80	3.13	5.23	2.20	1.72	6.46	1.59	2.94	1.83	5.16	41.84

TABLE XII.

SUNSHINE IN 1893. PERCENTAGE OF POSSIBLE.

Stations.	*Jan.*	*Feb.*	*Mar*	*Apr.*	*May.*	*June.*	*July.*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Annual.*
	%	%	%	%	%	%	%	%	%	%	%	%	%
Savannah, Ga.	53	47	51	60	48	52	67	33	54	61	51	53	53
New Orleans, La.	51	48	59	55	49	40	49	50	52	59	48	66	52
Galveston, Tex.	63	38	47	51	58	63	70	55	71	78	62	51	59
University of Arizona	86	73	72	87	81	87	61	61	78	85	79	73	77
San Diego, Cal.	66	70	56	75	66	61	73	78	69	75	71	66	68
San Francisco, Cal.	54	56	40	60	63	85	78	60	65	68	42	37	60
Denver, Colo.	74	67	71	67	60	67	66	60	79	72	65	56	67
St. Louis, Mo.	36	46	49	42	58	69	71	76	69	81	60	47	60
Cincinnati, Ohio.	31	27	40	26	44	63	65	66	50	56	41	25	47
Buffalo, N. Y.	22	29	39	43	49	57	67	67	53	53	43	13	47
Boston, Mass.	44	53	58	52	47	46	60	54	60	63	61	44	53

TABLE XIII.

MEAN MAXIMUM TEMPERATURE.

READINGS OF SELF-REGISTERING INSTRUMENTS AT NINE STATIONS IN ARIZONA.

Stations.	*Dates.*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May.*	*June.*	*July.*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
		°	°	°	°	°	°	°	°	°	°	°	°
Florence.....	Oct., 1877, to Apr., 1882	61.8	66.6	75.0	82.0	93.1	102.8	105.2	102.6	96.8	84.0	70.9	64.3
Fort Apache	Jan., 1880, to Sept., 1890	50.4	55.2	61.4	70.4	80.5	89.8	91.0	86.3	82.2	72.9	61.0	54.7
Fort Grant..	Jan., 1880, to June, 1890	53.6	56.6	62.9	70.4	79.2	87.8	91.1	87.6	82.4	73.9	62.4	56.8
Ft. Thomas	Apr., 1880, to Oct., 1890	55.9	62.1	69.9	78.4	89.0	96.3	100.8	96.2	89.8	78.9	65.0	58.3
Maricopa....	Nov., 1883, to July, 1887	65.4	70.4	77.0	82.7	95.9	103.9	107.6	105.0	98.7	87.6	74.7	67.9
Phœnix... ...	Jan., 1882, to Feb., 1890	65.7	71.7	81.6	86.8	94.6	104.6	107.3	104.0	99.2	90.1	78.7	73.4
Prescott.....	Jan., 1880, to June, 1890	46.9	51.6	57.8	65.3	75.2	84.2	88.1	84.9	80.3	69.0	57.4	51.2
Tucson.....	Feb., 1878, to June, 1883	66.6	67.3	75.2	81.9	92.2	100.8	99.0	94.1	91.5	82.0	69.6	65.4
Yuma.	Jan., 1880, to June, 1890	64.7	70.5	77.8	85.3	93.5	101.2	106.3	104.7	99.2	86.3	73.9	68.0

TABLE XIV.

MEAN MINIMUM TEMPERATURE.

READINGS OF SELF-REGISTERING INSTRUMENTS AT NINE STATIONS IN ARIZONA.

Stations.	*Dates.*	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct*	*Nov*	*Dec.*
		°	°	°	°	°	°	°	°	°	°	°	°
Florence.....	Oct., 1877, to Apr., 1882	34.4	38.2	43.1	48.4	54.8	63.0	74.0	73.6	63.7	51.8	39.7	37.2
Fort Apache	Jan., 1880, to Sept., 1890	20.8	24.7	29.3	34.4	40.3	47.9	58.7	62.6	49.1	38.5	26.2	23.8
Fort Grant..	Jan , 1880, to June, 1890	33.1	36.2	41.0	46.7	55.0	63.8	67.3	59.6	60.3	51.7	40.4	36.6
Ft. Thomas..	Apr., 1880, to Oct., 1890	27.6	32.9	39.0	44.0	50.9	60.7	71.4	69.5	60.0	45.0	33.5	30.5
Maricopa.....	Nov., 1883, to July, 1887	36.0	38.9	44.8	51.7	62.0	67.9	79.0	77.6	67.0	55.5	42.0	38.1
Phœnix	Jan., 1882, to Feb., 1890	32.2	35·8	41.0	46.3	53.1	40.5	71.6	71.0	60.6	50.2	42.4	36.6
Prescott.	Jan., 1880, to June, 1890	20.7	24.3	29.9	38.2	42.5	48.7	59.0	58.0	48.8	38.2	27.1	26.4
Tucson	Feb , 1878, to June, 1883	35.1	41.6	44.1	46.7	55.7	64.2	74.8	73.9	67.5	51.6	42.6	37.0
Yuma.....	Jan., 1880, to June, 1890	42.0	43.8	50.3	55.2	61.6	68.7	77.4	77.8	70.3	58.5	48.6	46.0

TABLE XV.

LIST OF STATIONS IN ARIZONA FOR WHICH RAINFALL DATA ARE GIVEN.

The names of Stations have been arranged alphabetically and by counties.

Latitudes, Longitudes and Elevations are not always precisely correct. Those which have not been determined by reliable surveys have been approximated by reference to the best maps available.

References:—S. S., second order stations of the Signal Service (since Jan. 1, 1891, Weather Bureau); V. O., voluntary stations; M. D., stations of the Medical Department of the Army reporting through the Surgeon-General; R. R., stations of the Southern Pacific Railway.

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea	Record. Length	From.	To (inclusive.)	Authority, and Remarks as to Missing Records.
	APACHE.	° ′	° ′	Feet.	Yr. Mo.			
V. O.	Cooley's Spring	34 20	109 50	6700	2 0	July, 1889	June, 1891	C. E. Cooley. [1859.
M. D.	Fort Defiance	35 43	109 10	6500	8 7	May, 1852	Dec., 1860	U. S. postal hospital. Record broken Nov.,
V. O.	St Johns	34 30	109 22	5700	1 4	May, 1891	Aug, 1892	Record broken Aug., 1891.
V. O.	Springerville	34 08	109 18	7000	1 8	Jan., 1890	Aug., 1891	Record broken Apr., July, Aug., 1891.
	COCHISE.							
V. O.	Ash Canon	31 23	110 12	.....	2 7	Aug., 1888	Feb., 1891	Jno. S. Robbins. Feb. to May, inclusive, 1889; Nov., 1889, to June, 1890, inclusive; Oct, Nov., 1890.
V. O.	Ash Springs	.....	.....	5500	1 1	Sept., 1889	Sept., 1890	J. D. Kinnear.
R. R.	Benson	32 00	110 22	3580	14 3	Oct., 1880	Dec., 1894	S. P. Ry. [1894.
V. O.	Bisbee	31 28	109 55	5298	5 5	Aug., 1889	Dec., 1994	Rev. J. G. Pritchard. Record broken Nov.,
M. D.	Camp Wallen	31 35	109 58	3000	3 1	Dec., 1866	Dec., 1869	U. S. Post Hospital.
V. O.	Chiricahua Mts	.....	.....	7400	4 7	Sept., 1889	Mar., 1894	D. D. Ross. Record broken Feb., July, Aug., Oct., 1892; Nov., 1893; Feb., 1894.
V. O.	Dos Cabezas	32 10	109 40	5450	3 3	Sept., 1889	Nov., 1892	T. C. Bain. Record broken Mar., Apr., 1892.
V. O.	Dragoon	.....	.....	5436	5 4	Sept., 1889	Dec., 1894	John W. Graham. Record broken Sept., Oct., Nov., Dec., 1891; Apr., May, Nov., Dec., 1892; Sept., Oct., Nov., Dec., 1893 May, June, Sept., Oct., Nov, 1894
	Dragoon Sum'it	32 02	110 00	4614	4 5	Aug., 1890	Dec., 1894	S. P. Ry. (?)
V. O.	Fairbank	31 45	110 10	3850	3 0	July, 1889	June, 1892	E. W. Perkins Grand Central Mill.

TABLE XV (CONTINUED.)

Class.	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From.	To (Inclusive.)	Authority, and Remarks as to Missing Records.
		° ′	° ′	Feet.	Yr. Mo			
S. S....	Fort Bo vie.....	32 12	109 20	4781	27 2	Aug., 1867	Sept., 1894	Signal Service. U. S. post hospital.
M. D..	Fort Huachuca	31 20	110 13	4785	9 0	Jan., 1886	Dec., 1894	U. S. post hospital. [south side
V. O..	Mt. Huachuca..	31 25	110 10	5000	6 7	June, 1888	Dec., 1894	J. W. Stump. (Near base of mountain,
R. R...	San Simon.....	32 18	109 10	3611	13 1	Dec., 1881	Dec., 1894	S. P. Ry. Record broken Mch., Apr., July, Aug., Oct., Nov., Dec., 1888; Jan., Feb., Mar., July to Nov., inclusive, 1889.
V. O...	Sulphur Spgs. Valley.....	....	.....	.....	0 5	Aug., 1894	Dec., 1894	
V. O...	Teviston.....	32 19	109 29	3846	5 7	June, 1888	Dec., 1893	Misses Belle and Mary Tevis. Record broken June, July, 1892; May, 1893.
V. O...	Tombstone.....	31 43	110 04	.....	5 5	Apr., 1889	Aug., 1893	S. C. Bagg Record broken May, June, Sept , Oct , Dec., 1889; Mch., Apr., 1890; Oct., 1890, to Sept., 1891, inclusive; Jan , 1892, to June, 1893, inclusive.
V. O...	Walnut Ranch.	31 45	109 15	5609	5 2	Nov., 1889	Dec., 1894	Fred W. Heyne. [Aug., 1892.
V. O...	Wilgus.....	.....	.....	.....	4 9	Apr., 1890	Dec., 1894	C. P. Smith. Record broken May, 1890;
S. S....	Willcox.....	32 20	109 42	4164	14 3	Oct., 1880	Dec., 1894	Signal Service and S. P. Ry. Record broken July, 1893.
V. O..	Wood Canon....	.....	.....	.....	5 0	Sept., 1889	Aug., 1893	T. D Bridger. Record broken May, June, July, 1890; Apr., May, 1891; Sept. to Dec., 1891, inclusive, June, Aug., Oct., Nov., Dec , 1892; Mar., Apr., May, June, Sept , Oct., Nov., Dec., 1893.
	COCONINO.							
V. O...	Flagstaff.....	35 11	111 38	6862	6 6	July, 1888	Dec., 1894	Brannen & Co., Mrs F. B. Jacobs, M. J. Riordan, C. M. Funston. Record broken Jan., Feb , Mar., 1889; Apr., 1890, to Sept., 1891, inclusive; Nov., 1891; Feb., June to Nov., inclusive, 1892; Apr. to July, inclusive, 1893.
V O...	Strawberry ...	34 23	111 33	5400	2 11	May, 1889	Mar., 1892	L. P. Nash.

TABLE XV (CONTINUED.)

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From	To (Inclusive	Authority, and Remarks as to Missing Records
		° ′	° ′	Feet.	Yr. Mo.			
V.O...	Williams.....	35 15	112 12	6727	2 5	May, 1888	Sept., 1890	Record broken Feb. to Aug., inclusive, 1890
	GILA.							
M.D..	Camp Reno.....	33 55	111 15	3728	2 1	Feb., 1868	Feb., 1870	U. S. post hospital. Record broken May to Dec., inclusive, 1868.
V.O...	Globe.....	33 26	110 45	.....	1 4	July, 1888	Oct., 1889	J. H. Hamill.
V.O..	Natural Bridge.	34 19	111 28	4800	5 0	Jan., 1890	Dec., 1894	D. D. Gowan.
V.O...	Payson.....	34 14	111 21	4900	5 6	July, 1889	Dec., 1894	Minnie Thompson, G. W. Bonacker. Record broken Apr. to Sept., inclusive, 1894.
V.O...	Rye.	34 07	111 22	3400	2 7	June, 1892	Dec., 1894	M. E. Curry. Record broken Sept., Oct., Nov., 1892.
S. S...	San Carlos.	33 12	110 27	3458	14 7	June, 1881	Dec., 1894	Signal Service, U. S. post hospital. Record broken July to Dec., inclusive, 1891.
	GRAHAM.							
M.D..	Camp Goodwin	33 05	110 00	2650	4 5	Jan., 1866	May, 1870	U. S. post hospital. Record broken May, June, July, Aug., Nov., 1866.
M.D..	Camp Grant, (combined with Fort Grant).....	33 25	109 23	3800	.....	.....	.....	
V.O...	Cedar Springs..	32 47	110 07	4900	1 8	May, 1888	Dec., 1889	B. E. Norton.
V.O...	Eagle Pass (Curtis)	.....	.....	4800	6 8	May, 1888	Dec., 1894	Dr. R. B. Tripp. Record broken June to Oct., inclusive, 1888; Feb., Mar., Apr., 1892; Jan., Feb., Mar., July to Nov., inclusive, 1893.
S. S...	Fort Grant.	32 36	109 58	4860	22 0	Jan., 1873	Dec., 1894	Signal Service, U. S. post hospital. Record broken Apr., May, Dec., 1876; June, July, 1886.
S. S...	Fort Thomas...	33 04	109 51	2700	12 3	Apr., 1880	June, 1891	Signal Service, U. S. post hospital.
V.O...	Oro (Clifton)....	33 05	109 17	.....	5 6	July, 1889	Dec., 1894	George W. Wells. Record broken Jan., May, June, Dec., 1892; June, Oct., 1893; Apr., June, Aug., Sept., 1894.

TABLE XV (CONTINUED.)

Class	County and Station.	Latitude.	Longitude	Elevation Above Sea.	Record. Length	From	To (Inclusive)	Authority, and Remarks as to Missing Records.
	MARICOPA.	° ′	° ′	Feet.	Yr. Mo.			
V.O...	Arizona Canal Co's dam	.....	.....	1150	5 3	Aug., 1889	Oct., 1894	Cortez Cox, W. D. Frazee. Record broken July 1894.
V.O...	Buckeye	33 22	112 34	.....	5 5	Aug., 1889	Dec., 1894	B. W. E. Hurley, James S. Day. Record broken Jan., Feb., Apr. to Dec., inclusive, 1890; Jan., 1892, to Feb., 1893, inclusive.
S. S...	Burke's	32 58	113 16	.....	3 1	Dec., 1877	Dec., 1890	Signal service.
S. S...	Fort McDowell	33 40	111 53	1250	24 4	Sept., 1866	Dec., 1890	Signal Service and U. S. post hospital.
V.O...	Gila Bend	32 57	112 40	735	5 6	July, 1889	Dec., 1894	S. P. Ry.
V.O...	Gillette	33 50	112 13	.....	0 7	July, 1889	Jan., 1890	
V.O...	New River	.....	.....	1500	3 9	Apr., 1889	Dec., 1892	J. F. Singleton. Record broken July, 1889.
V.O...	Peoria	.....	112 15	1000	6 0	Jan., 1889	Dec., 1894	S. H. Campbell, H. W. Adams. Record broken Feb. to Dec., inclusive, 1890; July to Oct., inclusive, 1892.
S. S...	Phœnix	33 28	112 00	1068	18 10	Feb., 1876	Nov., 1894	Signal Service, T. W. Hine. Record broken June, July, 1876; July to Nov., inclusive, 1887; Jan., Feb., Mar., 1888; Jan., Feb., Mar., Apr., 1889; June, 1890, to Oct., 1891, inclusive.
V.O...	Tempe	33 26	111 56	1100	2 5	Nov., 1889	Mar., 1892	C. W. Miller.
S. S...	Wickenburgh	33 56	112 42	1400	10 3	Nov., 1875	Jan., 1886	Signal Service. Record broken Mar. to July, inclusive.
	MOHAVE.							
M.D..	CampBeal'sSpg	35 12	114 05	2500	1 0	Apr., 1873	Mar., 1874	U. S. post hospital.
M.D..	Camp El Dor'do	35 40	114 50	7000	0 3	Apr., 1867	June, 1867	U. S. post hospital.
M.D..	Camp Mohave, (comb'd with Fort Mohave. elevation 755 feet).	35 00	114 34	600	.....	.....	.....	

TABLE XV (CONTINUED).

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From	To (Inclusive)	Authority, and Remarks as to Missing Records.
		° ′	° ′	Feet.	Yr. Mo.			
V.O...	Chloride	35 25	114 12	4200	1 11	July, 1889	May, 1891	H. P. Bwing Record broken July to Nov., inclusive, 1890.
M.D..	Fort Mohave...	35 02	114 36	604	34 5	Aug., 1859	Dec., 1893	U. S. post hospital. J. Ashton Lovett. Record broken Jan., 1861, to Sept., 1865, inclusive; May to Aug., inclusive, 1866; Nov., 1866, to Mar., 1867, inclusive; June to Dec., inclusive, 1867; Jan. to Mar., inclusive, 1868; Sept., 1882, Sept. to Dec., inclusive, 1890; Dec., 1892.
V.O...	Mineral Park...	35 23	114 09	4500	0 2	Nov., 1890	Dec., 1890	
V.O...	Signal.....	34 25	113 29	1500	5 8	May, 1889	Dec., 1894	William Koshland, Henry Koshland.
	NAVAJO.							
V-O...	Farley's Camp	.....	.....	.....	4 3	Oct., 1890	Dec., 1894	R. H. Farley. Record broken Mar. to June, inclusive, 1893.
S. S...	Fort Apache.....	33 48	109 57	5050	19 0	Jan., 1876	Dec., 1894	Signal Service, U. S. post hospital. Record broken July, 1894.
V.O...	Holbrook	34 54	110 09	5047	8 1	Dec., 1886	Dec., 1894	David Rope.
V.O...	Keam's Canon	35 49	110 11	6400	1 0	Jan., 1894	Dec., 1894	
V.O...	Navajo Springs	35 06	109 29	5200	3 0	Dec., 1891	Nov., 1894	Record broken Apr., Dec., 1892; Jan. to Dec., inclusive, 1893, Jan., Mar., Apr., June to Oct., inclusive, 1894.
V.O...	Show Low.....	34 16	110 02	6200	6 6	July, 1888	Dec., 1894	George M. Adams, John McNeil. Record broken Aug., 1888, to July, 1889, inclusive; Jan., Feb., Apr., May, June, Dec., 1892; Mar., May, 1893, Jan., 1894.
V.O...	Winslow.....	35 03	110 41	4825	4 8	June, 1888	Jan., 1893	L. W. Roberts, Chas. J. Dillon, C. B. Yost, A. & P. Ry. Record broken Jan., 1890, to Jan., 1892, inclusive; Aug., Nov., 1892.

TABLE XV (CONTINUED.)

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From	To (Inclusive)	Authority, and Remarks as to Missing Records.
		° ′	° ′	Feet.	Yr. Mo.			
V.O...	Woodruff.....	34 47	110 03	5100	2 7	Jan., 1890	July, 189-	Record broken June, 1892.
	PIMA.							
V.O...	Calabasas.....	31 27	110 59	.....	5 7	June, 1889	Dec., 1894	E. K. Sykes. [1868.
M.D..	Cmp.Critt'nden	31 43	110 40	2000	4 10	Apr., 1868	Jan., 1873	U. S. post hospital. Record broken Nov.,
V.O...	Crittenden.....	31 34	110 44	4172	4 6	July. 1889	Dec , 1893	E. Vanderlip. Record broken Dec., 1889, to June, 1890, inclusive; Nov., 1890, to June, 1891, inclusive; Oct., Nov , Dec., 1892.
M.D..	Fort Buchanan	31 43	110 55	5330	3 11	Aug., 1857	June, 1861	U. S. post hospital.
S. S...	Fort Lowell, near Tucson..	32 16	110 47	2500	23 10	May, 1867	Feb., 1891	U. S. post hospital and Signal Service. Record broken Nov., 1867; Aug., 1881; May to Aug., inclusive, 1883; May, 1884, to Feb., 1886, inclusive; Feb., 1887, to Dec , 1888, inclusive.
V.O...	Lochiel.....	31 20	110 37	.....	6 7	June, 1888	Dec., 1894	San Rafael Cattle Co., by Mrs. Cameron. Record broken Feb., 1889; Jan., July, Aug , Sept., Nov., Dec., 1892; Feb. to Sept., inclusive, and Dec., 1893; Mar. to June, inclusive, and Oct., 1894.
V.O...	Nogales.....	31 20	110 57	3870	2 10	Mar., 1892	Dec., 1894	W. N. Cummings. Record broken May, Aug , 1892; Feb., 1893, to Apr , 1894, inclusive; June to Nov., 1894, inclusive.
R. R..	Pantano	31 59	110 32	3538	14 3	Oct., 1880	Dec., 1894	S. P. Ry. Record broken June to Oct., 1888.
V.O...	St. Helena Rancho	.....	.....	5000	.....	Apr., 1893	July, 1894	Geo. P. Scolefield.
V.O...	Total Wreck.....	31 53	110 36		1 4	Sept., 1890	Sept., 1890	
M.D..	Tubac.....	31 40	110 58	3000	0 5	Oct., 1867	Feb., 1868	U. S. post hospital.
S. S...	Tucson.....	32 14	110 57	2400	19 2	Nov., 1875	Dec., 1894	Signal Service, S. P. Ry., E. L. Wetmore.

TABLE XV (CONTINUED.)

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From	To (Inclusive)	Authority, and Remarks as to Missing Records.
		° ′	° ′	Feet.	Yr. Mo.			
S. S...	University, (near Tucson)	32 14	110 57	2432	3 3	Oct., 1891	Dec., 1894	Signal Service and Agricultural Experiment Station.
	PINAL.							
V.O...	American Flag.	32 40	110 49	.....	1 0	July, 1889	June, 1890	I. H. Shields.
V.O...	Arizola.....	32 51	111 42	.....	0 6	Nov., 1893	Apr., 1894	
M.D..	Breckenridge, (OldCmpGrant)	32 48	110 36	3800	6 4	Sept., 1866	Dec., 1872	U. S. post hospital. Record broken July, Aug., Sept., 1867; Nov., 1867, to Mar., 1868, inclusive; Nov., Dec., 1868; Apr., 1869.
M.D..	CampMogollan	32 54	110 40	.....	0 1	Aug., 1870	.....	U. S. post hospital.
R.R...	Casa Grande	32 56	111 43	1398	14 3	Oct., 1880	Dec., 1894	S P. Ry. Record broken Nov., 1882.
V.O...	Dudleyville.....	32 58	110 46	.....	5 6	July, 1889	Dec., 1894	George F. Cook.
V.O...	Florence.....	33 03	111 20	1553	18 4	Nov., 1875	Feb., 1894	Signal Service, A. T. Colton, Chas. E. Perkins, C. E. Record broken Sept., 1882, to Dec., 1888, inclusive.
S. S...	Maricopa	33 05	112 00	1173	19 2	Nov., 1875	Dec., 1894	Signal Service and S. P Ry. Record broken Mar., 1878, to May, 1879, inclusive.
V.O ..	Oracle.....	32 40	110 56	4500	3 3	Oct., 1891	Dec., 1894	Mrs. E. S. Dodge. Jan., 1892, to Mar., 1893, inclusive; May to Sept., inclusive, 1893.
V.O...	Red Rock.....	32 34	111 19	1867	5 6	July, 1889	Dec., 1894	W. A. Langham, R. C. Telfer. Record broken July, Aug., Sept., 1890; Aug., 1892; Sept., Oct , 1894.
V.O...	Reymert.....	33 17	111 09	.....	3 5	Aug., 1891	Dec., 1894	W. W. Strohn. Record broken Sept., 1891; Apr., May, Oct., Dec., 1892.
V.O...	Silver King.....	33 26	111 03	.....	1 0	July, 1889	June, 1890	T. S. Collins.
V.O...	Willow Springs	.....	.....	.....	1 10	May, 1888	Feb., 1890	F. A. Chamberlain.

TABLE XV (CONTINUED.)

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From	To (Inclusive	Authority, and Remarks as to Missing Records
		° ′	° ′	Feet.	Yr. Mo.			
	YAVAPAI.							
V.O...	Antelope Valley	34 18	112 42	4375	6 4	July, 1888	Oct., 1894	Mrs. J. H. Hamilton. Record broken Mar., Apr., June, Oct., Dec., 1891, Mar., May, June, July, Aug., Oct., Dec., 1892, Mar., Aug., Sept., 1894.
V.O...	Ash Creek.....	34 25	112 03	3950	1 1	Sept., 1889	Sept., 1890	John H. Hudson.
V.O...	Banghart's, (Chino)	35 50	112 20	5047	2 11	July, 1888	May, 1891	George Banghart. Record broken Aug. to Nov., inclusive, 1888; Jan. to June, inclusive, 1889; Dec , 1890.
M.D..	Camp Date Creek	34 20	112 55	3726	6 4	May, 1867	Aug., 1873	U. S. post hospital.
M.D..	Camp Hualapai	35 10	113 50	5322	3 3	Apr., 1870	June, 1873	U. S. post hospital.
M.D..	Camp Keno.....	.....	.....	.....	0 2	Mar., 1868	Apr., 1868	U. S post hospital.
M.D..	Camp Lincoln...	34 52	111 35	3500	0 10	June, 1868	May, 1869	U. S. post hospital. Record broken July Dec., 1868.
M.D..	Camp McPherson	34 45	112 18	3726	1 7	May, 1867	Nov., 1868	U. S. post hospital.
M.D..	Camp Skull Valley.....	34 30	112 40	5000	0 4	Jan., 1867	Apr., 1867	U. S. post hospital.
M.D..	Camp Verde	34 34	111 53	3500	.....	.....	.....	U. S. post hospital and Signal Service Combined with Fort Verde.
M.D..	Camp Willow Grove	35 11	113 28	4170	1 9	Jan., 1868	Sept., 1869	U. S. post hospital. Record broken Mar., 1869.
V.O...	Cottonwood. ...	35 10	113 31	4170	1 8	July, 1889	Feb., 1891	Thomas Carroll. Record broken Mar. to Aug., inclusive, 1890.
S. S...	Fort Verde.....	34 34	111 47	3160	22 11	Feb., 1868	Dec., 1890	Signal Service, U S post hospital Record broken Mar. to Nov., inclusive, 1868.

TABLE XV (CONTINUED.)

Class	County and Station.	Latitude.	Longitude.	Elevation Above Sea.	Record. Length	From.	To (Inclusive.)	Authority, and Remarks as to Missing Records.
		° '	° '	Feet.	Yr. Mo			
S. S..	Prescott (Whipple Barracks)	34 33	112 28	5389	29 7	June, 1865	Dec., 1894	Signal Service. U. S. post hospital. Record broken July, 1865, to Aug., 1866, inclusive, Sept., 1867; May, 1868; Mar., to Sept., inclusive, 1869; Nov., 1874, to Apr., 1875, inclusive.
V. O..	Simmons.....	34 50	112 38	4600	1 6	Jan., 1890	June, 1891	Record broken Feb., 1891.
V. O..	Stanton	34 10	112 43	4000	0 4	Jan., 1890	Apr., 1890	
V. O..	Tip Top	34 03	112 15	2650	2 1	June, 1889	June, 1891	F. E. Wager.
V. O..	Walnut Grove..	34 15	112 33	3400	5 0	May, 1889	Apr., 1894	T. B. Carter. Record broken June, Sept, Nov., Dec., 1892; May, Aug., Sept., Nov., 1893; Jan., 1894.
	YUMA.							
M. D.	Camp Colorado	34 10	114 15	.....	2 2	Jan., 1869	Feb., 1871	U. S. post hospital.
M. D.	Camp LaPaz....	33 38	114 32	.....	0 5	Sept., 1874	Jan., 1875	U. S. post hospital.
V. O..	Palomas.....	32 54	113 28	.....	1 9	Jan., 1893	Sept, 1894	A. E Martin. Record broken July to Dec., inclusive, 1893.
V O..	Parker.....	34 10	114 15	.....	1 3	Oct., 1893	Dec., 1894	Record broken Mar., Apr., Sept, 1894
S. S..	Stanwix.....	32 57	113 21	567	2 1	Nov., 1875	Nov., 1877	Signal Service.
R. R..	Texas Hill..	32 46	113 35	355	15 5	Aug, 1879	Dec, 1894	S. P. Ry. Record broken Feb, Mch., Apr, 1892; June, 1894.
S. S..	Yuma.....	32 34	114 36	141	19 3	Oct., 1875	Dec, 1894	Signal Service.

TABLE XVII.

AVERAGE DAILY AND HOURLY WIND MOVEMENT AT FIVE STATIONS IN ARIZONA.

FORT APACHE, ARIZONA. (1883 to 1887, inclusive. Seventy-fifth meridian time.)

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 am	11 am	Noon.	1 pm
January*	4.6	4.5	4.2	4.1	3.8	3.7	3.5	3.2	3.2	3.1	3.1	3.4	4.5
February*	4.6	4.4	4.3	4.0	4.0	3.7	3 8	3.7	3.9	3.9	3.9	4.7	6 5
March*	5.0	4.5	4.4	4.7	4.4	4.5	4.2	4.0	3.9	3.6	3 8	5.8	8.6
April	5.6	4.9	4.9	4.5	4.6	4.5	4 3	4.1	4.0	4.5	5.1	8.3	11.3
May	5.1	4.5	4.0	3.9	4.0	4.1	3 9	3.7	3.7	3.6	4.7	8.5	11.2
June	5.1	4.6	4.2	3.9	3.9	3.7	3.6	3.3	3.3	3.0	3.8	7.5	9.7
July	4.5	4.2	4.2	4.0	3.8	3.5	3.3	3.3	3.2	2.8	2.7	4.7	6.5
August	4.3	4.3	3.9	4.0	3.8	3.6	3.5	3.3	3.0	2.9	2.6	4.0	6.1
September	4.4	4.2	4.0	4.0	3.8	3.6	3.5	3.6	3.4	3.5	3.5	5 0	7.9
October	4.9	4 5	4.6	4.2	4.2	3.9	3.7	3.7	3.7	3.5	3.7	5 2	8 3
November	4.2	4.3	3 8	3.8	3.5	3.0	3.0	3.1	2.8	2.7	2 4	3.0	5.7
December	4.0	3.8	3.8	3.6	3.6	3.4	3.7	3.7	3.5	3.7	3.5	3.4	5.0
Means	4.69	4.39	4.19	4.06	3.93	3.77	3.67	3.56	3.47	3.40	3.57	5.29	7.61

Month.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 pm	11 pm	Mid-night.	Average. Daily.	Average. Hourly
January*	6.4	7.9	9.1	9.5	9.5	8.7	6.3	4 9	4.9	5.0	4.7	125.7	0.2
February*	9.0	10.2	10.9	11.4	11.3	10.9	9.1	6.0	5.1	5.1	4.8	149.7	6.2
March*	10.1	11.4	11.7	12.5	12.5	11.9	10.7	7.8	5.4	5.2	5.2	166.1	6.9
April	12.9	14.3	15.3	15.9	16.0	15 9	14.6	11.4	6.2	4.9	5.5	203.5	8.5
May	12.3	13.4	13.9	14.7	15.0	14.7	13.8	11.9	6.5	4.4	5.5	191.2	8.0
June	11.3	12.5	13.5	14.4	14.6	14.2	13 4	11.8	7.9	4.5	4.9	182.3	7.6
July	8.0	9.1	10.2	10.6	10.5	10.4	9.8	8.9	6.5	4.5	4.7	143.8	6.0
August	7.3	8.7	9.9	10.2	9.6	9.2	8.3	6 9	5.5	4.9	4.7	134.4	5.6
September	9.6	10.9	11.0	11.2	10.5	10.3	8.9	6.0	4.7	5.1	4.9	147.2	6.1
October	9.7	10.6	10.8	11.3	10.9	10.4	8.3	4.9	5.2	5.6	5.3	150.8	6.3
November	7.9	9.2	10.0	10.2	10.1	8.6	5.5	4.7	4.9	4.8	4.4	125.6	5.2
December	6.6	8.0	8.9	9.3	9.1	7.3	5 2	5.1	5.1	4.9	4.6	122.6	5.1
Means	9.26	10.52	11.27	11.77	11.63	11.04	9.49	7.52	5.66	4.97	4.93	153.58	6.40

*1883 to 1888, inclusive.

TABLE XVII. (CONTINUED.)

FORT GRANT, ARIZONA. (1883 to 1889, inclusive. Seventy-fifth meridian time.)

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 am	11 am	Noon.	1 p.m.
January	6.7	6.4	6.3	5.9	5.9	5.7	5.6	5.3	5.3	5.0	4.5	5.2	6.3
February	7.3	6.9	6.6	6.4	6.4	5.9	5.7	5.8	5.5	5.4	5.5	6.6	7.7
March	6.5	6.0	5.8	5.7	5.5	5.6	5.4	5.1	4.7	4.4	5.1	6.3	7.9
April	6.5	6.1	5.8	5.7	5.4	5.2	5.1	4.8	4.3	4.7	6.0	7.3	8.2
May	6.1	6.1	6.0	5.8	5.8	5.9	5.7	5.4	4.9	4.9	5.9	7.2	8.3
June	6.2	6.2	5.9	5.7	5.8	5.4	5.2	4.7	3.8	4 3	5.1	6.0	7.1
July	5.7	5.2	4.9	4.7	4.3	4.0	3.7	3.4	2.9	3.2	3.8	4.8	5.9
August	5.3	4.9	4.8	4.6	4.4	4.4	4.0	4.3	3.6	3.7	4.4	5.1	6.2
September	6.9	6.4	6.4	6.1	5.8	5.7	5.7	5.4	5.1	5.0	6.0	7.1	8.2
October	6.7	6.6	6.4	6.0	5.8	5.4	5.2	5.1	4.7	4.4	5.6	6.9	8.2
November	6.8	6.4	5.8	5.7	5.4	5.1	5.0	5.1	4.9	4.4	5 0	6 2	7.4
December	6.2	5.7	5.7	5.4	5.5	5.9	5.7	5.4	5.4	5.3	5.4	6.1	7.0
Means	6.41	6.08	5.87	5.64	5.50	5.35	5.17	4.98	4.59	4.56	5.19	6.23	7 37

Month.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 pm	11 pm	Mid-night.	Average. Daily.	Average. Hourly.
January	6.7	7.5	8.2	8.7	8.9	8.5	7.2	6.8	6.9	7.0	6.9	157.5	6.6
February	8.8	9.6	10.2	10.7	10.9	9 9	8 7	7.3	7.3	7.0	7.0	179.0	7.5
March	8.7	9.4	9.8	10.2	10.4	10.1	9.0	7.2	6.8	6.6	6.5	168.5	7.0
April	9.2	10.4	11.2	11.8	12.5	12.3	11 5	9.2	7.3	6.6	6.6	183.7	7.7
May	8.9	9.6	9.7	10.3	10.4	10.6	10.6	9 3	6.7	6.3	6.2	176.7	7.4
June	8.0	8.5	9.3	9.6	10.5	10.6	10.7	10.0	7.6	6.6	6.4	169.1	7.0
July	6.7	7.5	8.2	8.3	9.0	9.2	9.2	8.8	7.3	6.6	6.4	143.7	6.0
August	7.0	7.7	8 0	7.8	8.2	8 1	7.6	6 8	6.4	5.8	5.4	138.5	5.8
September	9.0	9.2	9.5	9.7	9.5	8 9	8.3	6 9	6.9	7 1	7.2	172.2	7.2
October	8.5	8 9	9.1	9.2	9.1	8.8	7.2	6.8	6.9	7.0	6.9	165.3	6.9
November	8.0	8.4	8.3	8.6	8.5	7.9	6.9	7.1	7.2	7.3	7.0	158.2	6.6
December	7.7	8.2	8.4	8.6	8.4	7.6	6.6	6.7	6.8	6.8	6.5	157.1	6.5
Means	8.10	8.74	9.16	9.48	9.69	9.38	8.62	7.74	7.01	6.72	6.58	164.12	6 84

TABLE XVII. (CONTINUED). PHŒNIX. ARIZONA.

(1879 to 1881, inclusive. Local time, which is two hours and twenty-eight minutes slower that 75th meridian time.)

Month.	1 a.m.	2 a.m.	3 a.m	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 am	11 am	Noon.	1 p.m.
January	2 0	1.9	2.2	2.5	2.4	2.3	2.0	2.2	2.7	2.7	2.8	2.8	2.8
February	2.2	2.1	2.3	2.2	2.2	2.3	2.2	2.4	2.4	2.9	3.2	3.6	4.0
March	1.7	1.6	1.8	1.9	1.9	1.9	1.9	2 3	2.7	2.8	3.0	3.2	3.3
April	1.8	2.0	2.0	2 0	2.0	2.0	2.1	2.9	3.0	3.3	3.5	4.0	4.4
May	1.2	1.5	1.8	2.0	2 0	1.8	1.9	1.9	2.1	2.0	2.6	3.2	3.6
June	1.4	1.4	1.5	1.8	1.9	2.0	2 1	2 4	2.3	2.2	2.6	3.0	3.5
July	2.0	2.1	1.7	1.7	1.7	1.8	2.0	2.2	2.5	2.3	2.7	3.1	3.4
August	1.8	1.7	1.8	1.6	1.4	1.5	1.4	1 9	2.2	2.2	2.6	2.7	3.2
September	1.2	1.4	1 3	1.5	1.7	1.5	1.6	1.9	2.4	2.5	2.3	2.1	2.3
October	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.7	2.2	2.5	2.5	2.9	2.8
November	1.6	1.7	1.6	1.7	1.6	1.7	1.4	1.6	2.1	2.5	2.9	2.9	3.3
December	1.7	1.8	1.9	1.9	1.9	2.0	1.8	2.0	2.2	2.7	2.5	2.8	2.6
Means	1.68	1.72	1.78	1.86	1.85	1.86	1.83	2 12	2.40	2.55	2.77	3.02	3.27

Month.	2 p m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 pm	11 pm	Mid-night.	Average. Daily.	Average. Hourly.
January	2.8	3.0	2.9	2.4	1.5	1.6	1.6	1.6	1.8	1.8	2.0	54.0	2.2
February	4.5	4.6	4.4	4.2	3.0	2.5	2.6	2.0	2.0	2.0	2.2	68.0	2.8
March	3.6	4.0	4.0	3.6	2.6	1.8	1.4	1.3	1.7	1.4	1.6	57.1	2.4
April	5.1	5.3	5.7	5.4	4.7	2.7	2.5	2.3	2.0	2.1	2.1	75.3	3.1
May	4.4	5.0	5.3	5.1	4.4	2.4	1.9	1.8	1.4	1.4	1.3	62.2	2.6
June	4.3	4.9	5.3	5.3	5.0	3.0	2.1	2.0	1.6	1.6	1.3	64.3	2.7
July	3.9	4.1	4.3	4.4	4.2	3.1	2.6	3.0	2.9	2.3	2.1	66.3	2.8
August	3.3	3.6	3.4	3.3	3.2	2.2	2.0	2.2	1.9	2.0	2.0	55.0	2.3
September	2.8	2.8	2.7	2.3	1.4	1.1	1.2	1.0	1.0	1.0	1.0	41.9	1.7
October	3.0	3.1	2.9	2.2	1.3	1.0	1.0	1.0	1.1	1.4	1.7	44.9	1.9
November	3.1	3.1	2.8	1.7	1.3	1.0	0.9	1.1	1.5	1.6	1.8	46.6	1.9
December	2.8	2.7	2.3	1.4	1.1	1.1	1.0	1.1	1.4	1.6	1.6	45.6	1.9
Means	3.63	3.85	3.83	3.44	2.81	1.96	1.73	1.70	1.69	1.68	1.72	56.77	2.37

TABLE XVII. (CONTINUED.)

PRESCOTT, (WHIPPLE BARRACKS). (1883 to 1893, inclusive. Seventy-fifth meridian time.)

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m	8 a.m.	9 a.m.	10 am	11 am	Noon.	1 p. m.
January	3.9	4.0	3.8	3.6	3.7	3.5	3.6	3.8	3.9	3.9	4.0	4.5	6.6
February	5.2	5.2	5.0	5.0	4.9	4.9	4.6	4.4	4.1	4.0	4.3	5.9	8.4
March	4.9	4.3	4.1	3.9	3.7	3.8	3.8	3.4	3.4	3.4	4.2	6.7	9.4
April	5.5	5.4	5.1	5.1	4.8	4.2	4.0	3.8	3.6	4.5	7.7	10.7	12.4
May	4.8	4.6	4.3	4.0	3.7	3.4	3.3	3.0	2.8	4.2	7.8	10.9	12.8
June	4.2	3.9	3.4	3.4	3.0	2.6	2.4	2.4	2.3	3.6	7.9	10.4	13.1
July	4.6	4.3	3.7	3.6	3.4	2.8	2.5	2.2	1.9	2.6	4.8	7.3	9.1
August	3.9	3.8	3.3	3.4	3.2	3.0	2.8	2.6	2.2	2.2	3.7	6.4	8.0
September	3.6	3.2	3.1	2.7	2.8	2.7	2.6	2.5	2.5	2.3	4.1	7.8	9.5
October	3.8	3.4	3.3	3.3	3.1	3.0	2.9	2.8	2.7	2.5	3.8	6.8	9.7
November	3.4	3.3	3.3	3.3	3.4	3.2	3.1	3.1	3.3	3.3	3.3	4.6	7.0
December	4.9	4.8	4.8	4.5	4.5	4.5	4.4	4.4	4.4	4.5	4.4	5.2	7.1
Means	4.39	4.18	3.93	3.82	3.68	3.47	3.33	3.20	3.09	3.42	5.00	7.27	9.38

Month.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 pm	11 pm	Mid-night.	Averages. Daily.	Hourly.
January	8.5	9.6	9.5	9.9	9.3	8.3	6.6	5.3	4.7	4.3	4.1	132.9	5.5
February	10.2	11.1	11.5	12.2	12.4	11.9	10.4	8.1	6.8	6.4	5.8	172.7	7.2
March	10.5	11.4	12.2	12.6	12.7	12.7	11.6	9.1	7.0	6.1	5.6	170.8	7.1
April	13.5	14.3	14.7	15.4	15.7	15.3	14.4	12.4	8.7	7.3	6.1	214.8	9.0
May	13.5	14.5	15.0	15.5	15.8	15.4	14.7	12.9	8.6	6.1	5.2	206.0	8.6
June	14.5	15.3	16.1	16.7	17.0	16.5	15.7	14.0	9.6	6.4	4.7	210.0	8.8
July	10.1	11.0	12.0	12.9	12.7	12.6	12.0	10.6	7.9	5.8	5.0	165.3	6.9
August	9.1	9.9	10.9	11.3	11.7	11.4	11.3	9.0	6.5	5.2	4.3	148.7	6.2
September	10.3	10.9	11.6	11.6	11.5	11.2	10.3	7.7	5.4	4.3	4.0	148.1	6.2
October	10.9	11.6	11.9	11.7	11.8	11.2	9.1	6.7	5.3	4.7	4.0	150.1	6.3
November	8.9	9.5	9.9	10.1	9.9	8.9	6.6	4.9	4.3	3.9	3.7	128.1	5.3
December	8.7	9.6	9.9	10.1	9.5	8.1	6.6	5.8	5.0	4.7	4.7	144.9	6.0
Means	10.72	11.56	12.10	12.50	12.50	11.96	10.78	8.88	6.65	5.43	4.77	166.03	6.92

TABLE XVII. (CONTINUED).

YUMA, ARIZONA. (1883 to 1889, inclusive. Seventy-fifth meridian time.)

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 am	11 am	Noon.	1 p.m.
January	4.1	4.3	4.4	4.6	4.8	5.2	5.4	5.3	5.4	5.3	5.7	7.1	9.0
February	5.3	4.8	4.8	4.6	4.8	5.0	5.2	5.0	5.2	5.2	5.7	7.5	9.4
March	5.1	4.5	4.3	4.1	3.7	3.8	3.9	3.9	4.1	4.3	5.2	7.0	8.5
April	7.3	6.4	5.8	5.3	4.8	4.7	4.3	4.3	4.0	4.2	5.8	7.6	8.3
May	7.0	6.2	5.4	4.8	4.4	3.9	3.4	3.2	3.2	3.9	5.8	6.7	7.5
June	5.8	5.3	4.8	4.3	4.0	3.4	3.2	3.1	2.8	3.9	5.2	6.2	6.8
July	5.8	5.1	4.7	4.6	4.5	4.6	4.4	3.7	3.8	5.5	7.5	8.2	8.5
August	5.4	4.7	4.4	4.1	3.9	3.7	3.6	3.4	3.2	4.1	6.0	6.9	7.3
September	4.1	4.2	3.4	3.3	3.1	2.9	2.9	2.9	2.9	3.2	4.4	5.9	6.6
October	3.5	3.3	3.2	3.2	3.1	3.3	3.3	3.4	3.4	3.7	4.2	5.6	6.7
November	3.6	3.5	3.6	3.5	3.7	3.9	4.2	4.4	4.9	5.1	5.4	6.6	8.2
December	4.1	3.9	4.0	4.2	4.3	4.7	5.0	5.0	4.9	5.2	5.3	6.2	7.8
Means	5.09	4.68	4.40	4.22	4.09	4.09	4.07	3.97	3.98	4.47	5.52	6.79	7.88

Month.	2 p m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 pm	11 pm	Mid-night.	Average. Daily.	Average. Hourly.
January	10.1	10.2	10.0	9.8	9.2	8.4	6.4	4.9	4.3	4.2	4.0	152.2	6.3
February	9.9	9.9	9.8	9.9	9.8	9.7	8.7	6.5	6.0	5.7	5.7	164.1	6.8
March	8.3	8.4	8.1	8.4	8.6	8.9	8.7	7.6	6.9	6.7	6.2	149.1	6.2
April	8.1	8.5	8.7	9.0	9.4	9.5	9.5	9.2	8.8	8.7	8.3	170.8	7.1
May	7.3	7.7	7.8	8.2	8.7	8.9	9.1	9.8	9.2	8.9	8.4	159.3	6.6
June	7.1	7.4	7.6	7.9	8.3	8.8	9.0	9.6	9.2	8.1	7.0	148.7	6.2
July	8.6	8.5	8.5	8.8	9.0	9.5	9.7	10.0	9.8	8.2	6.6	168.0	7.0
August	7.2	7.4	7.1	7.6	7.8	8.2	8.7	8.8	8.5	7.7	6.2	146.3	6.1
September	6.4	6.4	6.2	6.3	6.2	6.1	6.1	5.9	5.9	5.8	5.1	115.6	4.8
October	6.8	6.4	6.2	6.2	6.3	5.9	5.4	4.9	4.4	4.2	4.1	110.8	4.6
November	8.6	8.3	8.0	7.7	7.4	6.7	5.4	4.3	4.0	3.7	3.7	128.8	5.4
December	8.6	8.9	8.9	8.8	8.3	7.2	5.2	4.6	4.5	4.2	4.0	138.0	5.8
Means	8.08	8.17	8.07	8.22	8.25	7.15	7.66	7.18	6.79	6.34	5.78	145.98	6.08

A EESUME OF THE TABLES.

The subjects of the preceding tables are as follows:

Table I is a record of temperature from October, 1891, to December, 1897, inclusive.

Table II is a record of temperature, dew point, humidity and vapor pressure from October, 1891, to June, 1895, and of temperature to December, 1897.

Table III is a record of precipitation for the same period.

Table IV is a record of sunshine, cloudiness and evaporation from October, 1891, to June, 1895.

Table V is a record of wind movement from October, 1891, to June, 1895.

Table VI is a record of barometric pressure for the same period.

Tables VII to XI compare at eleven places, for the year 1893, the maximum temperature, relative humidity, minimum temperature, mean monthly temperature, precipitation.

Table XII gives the percentage of sunshine at nine different places, for the same year.

Tables XIII and XIV compare the mean maximum and minimum temperatures at nine representative stations in Arizona.

Table XV is a list of Stations in Arizona for which rainfall data are given.

Table XVI gives the rainfall for Arizona for the month and the year.

Table XVII gives the daily and hourly wind movement at five stations in Arizona.