and also the care that was taken by him to determine its error. The latitude of the ship by which his observations were computed was 69° 20′ 41″ N., determined trigonometrically from the latitude of the observatory, agreeing within two seconds with that determined by himself, by near one hundred observations, with an eight-inch sextant, by Troughton, and false horizon. A comparison of the zenith distances of different objects, with this instrument and the repeating circle, at the same time and place, assign an error to this instrument a little different, and which if applied to his observations would make them agree nearly with my own; but in order that his observations should be as independent of my own as possible, his own error has been applied.

The greatest part of the observations made with the sextants and the altitude instrument, were confined to altitudes not exceeding four or five degrees. And in all the observations made out of the meridian, whether made with sextant or repeating circle, the altitudes were also within the same limits; those at higher altitudes were entirely confined to observation in the meridian with the repeating circle, with not less than six or eight repetitions each. There are some circumstances which rendered the usual sources of inaccuracy attached to this method of determining the refraction by observations out of the meridian within very narrow limits, which were, first, from the high latitude of the place of observation, and from the greater part of the observations being taken near the meridian, the motion in altitude was therefore so slow, that an error of three or four seconds in time would cause but a very small error in the computed altitude; and secondly, the probable error in the horary angle was much within these limits, for there was not an observation registered in which the transit of either the same object or one of the fundamental fixed stars was not observed within about an hour either before or after the observation, so that the going of the chronometer was only depended upon during that short interval. A few of Lieutenant Palmer's observations with the sun were taken at a greater distance from noon, but whenever this happened, great care was taken by him to measure the horary angle by four of Arnold's chronometers, the errors of which were determined by a comparison at noon with one of my own chronometers, by which the sun's transit was observed the same day at the observatory.

With respect to the observations upon Sirius, made the same way with the repeating circle, still greater accuracy appeared to be attained, in consequence of taking always the transit of one of the principal stars, both before and after an observation, so but very little error could arise from this source, except that

arising from the instrument not being exactly in the meridian; but the frequent observations made for the verification of its position, assigned to a very considerable degree of accuracy, the deviation of the centre hole of the meridian mark (to which the transit was constantly referred before and after an observation) from the true meridian.

The observations upon Sirius with the repeating circle are given in Table IX. Those made on the meridian are of course the most unexceptionable, they are ten in number, contained in Table VIII., and present the following results. At the apparent altitude of 4° 22′ 55″ the observed refraction is 13′ 1″.6, bar. 29.84, and the thermometer −21° Fahrenheit, by a mean of five of the observations at the highest temperature; the refraction by the French Tables is 12′ 48″.6, which is 13″.0 in defect. By the Table given by Dr. Young in the Nautical Almanac, the refraction is 12′ 51″.24, which is in defect 10″.36; being two or three seconds nearer the truth.

By a mean of five meridian observations of Sirius at the lowest temperatures, at an apparent altitude 4° 21′ 20″, the observed refraction is 13′ 52″.52, the bar. 29.76, and thermometer −40°.6 Fahrenheit; the refraction by the French Tables is 13′ 29″.4, which is 23″ in defect, and the refraction also by Dr. Young's Table is 13′ 31″.02, which is in defect 21″.5.

It appears therefore that at 20 degrees below zero the tables are not more than 10 or 11 seconds in defect, at an altitude of 4° 22′; but when the temperature is as low as 41 degrees below zero, the errors of the Tables rapidly increase; the correction by the Tables due to 1 degree of temperature Fahrenheit is 1″.57 or $\frac{1}{424}$th part of the whole refraction at this altitude, but by observation the correction for each degree between these temperatures is 2″.37, or $\frac{1}{450}$th part of the refraction.

The observations of the officers with the sextants make the observed refractions a little greater, which should be the case as they were made at about fourteen feet above the level of the frozen sea, whereas my own were made forty feet above the sea.

It appears that in the winter whenever the star Sirius was observed in the direction of S.E. from the observatory, its observed refraction was always less than that of the Tables, but when observed to the S.W. it was constantly greater, which appears to arise from the quantity of open water in the former direction; for by the action of the tides, together with the prevailing winds, which in the Artic Regions during the winter, in this part of the world, are from the N.W., there was always some portion of the surface of the sea free

from ice in the direction of S.E. even in the depth of winter, and as the temperature of the surface of the sea was generally about + 28° at that time, the lower stratum of air immediately in contact with it, must have been more attenuated, and have had a greater capacity for moisture than when the sea was covered with ice, which is sufficient, I conceive, to account for this circumstance. A space of open sea at a distance among ice is always indicated by a dense haze or cloud immediately over it, and known by the name of "sea blink." In the direction of S.W. from the observatory were sea and land, both constantly covered during the winter with ice and snow, so that the refraction was less or greater than the Table, according as the visual ray passed through a space more or less in contact with the open sea; to render this more apparent the observations upon Sirius, both to the east and westward are arranged according to the altitudes in Table IX., from which it appears that at a temperature between 20 and 30 degrees below zero, and at an apparent altitude of 3° 8′, the observed refraction was either less or greater than that computed from Dr. Young's Tables by about 30″, according as the star was to the eastward or westward, and a mean between the refraction observed on both sides of the meridian at this altitude nearly agrees with that computed from these Tables. In the early part of the winter, before the sea was completely frozen over, the tabular refraction (for the fixed stars) was generally in excess, but this was not the case afterwar

ON THE DIFFERENCE BETWEEN THE REFRACTION OF THE SUN AND THAT OF A FIXED STAR APPARENT AT VERY LOW TEMPERATURES.

After an absence of the sun during the winter of 1822-3 of about six weeks, every opportunity was taken when it again made its appearance to the southward, of obtaining very low meridian altitudes with the repeating circle whenever the weather would permit. This was done by taking two or three repetitions with one limb upon the east side of the meridian, and in the same way with the other limb after the sun's transit had been observed; by this means an observation of each limb was obtained, and the apparent altitudes thus deduced from observation were compared with the true altitudes of the same limbs computed from the declination taken from the Nautical Almanac, and the latitude of the observatory. A progressive series of altitudes of both limbs was thus obtained in this way, until the meridian altitude of sun had so far increased that the observed refraction nearly coincided with that of the Tables; the number of repetitions was then increased to six or eight, and confined to one limb each day at noon.

The observations upon the star Rigel which I had previously made, at an apparent altitude of 12° 18′, had led me to expect, from the very near agreement of the observed refraction of that star with that of the Tables, that the same would take place with the sun when it had acquired the same altitude, this however was not the case. From a habit of daily computing the refraction from the observations soon after they were made, a difference soon became perceptible, which I at first ascribed to some error in the observations; and as it first appeared in observations upon the lower limb, it seemed probable that it arose from a habit of making too close a contact with the wire; subsequent observations, however, with both limbs, proved this way of accounting for it to be quite inadmissable; every precaution, therefore, in the perfect adjustment of the circle was taken, as well as care to obviate any habitual source of error in the use of it that might possibly vitiate the observation, and the perpendicular position of the vertical circle continually verified, by observing the interval of the passages of the sun's limbs, one by reflection, and the other by direc vision, and comparing it with that given in the Nautical Almanac.

The observations, however, both of the sun and Rigel were made under cir-

cumstances so nearly similar, as to render it quite impossible to account for it by any error of this kind, independent of the care taken to obviate them. On the 27th February, the sun's lower limb had the same meridian altitude within a few minutes as the star, the thermometer at noon being 30 degrees below zero; at which time, by an excellent observation at an apparent altitude of 12 degrees, the sun's refraction was *greater* than that computed from the Tables, by 18.5 seconds; whereas, the same evening, the temperature being 43 degrees below zero Fahrenheit, the observed refraction of Rigel was *less* than that of the tables by 2.3 seconds, although the temperature was 13 degrees lower than at noon; the refraction of the sun, therefore, exceeded that of the star by about 21 seconds. And it appears upon the whole, that from the four observations upon Rigel, (which agree within one or two seconds of each other) that at an apparent altitude of 12° 18′ 28″, the barometer 29.652, and thermometer —31.7 Fahrenheit, the refraction of a fixed star is 5′ 0″.7, taking the apparent North Polar distances of that star from the Nautical Almanac, and the latitude of the observatory as determined by the other stars on both sides the Pole, which refraction is 1″.4 less than that computed from Dr. Young's Table in the Nautical Almanac; whereas the refraction of the sun at the same altitude and temperatures is greater than that of the Tables by 16″; the solar refraction, therefore, exceeded that of a fixed star by 27 or 28 seconds at that altitude, when reduced to the same temperature. It happened fortunately that at the time of making these observations of the sun at thesea ltitudes, the weather was so fine as to enable me to obtain no less than thirty-one meridian observations of the sun with the repeating circle in thirty-nine days, in all of which (with the exception of one on the 15th March, when there was probably some error in the observation) an excess of the observed above the tabular refraction is apparent, gradually diminishing as the altitudes increased.

If the solar declinations in the French Almanac be taken for granted, this difference indeed is not quite so much, for if reduced to the same meridian, the declinations are a little less than those given in the Nautical Almanac; but by a mean of excellent observations of the sun at the time of the summer solstice, 1823, *viz.*, three of the upper limb, and three of the lower, I make the latitude of the observatory to be 69° 20′ 56″.5 N.. using the declinations given in the Connaissance des Tems, but by many meridian observations of the stars on both sides the Pole, I make the latitude 69° 21′ 0″. 62, which differ about four seconds. If the declinations be taken from the Nautical Almanac, the latitude by the sun is 69° 20′ 59″.4, which differs one second only from the observations

of the stars, I have therefore taken in preference the declinations from the Nautical Almanac for determining the solar refraction.

In Table XII. are given the results of Lieutenant Palmer's observations with the altitude Instrument, by Carey, and they are deduced by taking means of all the observations, which do not differ from each other more than three or four minutes in altitude.

As the observations with the repeating circle are so numerous as, I conceive, clearly to establish this difference between the refraction of the sun and that of a fixed star, yet it may not be superfluous, considering the importance of the subject, as connected with the determination of the obliquity of the ecliptic, to procure as much additional confirmation as possible to this fact. It has been observed, since the great improvement of instruments of late years, by many astronomers who have been in the habit of making astronomical observations at the time of the summer and winter solstices, in order to determine the obliquity of the ecliptic, that they have obtained different results from the summer and winter observations, the obliquity appearing about nine or ten seconds greater in summer than in the winter observations; this has been ascribed to some temporary expansion which periodically affected the instrument in similar situations of the sun. It has also been suggested by M. Piazzi, and very lately by Dr. Brinkley, that it possibly may arise from some peculiar modification of the refraction of the sun's rays, which may differ from those of a fixed star The truth of this latter suggestion of these celebrated astronomers, the observations made during the late voyage to the Arctic Regions, will, I trust, fully demonstrate, and also that the solar rays are the most refrangible of the two.

With respect to the observations made by the officers of both ships, during the last winter, I shall compare the observations upon the sun, made by Lieutenant Palmer with the altitude instrument, with those upon the fixed stars, by the other officers with their sextants; since they were all made nearly at the same height above the level of the sea. With respect also to observations made with sextants at very low temperatures, I have before mentioned that they are subject to very considerable errors, therefore we can only expect any thing like an accurate result but from a multitude of observations, and, what is of far more consequence, that they should be made by many observers with different instruments. At very low altitudes, indeed, this difference is very evident without including many observations together. For instance, the lowest altitudes at which a fixed star was observed during the voyage were taken on the 10th March, 1823, by Mr. Ross, at a temperature of 28 degrees below zero; from which

it appears, that by a mean of seven observations at the apparent altitude of 29′ 25″, the observed refraction of Sirius was 3′ 54″.2, greater than that computed from the Tables. Now, there is not at this temperature an observation upon the sun at exactly the same altitude, but on the 23d January (the temperature being the same) there is one of the lower limb at an apparent altitude of 28′ 22″, which is a little less, and also one of the upper limb at an apparent altitude of 30′ 0″, which is a little greater, by which the observed refraction, by the lower limb is 17′ 22″, and that by the upper limb 15′ 46″ greater than that computed from the Tables, and by a mean of the observations of both limbs, the solar refraction, therefore, exceeded that of the star at the same altitude and temperature by 12 or 13 minutes, a quantity much too great to be an error of observation.

In many observations with different instruments by persons of different degrees of experience in observation, it is difficult to assign such a result from the observations, which, when every circumstance connected with them be taken into consideration, will in all probability be the most accurate. If we consider the authority due to each result to be proportional to the number of observations, without considering either the number of instruments employed, or the number of persons who made the observations, then the results of all the sextant observations are contained in Table III., and which are obtained by arranging them according to the altitude, and taking a mean of the results of the observations differing not more than a few minutes from each other in altitude. This method would no doubt be correct, had the number of observations of each observer been nearly equal; but the great differences between the results of the observations by different observers, clearly shew that they arise from some constant error produced by the cold upon the instruments. This is, I think, evident, not only from some of the observers constantly making the Tables more in defect than others, but because this defect does not appear in the observations to diminish, as the altitudes increase, which is contrary to the nature of the subject; and which occurs in the observations of some of the most experienced observers.

A result, however, far less exceptionable may be obtained by taking a mean between the results of each observer, instead of a general mean of all the observations together; for although this method of proceeding may appear to give a more than proper share of credit to the observations of those observers who have made but few, yet it is evident that there are other conditions to be taken into consideration besides the number of observations; such as the

number of observers, and instruments employed, and also the number of evenings in which the observations were made; for those made at different periods are to be preferred to a greater number when confined to a fewer number of times of observations, as the results clearly shew.

In Table II. are given the results of the observations of each observer, made between the altitudes of 4 and 5 degrees, which are selected as they principally consist of observations upon Sirius when on or near the meridian, and therefore, were made under somewhat more favourable circumstances than the rest; and also for the sake of comparison with my own meridian observations upon Sirius, with the repeating circle at the same altitude. It appears upon the whole, by seven hundred and ninety-seven observations, made by eight different observers with sextants, at the height of about fourteen feet above the frozen sea, that at the apparent altitude of 4° 22′ 54″, thermometer −33°.2, bar. 29.87, the refraction is 13′ 39″.4, whereas by my own observations the refraction is 7″.7 less; which is as near an agreement as could be expected, considering the great differences between the results of the sextant observations.

The rapid increase in the refraction as the altitudes diminish is very remarkable; and, in consequence, the great distortions of the sun's disc when near the horizon are very great, the lower limb appearing perfectly flat, and the upper part of an elliptical shape, but of a jagged and broken appearance, having over it often a kind of tuft or crown, detached from that which would appear under usual circumstances to be the upper limb; but from its resemblance in other respects to part of the disc, so much uncertainty was introduced in making the contact with the horizontal wire of the instruments, that the observations made when this was the case are not registered. The law of variation in the refraction for altitudes near the horizon is about 12″ for one minute change in altitude, in the Tables deduced from observations made in temperate climates; whereas, in the Artic Regions, at temperatures 30 and 40 degrees below zero, the variation is no less than forty times as great, or about 8″ for one minute in the apparent altitude.

The testimony of De Veer, who wrote the particulars and who accompanied Barentz to Nova Zembla in his third voyage, where he wintered in latitude 76° N., in the year 1596-7, has been so often called in question, with respect to his account of the re-appearance of the sun, that it is but justice to state that he appears to be perfectly correct; and his observations consistent with those made during this voyage. He reports that he, in company with two others, saw the edge of the sun from the sea side, on the south side of Nova Zembla,

on the 24th of January (or 3d of February, new style) at which time the sun's declination when it passed the meridian in that longitude was about 16° 48′ S., and therefore the true meridian depression of the upper limb at noon was 2° 32′ nearly, which ought to have been the amount of the refraction that the limb might have been visible. Now, if the observation at the least apparent altitude observed on the 23d January, 1823, at Igloolik, which was 8′ 40″, be reduced to the horizon, by observing the rapid law of increase in the refraction visible in the series of observations made on that day, the horizontal refraction cannot be estimated at less than 2° 30′, and which, if increased by the apparent dip, (which sometimes amounts to more than 20′ in the winter time, as I have mentioned when speaking of the terrestrial refraction,) will be quite sufficient to render the upper limb visible: and there is still less difficulty in believing that they "saw the sunne in his full roundnesse above the horizon" three days afterwards, since the daily motion in declination at that time of the year is nearly 18 minutes to the northward.

M. Le Monier, from the observations made on these two days, assures us that there must have been more than 4½ degrees of refraction, and that he "could neither explain these observations, reject them as doubtful, nor suppose any error, as was done by most other astronometers." How this conclusion has been deduced from the facts related in the Journal does not appear, neither is there the least occasion to reject as doubtful the simple and honest account of the Dutchmen.

The results of the observations made with sextants which are contained in Table I., were computed by the officers who made them, excepting those made by Mr. Fyfe, which were computed by myself. The temperatures annexed to them are those shown by thermometers fixed upon poles, a few feet above the level of the frozen sea, about twenty or thirty yards from the ships. By a comparison of these thermometers with ten others, it appears that although they agreed together tolerably well at moderate temperatures, yet the temperatures registered with the observations are three degrees higher than those indicated by the mean of all of them, when the temperatures were below −20° Fahrenheit. Frequent observations upon the point of congelation of pure mercury will probably assign a more accurate determination of the errors of the registering thermometers, by which it appears, that taking the freezing point at −39° Fahrenheit, the temperatures attached to the observations should be two degrees lower than those given in the Tables; I have not, however, altered them, but have given them as they were taken by the officers themselves at the time of

observation. The temperatures attached to my own observations with the repeating circle are those determined with a thermometer freely suspended in the shade outside the observatory: the temperature in the interior was the same.

The heights of the barometer annexed to the observations are those observed with a barometer on board the Fury, which agreed, very nearly, with several mountain barometers in several comparisons: that kept on board the Hecla differed continually, and frequently very materially from the others; I have therefore substituted the observations with the barometer kept on board the Fury instead. This will cause errors of a few seconds in the computed refractions at very low altitudes, in those observations where this barometer has been used, but which will be sufficiently accurate to give an idea of the differences between the observed and computed refractions. The Table of Refractions alluded to in these observations, is that of Dr. Young's, given in the Nautical Almanac.

ON THE TERRESTRIAL REFRACTION.

THE refraction of objects nearly horizontal, in high latitudes, when the land is covered with snow, and the sea with floating ice, is subject to a very great degree of uncertainty; for it seldom happens that different parts of the horizon, appear at the same elevation or depression, and the same object is often very differently refracted within a very short space of time. In Table XIII. are given the results of the observations upon this subject, made by Lieutenant Palmer and myself, together with the circumstances connected with them, to afford the data for making those conclusions which the observations themselves may appear to warrant. During the period the ships were navigating amongst the ice, the method used for determining the apparent dip was principally by comparing the observations of the apparent altitude of the sun's lower limb, taken by reflection with the artificial horizon upon the sea ice, with the altitude of the same limb above the horizon taken in the usual way with sextants, the difference between these altitudes is the elevation or depression of the visible horizon due to the altitude above the level of the sea ice, from which it was observed on ship-board. The dip sector was occasionally used, but from the navigation during the greatest part of the voyage being close in shore, as well as the circumstance I have just mentioned of the different parts of the horizon being differently refracted, it was of little use. At the time the ships were frozen up in their winter stations, the methods employed were, by observing the zenith distance of the horizon with the repeating circle, and by comparing the mean of five or six simultaneous observations, by Lieutenant Palmer and myself, one observing the altitude over the ice horizon when it was sufficiently well defined for the purpose, and the other with the artificial horizon, each alternately; and by comparing the observed altitude of the sun's lower limb with that computed from the hour angle, declination, and latitude of the place; and also by comparing the observed meridian altitude over the sea or ice horizon, with that deduced from the latitude of the place.

The refraction of a distant terrestrial object in terms of the contained angle at the earth's centre, was determined in a way similar to that employed in

trigonometrical survey, that is, from the observed elevation or depression of two distant objects observed from each of them. To effect this an object was set up upon a distant hill, which was a pole, having upon the top of it a large hollow sphere formed of hoops of casks, and covered over with canvass; the distance of this object from the observatory, from which it was observed, was determined trigonometrically by two different bases measured upon the frozen sea.

As I was furnished with only one instrument with which these observations could be made with any great degree of accuracy, which was the repeating circle, simultaneous observations therefore at each place (as the rigid determination of the refraction requires) could not be obtained; but was done by first observing the zenith distance of the object from the observatory, near which was fixed a cask, the upper part being the same height as the centre of the circle; after this, the instrument was removed with the greatest possible expedition to the hill where the object was fixed, and from thence the depression of the upper part of the cask was observed; the circle was again removed to its former station at the observatory, and the zenith distance of the object again ascertained, and a mean between the two altitudes thus obtained, was taken for that which *would have been observed* at the same time the depression was taken.

As the height of the centre of the circle when upon the hill was less than the object at the same place, the observed depression was increased by the angle subtended by the height of the object above the centre of the circle, in order to reduce it to what it would have been, had the circle been the same height as the object, and as the elevation of the object from the observatory was less than the depression observed from the hill, their difference subtracted from the angle at the earth's centre will be twice the refraction. As the repeating circle could not frequently be conveyed to so great a distance over a rugged country covered with snow without very considerable exertion, as well as danger to the instrument, these observations, therefore, instead of being repeated, the true altitude of the distant object above the horizontal plane, at the place of observation was also deduced from the known altitudes of each station above the level of the sea, determined by the method of continued levelling from the water's edge, and corrected for the earth's curvature; the true altitude, determined in this way, agrees very nearly with that determined with the repeating circle. It was also further confirmed by observations made with three mountain barometers, two of which give the same determination;

By a mean, however, of the two first methods, the true altitude of the distant object above the horizontal plane at the observatory was found to be 2′ 25″.2; from which and the apparent zenith distances of the object, which were observed for some days both in the morning and afternoon, the refraction in terms of the contained terrestrial arc is computed. The distance between the objects was 20,612 feet, subtending at the earth's centre an angle of 3′ 23″.0. As the whole detail of these operations would far exceed the present limits I have given in Table XIV. the results of them only.

By a mean of ten observations made with the repeating circle, (each consisting of either two or three repetitions), it appears that, in April, 1823, the refraction at about 9h. A.M., was a little more than $\frac{1}{5}$th, and at 5h. P.M., at little less than $\frac{1}{11}$ of the contained arc, and a mean of the whole is exactly $\frac{1}{7}$th, the temperature being about 0° Fahrenheit, the whole space between each station (consisting of land and the frozen sea) being covered with snow. In the following July, by two excellent observations of the zenith's distances observed from each station, it was $\frac{2}{7}$th of the contained arc, the snow at that time being entirely gone from the land between the places of observations, and the temperature + 47° Fahrenheit.

The column attached to the observations exhibiting the hygrometrical state of the atmosphere at the time of observation, contains the space estimated upon the scale attached to Professor Leslie's hygrometer, through which the coloured liquid falls by reason of the cold produced from the evaporation of pure alcohol applied to the bulb with a camel's-hair brush: these results require a small correction to make an exact comparison between them, as the evaporation takes place at the reduced temperature of the wetted bulb; the temperatures, however, are so nearly equal, as to render this unnecessary for the present purpose.

I have before mentioned that the refraction of a low star observed during the winter appeared diminished when seen through the vapours which arise from those parts of the sea which are not covered with ice, and known by the name of "sea-blink." This appears to be the principal cause of those extraordinary observations and depressions of not only the distant horizon, but of objects of no considerable distance. By a constant comparison of altitudes of the sun taken with sextants in the usual way, with corresponding ones taken by reflection with the artificial horizon during the three summers' navigation in these seas, it soon became apparent, that as there was more or less ice in the way, (that is, between the place of observation and that part of the horizon to which the

sun was referred), the observed dip was less or more accordingly; but hardly ever exceeded the tabular dip, excepting during the winter-time; and it may be useful to observe, for those who are in the habit of navigating the seas during the summer time, that the general state of the horizontal refraction is such, that in determining the altitude of the sun in the usual way, by means of the visible horizon,—that at the height of about fourteen or twenty feet above the level of the sea, if there is but little ice between the observer and the horizon, then the tabular dip is nearly correct; if the sea is about one half covered with ice, then $\frac{1}{4}$th of the tabular dip should be allowed, and if the ship is *close beset* with ice as far as it can be seen towards the sun, then no dip whatever should be allowed; although this rule will not always hold good, yet it appears to be the general result of near one hundred observations. The effect upon the elevation or depression of the horizon, when seen through "sea-blink" was often observed by bringing the horizontal wire of a fixed instrument in contact with the horizon. Upon moving the instrument in azimuth it was found that the edge of the horizon was below or above the wire, according as there is more or less water between the observer and that part of the horizon to which the instrument is directed; or as the visual ray passes through a portion of the atmosphere more or less in contact with the open sea.

The remarkable distortion, as well as the inverted appearance of distant objects nearly horizontal, such as ships, distant lands, &c., have not escaped the notice of those persons who frequent these seas in the summer season. A common appearance is that of the distant confines of the visible horizon appearing like a distant high wall surrounding the ship, composed of pillars of ice closely arranged together, the intervening space appearing a valley of gradual descent from the ship, rising again towards the distant horizon. It was during a singular appearance of this kind, that the observations on the 17th July, 1823, were made by Mr. Ross and myself (given in Table XIII.) the ship at the time was closely beset with ice. It appears from four observations made at the mast-head with a dip sector, at the height of 103 feet above upper edge of the ice, that the distant horizon in different directions appeared at mean elevation of nearly 5 minutes instead of a depression of 14 or 15 minutes as given in the Table. At the height of 86 feet above the ice, the apparent altitude of the horizon was nearly 2′, the tabular dip for that height being 9′, and at the height of 3 and 5 feet its altitude was 5′ 30″, which is the same as it had at the height of 103 feet from the ice.

In the winter time very great depressions of the horizon take place, amounting to 15 or 20 minutes; the height of the eye above the level of the frozen sea being 14 feet, whereas the tabular dip for height is 3′ 14′ only.

As the refraction was diminished whenever the object was observed through a portion of the atmosphere in contact with the open sea: humidity may at first appear to be the principal cause of this; and, in order to determine this, the zenith distances given in Table XIV. were taken in the morning and afternoon, together with the state of the hygrometer at the time. These observations, however, afford rather a different result, for the zenith distances of the distant object in the morning was less than in the afternoon, when the humidity as shewn by the hygrometer was least; it appears, therefore, to arise from the great difference of temperature between the lower stratum of air and the atmosphere above it.

In the summer time, the greatest terrestrial refractions occur when the sea is entirely covered with ice in warm fine weather, and the temperature of the lower stratum of air much lower than that immediately above it In the winter time the refraction is least when there is very little ice upon the sea, the temperature of the lower stratum in this case being much higher than the atmosphere above. It appears by an experiment that, when the sea is covered with ice in the winter, there is no sensible difference between the temperatures of the atmosphere at the surface of the ice, and at the height of 400 feet above it; this was tried by means of a paper kite with an excellent register thermometer attached to it, the altitude of which was determined by two different observers at the time, at a given distance from each other, and in the same vertical plane as the kite, and from which the perpendicular height of the kite above the level of the ice was computed. This experiment was tried under favourable circumstances, at the temperature of −24° Fahrenheit. The kite was sent up and caught in coming down without the thermometer being in the least disturbed, the indices of which did not shew the slightest alteration, although carefully compared before and after the experiments and the kite remained at the same height in the air for a considerable time.

There is another circumstance which materially affects the refraction of a distant terrestrial object at low temperatures, this is the position of the sun with respect to the object observed, which appears most depressed when it is in the same direction as the sun. I cannot better exemplify this than by relating the first observation as it occured, by which this circumstance first became apparent.

On te 23d of March 1822, at the observatory in Winter Island, the thermometer being −13° Fahrenheit, the front telescope of the repeating circle was directed towards the horizon (on the frozen sea) which appeared a well defined line of ice, and the contact made with the horizontal wire, the principal level being adjusted and clamped to the vertical circle; the sun at the time was in the direction of the telescope, and the reading of the principal vernier was 355° 1′ 0″. Upon moving the instrument in azimuth, and at the same time keeping the level adjusted, the horizon appeared considerably elevated, both to the eastward and westward of the sun; and the reading of the same vernier when the telescope was directed about 30 degrees from the sun, was 355° 4′ 15″; the horizon being elevated more in this part of the horizon by the quantity 3′ 15″ than the part under the sun, and at the distance of 15 degrees from the sun by the quantity 2′ 0″.

In order to ascertain if objects were successively depressed in this way as the sun came in azimuth over them, the horizontal wire was brought in contact as before with a piece of ice situated upon the horizon, the sun at the time being about 30° in azimuth to the left of the object. The instrument was kept in this position until the sun had come exactly over the object, which was found in the same way as before to be depressed below its former position 3′ 58″; at the same time, a faint but distinct and more distant horizon appeared above, and parallel to the former, and nearly as much above the horizontal wire of the instrument, as the object observed was depressed below it. As the sun moved to the right of the object, it gradually acquired its former elevation, and came again in contact with the horizontal wire, and the distant horizon disappeared. The same thing was constantly observed during the winter, both by Lieutenant Palmer and myself, and drawings frequently made representing the different states of the horizon under these circumstances.

TABLE I.

Of the OBSERVED REFRACTIONS of STARS at LOW ALTITUDES and TEMPERATURES, determined by means of the Apparent Distances, as observed with Sextants by different Observers of high and low Stars.

NOTE.—The different observers, viz., Captain PARRY, Messrs. HOOPER, CROZIER, ROSS, BUSHNAN, and FISHER, of H. M. S. Hecla, also Lieutenant PALMER, Messrs. RICHARDS, BIRD, and FYFE, of H. M. S. Hecla, are denoted by the initials P, H, C, R, B, F, Pr, Rds, Bd, Fy, respectively; also the Table of Refractions, with which the observations are compared, is Dr. YOUNG's, given in the *Nautical Almanac*.

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1822.		° ′ ″			′ ″	′ ″	′ ″			
Feb. 19	Castor and Sirius	6 9 18	−36	29.70	10 30.9	....	0 41.7	3	F	Fine clear weather with aurora.
„ 25	„ „	6 5 44	−30	30.01	9 36.5	0 17.0	....	7	F	Clear weather
„ „	„ „	5 37 30	−30	30.01	9 21.3	1 14.6	....	3	F	
Oct. 20	α Pol. and Arcturus	2 36 12	+ 5	30.26	18 6.0	....	0 37.3	9	F	
„ „	Capella & α Orion.	10 11 11	.	..	5 44.2	0 1.9	.. .	5	F	
Nov. 12	α Pol and Arcturus	6 48 28	−24	29.40	.....	0 43.4	....	6	Pr	Hazy about α Pol.
„ 13	„ „	5 6 24	−33	30.02	11 38.8	....	0 5.6	5	Fy	
„ „	„ „	4 48 41	..	...	11 24.4	0 43.8	...	5	Fy	
„ „	„ „	3 55 14	..	...	13 27.0	0 56.0	....	5	Pr	
„ „	„ „	3 37 3	..	...	14 51 2	0 29.0	....	5	Pr	
„ 14	„ „	3 16 35	−18	30.03	14 34.1	1 28.1	....	5	Pr	Hazy weather.
„ „	„ „	3 2 13	..	...	16 18.8	0 47.2	....	4	Pr	
„ 15	„ „	5 55 52	−18	29.73	9 39.6	0 8.7	....	5	Fy	Fine clear weather, bright aurora.
„ „	„ „	5 36 27	..	...	8 35.2	1 42.4	....	5	Fy	
„ „	„ „	5 2 30	..	...	9 49.7	1 27.8	...	5	Pr	
„ „	„ „	4 43 51	..	...	10 57.1	0 56.4	....	5	Pr	
„ „	„ „	3 33 38	..	...	13 10.4	1 49.2	..	5	Fy	
„ „	„ „	3 22 49	..	...	15 29.8	....	0 0.7	5	Fy	
„ „	„ „	3 5 41	..	...	15 52.7	0 38 7	....	5	Pr	
„ „	„ „	2 52 30	..	.	17 5.1	0 21.0	....	5	Pr	
„ 16	„ „	4 52 50	−18	29.50	11 8.0	0 20 2	....	5	Fy	

TABLE I.—ON THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1822.		° ′ ″	°	″	′ ″	′ ″	′ ″			
Nov. 16	α Pol. and Arcturus	4 36 57	−13	29.50	11 17.9	0 41.5	....	5	Fy	Fine weather, with aurora.
„ 22	„ „	3 41 10	−35	29.68	15 9.0	0 2.8	....	5	Pr	
„ „	„ „	3 26 57	..	...	16 23.6	....	0 26.1	5	Pr	
„ 23	„ „	5 15 4	−36	29.84	11 28.6	.. .	0 2 0	5	Fy	Rather hazy about ✱
„ „	„ „	4 56 22	..	...	11 50.3	0 13.0	...	5	Fy	
„ „	„ „	4 21 2	..	..	13 38.4	....	0 17 0	5	Pr	
„ „	„ „	4 6 57	..	...	14 0.1	. ..	0 4 2	5	Pr	
„ „	„ „	3 16 47	..	..	16 17.0	0 25.2	.	5	Fy	
„ „	„ „	3 3 26	..	...	17 32.2	0 1.7	....	5	Fy	
„ „	„ „	2 37 53		..	19 16.0	0 22.8	....	5	Pr	
„ „	„ „	2 25 52	.	..	19 59.2	0 33.0	...	5	Pr	
Dec. 6	Capella and Rigel	3 40 15	−22	20.57	14 31.1	0 22.4	....	6	F	Hazy, light fog.
„ „	„ „	4 4 33	.	...	13 8.8	0 50.1	....	6	F	
„ 7	„ „	10 49 0	−31	29.60	5 43.0	0 2.0	. .	12	F	
„ „	α Pol. and Arcturus	2 29 54	..	...	18 33.8	1 15.4	...	4	F	
„ „	„ „	3 15 26	..	...	16 36.5	....	0 6.5	4	F	
„ 8	„ „	6 31 8	−43	29 60	10 18.0	....	0 48.8	7	P	Clear weather
„ „	„ „	6 2 33	..	..	10 44.8	....	0 37.2	7	R	
„ „	„ „	5 26 27	..	...	12 42.0	.. .	1 35.0	7	P	
„ „	„ „	5 5 47	..	...	12 16.8	....	0 30.2	7	R	
„ „	„ „	4 48 5	..	...	13 25 0	....	1 1.9	7	P	
„ „	„ „	4 26 50	..	..	13 32.8	....	0 21.2	7	R	
„ „	„ „	4 3 49	..	..	14 34.0	....	0 24.2	7	P	
„ „	„ „	3 52 46	..	...	14 31.9	0 17.8	....	5	Pr	
„ „	„ „	3 53 50	..	...	15 1.8	....	0 17.0	7	R	
„ „	„ „	3 36 58	..	...	15 18.3	0 16.9	....	5	Pr	
„ „	„ „	3 2 58	..	...	17 51.5	....	0 13.4	5	Pr	
„ „	„ „	2 50 13	..	...	18 41.1	....	0 8.0	5	Pr	
„ 9	„ „	7 17 13	−43	29.63	9 5.0	....	0 32.2	7	P	Hazy about ✱
„ „	„ „	6 59 51	..	...	9 29.0	....	0 35.4	7	P	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Therm. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1822.		° ′ ″	°		′ ″	′ ″	′ ″			
Dec. 9	α Pol. and Arcturus	6 36 44	−43	29.63	10 4.0	...	0 43.1	7	R	Hazy about ✱
,, ,,	,, ,,	6 19 11	..	...	10 35.0	....	0 44.8	7	R	
,, ,,	,, ,,	5 57 51	..	...	11 9	....	0 53.1	7	P	
,, ,,	,, ,,	5 40 32	..	...	11 22	....	0 38.8	7	P	Fine and clear.
,, ,,	,, ,,	5 23 1	..	..	11 46.0	....	0 30.5	7	R	
,, ,,	,, ,,	5 8 12	.	..	12 27	....	0 43.8	7	R	
,, ,,	,, ,,	4 29 29	..	...	13 53	....	0 48.7	7	P	
,, ,,	,, ,,	4 7 45	..	...	14 28	..	0 27.2	7	R	
,, ,,	,, ,,	2 4 30	..	...	20 22.5	....	0 56.5	5	P	
,, 10	,, ,,	7 25 7	−45	29 61	8 58.6	....	0 33.2	7	P	Fine clear weather.
,, ,,	,, ,,	7 9 33	..	...	9 41.6	....	1 2.0	7	P	
,, ,,	,, ,,	6 39 58	..	..	9 46.8	....	0 27.7	7	R	
,, ,,	,, ,,	6 19 51	..	...	10 49	....	1 3.0	7	R	
,, ,,	,, ,,	6 4 22	..	..	11 11.1	....	1 3.9	7	P	
,, ,,	,, ,,	5 49 29	.	...	11 35.3	....	1 3.6	7	P	
,, ,,	,, ,,	5 31 53	..	...	12 5	....	1 5.5	7	R	
,, ,,	,, ,,	5 14 45	..	..	12 37	....	1 4 8	7	R	
,, ,,	Capella and Rigel	7 59 2	..	..	6 46.1	1 3.7	....	10	F	
,, ,,	,, ,,	8 18 11	.	...	6 29	1 13.0	....	10	F	
,, ,,	,, ,,	9 57 55	..	...	5 40.3	0 40.6	....	15	F	
,, ,,	α Pol. and Arcturus	2 42 17	..	...	22 5	....	2 45.4	5	F	
,, ,,	,, ,,	2 57 22	..	...	17 4.1	1 0.6	...	5	F	
,, ,,	,, ,,	3 13 46	.	...	16 46.2	0 10.5	...	5	F	
,, ,,	,, ,,	1 55 28	..	...	25 20.2	....	1 38.9	5	F	
,, ,,	,, ,,	2 7 46		...	24 18.2	....	1 57.2	4	F	
,, ,,	,, ,,	2 19 26	..	...	23 13.7	....	2 5.3	4	F	
,, ,,	,, ,,	2 29 53	..	...	21 38.6	....	1 19.7	4	F	
,, 11	,, ,,	3 13 52	−43	29.71	16 56.4	.. .	0 1.3	5	Pr	
,, ,,	,, ,,	3 3 10	..	.	17 19.8	0 19.4	....	5	Pr	
,, 12	,, ,,	6 41 24	−40	29.72	10 17.7	....	1 3.9	7	P	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1822.		° ′ ″	°		′ ″	′ ″	′ ″			
Dec. 12	α Pol. and Arcturus	6 21 9	−40	29.72	10 10.6	....	0 29.2	7	P	Fine clear evening
,, ,,	,, ,,	5 38 19	..	...	11 44.0	....	0 57.2	..	R	
,, ,,	,, ,,	5 13 30	..	...	12 30.0	....	0 49	..	R	
,, 17	,, ,,	6 25 53	−35	29.60	10 35 6	....	1 8.7	..	R	
,, ,,	,, ,,	5 16 48	..	.	12 18 3	...	1 3.1	..	P	
,, ,,	,, ,,	4 50 14	..	...	12 33.6	....	0 25.4	..	R	
,, ,,	Capella & Regulus	4 4 50	..	.	14 19.6	...	0 20.6	.	B	
,, ,,	,, ,,	5 28 0	..	.	11 19.4	....	0 10.4	..	B	
,, ,,	,, ,,	6 29 44	.	...	7 55.5	1 4.2	....	..	B	
,, 18	α Pol. and Arcturus	5 4 38	−33	30.00	12 15.0	...	0 33.8	..	P	Fine clear weather.
,, ,,	,, ,,	4 48 38	..	.	12 44.0	....	0 27.8	..	P	
,, ,,	,, ,,	4 19 25		..	13 36.6	...	0 19.3	..	R	
,, ,,	,, ,,	4 7 20		..	14 1.6	....	0 12.5	..	R	
,, 19	,, ,,	5 8 25.1	−33	30 05	12 22.1	...	0 43.7	..	P	
,, ,,	,, ,,	4 48 44	.	...	12 59.2	....	0 42.9	..	P	
,, ,,	,, ,,	4 32 20	..	.	13 38.9	....	0 45.0	..	P	
,, ,,	,, ,,	4 8 33	..	...	14 29.6	....	0 38.7	..	R	
,, ,,	,, ,,	3 53 36	..	...	15 15.6	....	0 28.9	..	R	
,, ,,	,, ,,	3 37 30	..	...	16 3.6	..	0 2.0	..	R	
,, ,,	Capella & Regulus	4 40 24	..	...	12 51.7	0 28.2	....	5	B	
,, 29	α Pol. and Arcturus	6 39 44	−41	29.75	11 2.3	....	1 45.5	..	P	
,, ,,	,, ,,	6 18 35	.	...	11 0	...	1 14.3	.	P	
,, ,,	,, ,,	6 2 54	..	...	11 18	....	1 9.2	..	P	
,, ,,	,, ,,	5 40 39	.	...	11 32.7	....	0 49.5	..	R	
,, ,,	,, ,,	5 25 52	..	...	12 8.3	...	1 0.2	..	R	
,, ,,	,, ,,	5 11 17	..	...	12 51 7	....	1 14.2	..	R	
,, ,,	,, ,,	4 55 20	..	...	13 6.0	....	0 55.9	..	P	
,, ,,	,, ,,	4 42 54	..	...	13 47	...	1 11.9	..	P	
,, ,,	,, ,,	4 31 49	..	..	14 27	....	0 28 0	..	P	
,, ,,	,, ,,	4 15 5	..	...	14 48.7	....	1 8.0	..	R	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1822.		° ′ ″	°		′ ″		′ ″			
Dec. 29	α Pol. and Arcturus	4 2 5	−41	29.75	15 23.3	....	1 6.8	7	R	Fine clear evening
,, ,,	,, ,,	3 49 20	..	...	16 6.1	....	1 1.1	7	R	
,, ,,	,, ,,	3 42 5	..	...	16 44	....	1 21.6	7	P	
,, ,,	,, ,,	3 23 20	..	...	17 24	....	1 20.4	7	P	
,, ,,	,, ,,	3 12 18	..	...	18 28	....	1 16.9	7	P	
,, ,,	,, ,,	3 0 53	..	...	19 9.1	....	1 7.5	7	R	
,, ,,	,, ,,	2 50 49	.	..	19 55.4	....	1 20.2	7	R	
,, ,,	,, ,,	2 41 48	.	...	20 49.7	.	1 24.6	7	R	
,, ,,	,, ,,	2 31 18	..	...	21 58	....	1 41.0	7	P	
,, ,,	,, ,,	2 17 51	..	...	22 33	....	1 10.0	7	P	
,, ,,	,, ,,	2 12 6	..	..	24 8.2	....	2 29.8	6	P	
,, 30	,, ,,	6 47 58	−40	29.65	10 38	....	2 34.4	7	P	Rather hazy weather.
,, ,,	,, ,,	6 33 4	..	...	10 43.0	....	1 18.5	..	P	
,, ,,	,, ,,	6 17 50	.	...	10 30	...	0 36.6	..	P	
,, ,,	,, ,,	5 56 51	..	...	10 53 9	...	0 39.6	..	R	
,, ,,	,, ,,	5 42 10	.	...	11 32.5	...	0 54.2	.	R	
,, ,,	,, ,,	5 28 27	..	...	12 16.8	....	1 15.8	..	R	
,, ,,	,, ,,	5 8 11	..	..	12 41.0	...	1 1.7	.	P	
,, ,,	,, ,,	4 57 44	..	...	13 4.0	....	1 4.7	..	P	
,, ,,	,, ,,	4 44 22	..	...	13 40	...	1 11.0	..	P	
,, ,,	,, ,,	4 28 12	..	...	14 27.4	....	. 23.4	..	R	
,, ,,	,, ,,	4 16 59	..	...	15 11.8	....	1 40.5	..	R	
,, ,,	,, ,,	4 5 33	..	...	16 3.2	....	2 0.9	..	R	
,, ,,	,, ,,	3 47 23	..	...	16 23	...	1 18.7	..	P	
,, ,,	,, ,,	3 35 3	..	...	16 57	....	1 13.1	..	P	
,, ,,	,, ,,	3 20 54	..	...	17 42	....	1 10 6	..	P	
,, ,,	,, ,,	3 4 20	.	...	18 39.7	...	1 15.2	..	R	
,, ,,	,, ,,	2 52 28	..	...	19 41.8	...	1 22.3	..	R	
,, ,,	,, ,,	2 39 56	..	..	20 34.7	....	1 10.6	..	R	
,, ,,	,, ,,	2 25 37	..	...	22 25.0	....	1 57.5	..	P	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS.
1822.		° ′ ″	°		′ ″	′ ′	′ ″			
Dec. 30	α Pol. and Arcturus	2 17 27	−40	29.65	23 28	....	2 5.4	7	P	Clear weather.
" "	" "	2 9 53	..	...	24 17	....	2 16.1	7	P	
" "	" "	2 0 21	..	...	25 46.8	....	2 43.6	7	R	
" "	" "	1 48 58	..	...	26 46.1	....	2 32.8	7	R	
" "	" "	1 39 59	..	...	27 47.5	....	2 29.5	7	R	
" "	Capella and Rigel	7 17 19	..	...	8 6.7	0 22.1	...	20	F	
" 31	α Pol. and Arcturus	5 27 38	−40	29.75	11 52.0	....*	0 51.3	5	H	
" "	" "	5 7 33	..	...	12 16	....	0 37.3	5	H	
" "	" "	4 50 59	..	..	12 52.1	....	0 45.3	7	R	
" "	" "	4 39 27	..	...	13 36.8	....	0 55.8	7	R	
" "	" "	4 23 17	.	...	15 25.0	....	2 5 5	5	H	
" "	" "	5 18 25	..	...	11 10.8	...	0 43.5	5	F	
" "	" "	4 9 0	..	...	15 45	....	1 51.8	5	H	
" "	" "	3 55 9		...	15 51.4	...	1 12.1	7	R	
" "	" "	3 45 48	..	...	16 43.5	...	1 32.9	7	R	
" "	" "	3 21 56	..	...	18 3.6	....	1 38	6	H	
" "	" "	3 4 46	..	...	20 0	....	2 28	7	R	
" "	" "	2 52 12	..	.	20 58.5	....	2 34 5	7	R	
" "	" "	2 38 14	..	..	21 54.5	....	2 12.8	4	R	
" "	" "	2 30 7	..	...	22 31 4	....	2 15.6	4	R	
" "	" "	2 23 6	..	...	23 4.4	....	2 18	5	R	
1823. Jan. 2	" "	6 7 28	−41	29.90	10 55.1	....	0 54.1	7	H	Fine clear weather.
" "	" "	5 41 38	..	...	11 43.0	....	0 59.4	7	H	
" "	" "	5 22 34	..	...	13 48.3	...	2 28.6	7	R	
" "	" "	5 7 53	..	...	14 22.6	....	2 35.8	7	R	
" "	" "	4 47 8	..	...	18 40.1	....	1 13.8	7	H	
" "	" "	4 31 24	..	...	14 31.5	....	1 30.3	7	H	
" "	" "	4 16 14	..	...	16 19.0	....	2 39.3	7	R	
" "	" "	4 4 8	..	...	17 16 2	....	3 5.1	7	R	
" "	" "	3 40 59	..	...	17 15.1	....	1 50	7	H	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1828.		° ′ ″	°		′ ″	′ ″	′ ″			
Jan. 2	Capella and Sirius	3 19 14	−43	29.86	18 34.4	....	1 50.2	7	F	Fine clear evening Sirius shining brilliantly, with the prismatic colours
" "	" "	3 29 51	..	...	17 21	....	1 11.8	7	F	
" "	" "	3 39 6	..	...	16 38.4	....	1 2.6	7	F	
" "	" "	3 49 18	..	...	15 49	....	0 41.6	9	F	
" "	" "	3 59 57	..	...	15 4.7	....	0 41.4	9	F	
" 3	α Pol. and Arcturus	6 12 34	−44	29.84	11 34	....	1 37.3	7	H	Clear weather.
" "	" "	5 56 49	..	...	12 26.4	....	2 6.5	7	H	
" "	" "	5 39 51	..	...	12 38.9	.. .	1 49.1	7	R	
" "	" "	5 27 12	..	...	13 25.9	. .	2 12.6	7	R	
" "	" "	5 1 45	..	...	14 18.5	.. .	2 19.3	7	H	
" "	" "	4 42 38	..	...	15 0.7	..	2 21 2	7	H	
" "	" "	4 25 21	..	...	16 1.6	. ..	2 41.6	7	R	
" "	" "	4 20 50	−43	...	13 12.5	0 18.4	....	10	Pr	
" "	" "	4 11 24	−44	...	16 53.8	...	2 55 0	7	R	
" "	" "	3 48 7	..	..	17 17.1	. .	2 5.4	7	H	
" "	" "	3 29 45	..	...	18 0	...	1 52.5	7	H	
" "	" "	3 24 48	−43	...	17 12	....	0 49	10	Pr	
" "	" "	3 13 33	−44	...	19 22.9	. .	2 17.1	7	R	
" "	" "	3 2 56	..	...	20 36 6	. .	2 45 4	7	R	
" "	" "	2 44 46	..	...	20 17.1	....	1 6.0	4	H	
" "	" "	2 37 23	−43	...	19 35	0 19	..	5	Pr	
" "	" "	2 31 35	−44	...	21 13.4	....	0 51.8	4	H	
" "	" "	2 21 59	..	...	25 18.9	.. .	4 9.2	7	R	
" "	" "	2 13 23	..	...	27 6.9	....	5 7.4	7	R	
" "	" "	2 3 27	..	...	24 3.2	....	1 3.6	5	Pr	
" "	" "	1 48 26	..	...	31 3.8	....	6 23.4	7	R	
" "	" "	1 35 27	..	...	32 8.4	....	5 50	4	H	
" "	" "	1 27 34	..	...	34 33.4	....	7 4	4	R	
" "	" "	1 22 7	..	...	35 14.7	....	7 1.4	4	R	
" "	" "	1 17 36	..	...	36 9.9	....	6 57.2	5	R	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1828.		° ′ ″	°		′ ″	′ ″	′ ″			
Jan. 4	α Pol. and Arcturus	5 13 24	−41	29.75	12 52.4	....	1 22.9	5	H	Fine clear evening.
” ”	” ”	4 59 57	..	...	13 49.4	....	1 53.6	5	H	
” ”	” ”	4 46 22	..	...	14 27.4	....	2 3.2	5	H	
” ”	” ”	4 33 27	..	...	14 54.8	....	1 59.4	7	R	
” ”	” ”	3 18 41		..	19 56.0	....	3 14.0	7	R	
” ”	” ”	3 7 22	..	...	20 48	....	3 23	7	R	
” ”	” ”	2 48 18	..	...	21 7.5	....	2 27.9	7	H	
” ”	” ”	2 31 44	.	...	22 21.1	....	2 13.8	7	H	
” ”	” ”	2 11 53		...	25 44.4	...	3 43.9	7	R	
” ”	” ”	2 2 9	.	...	26 59.1	....	4 4.3	7	R	
” ”	” ”	1 48 25		..	28 45	...	4 20 4	5	R	
” ”	” ”	1 38 46	.	...	29 51	...	4 20.9	5	R	
” ”	” ”	1 31 15		..	31 15	.	4 31.1	5	R	
” ”	” ”	1 25 7		.	32 17	....	4 47.2	6	R	
” ”	” ”	1 17 45	..	...	33 39	...	4 35 2	7	R	
” ”	” ”	1 11 35	..	...	35 38.9	...	6 0.8	7	R	
” ”	” ”	1 5 22	..	...	37 14	...	6 41.7	7	R	
” 5	” ”	4 9 40	−40	29 90	14 40	....	6 44.2	7	P	
” ”	” ”	3 57 7	..	..	15 16	....	0 38.1	7	P	
” ”	” ”	3 37 23	..	...	16 39	...	0 59.1	7	P	
” ”	” ”	3 28 31	..	...	17 17	...	1 8.7	7	P	
” ”	” ”	3 18 23	..	...	17 51	....	1 5.6	7	P	
” ”	” ”	3 8 45	..	...	18 42	....	1 38.9	7	P	
” ”	” ”	2 55 49	.	...	19 31	..	1 18.8	7	P	
” ”	” ”	2 45 38	..	...	20 18	....	1 5.7	7	P	
” 19	Capella and Sirius	4 17 5	−19	29.67	13 16.6	....	0 21.7	11	F	
” ”	Sirius	4 23 8	..	...	13 0.0	...	0 18.5	1	F	Repeating circle on meridian.
” 20	α Pol. and Arcturus	1 15 59	−22	29.83	31 19.4	....	3 37.4	..	R	
” ”	” ”	1 25 54	..	...	29 59.9	....	3 48.6	..	R	
” ”	” ”	1 35 59	..	...	28 38.9	....	3 40 3	..	R	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No of Observations	Observer	REMARKS
1823.		° ′ ″	°		′ ″	′ ″	′ ″			
Jan. 20	α Pol. and Arcturus	1 46 34	−22	29.83	27 17	...	3 36.8	7	R	Fine clear weather
" "	" "	1 58 21		..	26 4.5	..	3 43.9	7	R	
" "	" "	2 9 30	.	. .	21 48 3	.	3 31.1	7	R	
" "	" "	0 50 53	.	..	38 7 7	.	6 20.4	7	R	
" "	" "	1 4 6		. .	36 15 1		6 57.8	7	R	
" "	" "	1 17 9	..	.	31 7.1	.	6 16 9	7	R	
" "	" "	1 28 27	.		30 57.3	.	5 1.9	7	R	
" "	" "	1 12 1			28 41.2		1 29 3	7	R	
" "	" "	1 55 16	..	...	27 5.7		1 10.3	7	R	
" "	" "	1 51 0	−19	...	22 35.5		0 9 5	5	Pr	
" "	" "	2 8 58	−22	..	25 28	. .	4 5 1	7	R	
" "	" "	2 4 51	−19	.	21 23.9	0 7	..	5	Pr	
" "	" "	2 16 58	..	..	28 58?	...	0 31.4	5	Fy	
" "	" "	2 20 53	−22	. .	21 5	.	3 40.2	7	R	
" "	" "	2 27 49	−19		19 0.3	0 27 7	..	5	Pr	
" "	" "	2 28 30	.		19 51	..	0 18 4	5	Fy	
" "	" "	2 33 20	−22	. .	22 39.6	. .	3 18 1	7	R	
" "	" "	2 35 56	−19		18 52	0 4.7		5	Pr	
" "	" "	2 36 9	..	..	19 7	.	0 8.1	5	Fy	
" "	" "	2 43 17	−22	.	21 15.7	..	2 46 2	7	R	
" "	" "	2 51 57	..	.	20 18.6	...	2 30.9	7	R	
" "	" "	3 19 13	−19	...	15 3 9	0 52.5	.	5	Pr	
" "	" "	3 19 46	..	...	15 36.1	0 18.2	.	5	F	
" "	" "	3 25 45	..	..	14 54.1	0 37.6	. .	5	Pr	
" "	" "	3 26 25		...	15 32.1	....	0 2.0	5	Fy	
" 21	" "	2 22 27	−16	29.80	20 26.5	...	0 40.3	5	Pr	Fine weather
" "	" "	2 22 56	..	..	20 56	.	1 11.8	5	Fy	
" "	" "	2 34 31	.	...	19 20.8	...	0 26.8	5	Pr	
" "	" "	2 34 56	..	.	19 46	...	0 53.8	5	Fy	
" "	" "	2 59 28	..	...	17 18.5	....	0 17.1	5	Pr	

TABLE I.—ON THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1828.		° ′ ″	°	″	′ ″	′ ″	′ ″			
Jan. 21	α Pol. and Arcturus	2 59 31	−16	29.80	17 21	....	0 19.6	5	Pr	Clear weather
,, ,,	Sirius and Capella	3 7 7	.	..	16 56 8	.	0 25.3	5	Pr	
,, ,,	,, ,,	3 7 4		..	16 53	....	0 21 7	5	Pr	
,, ,,	,, ,,	4 18 41	.	..	12 18.1	0 34.4	...	10	Pr	
,, ,,	,, ,,	4 6 53			12 42.4	0 38.0	..	10	Pr	
,, ,,	,, ,,	4 7 35	..	..	13 24.6	0 3.6	...	10	Pr	
,, 22	,, ,,	4 23 18	−24	29.95	12 40	0 20.2	...	10	Pr	
,, ,,	,, ,,	4 22 16	.	...	12 39.1	0 23.9	...	10	Pr	
,, 23	α Pol. and Arcturus	1 7 27	−33½	30.24	33 42.5	....	3 46.7	5	Pr	
,, ,,	,, ,,	1 14 23	.		33 15.5		4 11.8	5	P	
,, ,,	,, ,,	1 18 55		..	30 12.5	....	2 27.9	5	P	
,, ,,	,, ,,	1 26 37	.	.	29 1.5	...	1 51.7	5	P	
,, ,,	,, ,,	1 36 15		.	27 21.5	...	1 27.8	5	P	
,, ,,	,, ,,	1 42 9	.	.	26 5.5	..	0 58.7	5	P	
,, ,,	,, ,,	1 46 10	.		25 23.5	..	0 46.4	5	P	
,, ,,	,, ,,	1 56 42	.		24 29.5	....	0 47.2	5	P	
,, ,,	,, ,,	2 8 10	.	..	23 16.5	...	1 7.9	7	P	
,, ,,	,, ,,	2 23 8	..	.	21 25.1	....	0 36.3	7	P	
,, ,,	,, ,,	2 30 56	.	.	20 5.8	0 11.0	....	7	P	
,, ,,	,, ,,	2 42 55	..	..	18 21.9	0 52.6	...	7	P	
,, ,,	,, ,,	2 52 47			17 39.4	0 36.7	....	7	P	
,, ,,	,, ,,	3 1 26	..	.	17 9.4	0 38.9	....	7	P	
,, ,,	,, ,,	1 38 30	−35	..	30 26.7	...	4 33.9	7	R	
,, ,,	,, ,,	1 50 41		...	28 25	....	4 10.7	7	R	
,, ,,	Sirius and Capella	2 3 42	..	...	27 0	....	4 10.2	7	R	
,, ,,	,, ,,	2 18 13		...	24 58.5	...	3 36.4	7	R	
,, ,,	,, ,,	2 30 50	..	...	23 9.9	....	2 52.2	7	R	
,, ,,	,, ,,	2 41 59	..	...	21 44.3	....	2 21.0	7	R	
,, ,,	,, ,,	2 53 17	..	..	20 39.6	....	2 11.5	7	R	
,, ,,	,, ,,	3 4 53	..	...	19 47	....	2 7.1	7	R	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1823.		° ′ ″	°		′ ″	′ ″	′ ″			
Jan. 25	α Pol. and Arcturus	2 10 17	−23	30.48	23 11.6	. .	1 34.1	5	P	
,, ,,	,, ,,	2 21 5	.		22 46.8	.	2 13.4	4	P	
,, ,,	,, ,,	3 12 48			16 48.4		0 7 1	5	P	
,, ,,	,, ,,	3 25 22			16 26.0		0 28.5	5	P	
,, ,,	,, ,,	3 35 18			15 42.7		0 13 1	7	P	
,, ,,	,, ,,	3 18 12			14 58.0		0 8 6	7	P	
,, ,,	,, ,,	3 58 43		29 75	14 35.9		0 26 8	7	P	
,,	,, ,,	4 9 31			14 7		0 28 9	7	P	
,, ,,	,, ,,	4 23 11			13 28		0 17 7	7	P	
,, ,,	,, ,,	4 34 10	.	.	12 58		0 17 0	7	P	
,, ,,	,, ,,	4 44 13			12 29 1		0 6 4	7	P	
,, 29	Rigel	12 18 57	−14	29.29	4 49.3	.	0 0 7	1	F	Repeating circle on Meridian
,, ,,	Sirius and Capella	4 22 33		...	11 57 2	0 39 1	...	10	P	
,, 30	,, ,,	4 21 31	−21	29.53	12 31.9	0 12 7		10	F	
,, 31	,, ,,	2 32 17	−21	29.82	19 23		0 26.1	10	Fy	
,, ,,	,, ,,	2 51 20		.	18 6.5		0 31.8	5	Pr	
,, ,,	,, ,,	3 1 52			17 11.0		0 22	5	Pr	
,, ,,	,, ,,	3 14 14			16 5		0 0 5	5	Fy	
,, ,,	,, ,,	3 21 9		.	15 40 8	0 14.6	....	1	F	Repeating circle East of Meridian.
,, ,,	,, ,,	3 21 12			15 51.1	....	0 22.1	5	Pr	
,, ,,	,, ,,	4 22 28		. .	11 56 1	0 51.2	.	10	Pr	
,, ,,	,, ,,	4 22 23	.		12 55.4	.	0 3.9		F	Repeating circle on Meridian.
,, ,,	,, ,,	4 20 16	..	.	11 47	0 58.4	.	10	Fy	
Feb. 5	,, ,,	0 40 55	−10	30.26	35 42.6		3 11.8	2	Pr	
,, ,,	,, ,,	0 45 57	.		35 1.0	....	3 19.6	5	Fy	
,, ,,	,, ,,	1 2 54	..	..	29 38.5	.	0 31.6	5	B	
,, ,,	,, ,,	1 15 0	..	..	28 31.2	.	1 25.6	5	P	
,, ,,	,, ,,	1 23 6	..	.	25 57	....	0 5.8	5	Fy	
,, ,,	,, ,,	1 26 25	..	.	25 56.7		0 26.7	5	Pr	
,, ,,	,, ,,	1 43 18	.		23 30	...	0 3.2	5	Fy	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1828.		° ′ ″	°	″	′ ″	′ ″	′ ″			
Feb. 5	Capella and Sirius	1 34 47	−10	30.26	23 15	1 16	...	5	G	Clear weather.
,, ,,	,, ,,	1 43 18		...	23 30		0 3.2	5	Fy	
,, ,,	,, ,,	1 56 29	..	...	22 9.4	...	1.3	5	Pr	
,, ,,	,, ,,	1 57 12	.	...	20 47.5	1 21 3	....	5	B	
,, ,,	,, ,,	2 6 12	− 8	.	21 27.8	...	0 20.2	5	Pr	
,, 8	,, ,,	2 12 20		..	19 11.1	0 58.3	....	5	C	
,, ,,	,, ,,	2 19 51	..	...	20 8	...	0 7.2	5	Fy	
,, ,,	,, ,,	2 29 6	−10	..	18 6.5	1 8.6	...	5	B	
,, ,,	,, ,,	2 35 31.3	−13	.	18 1.3	0 51 6	..	5	F	Repeating circle, * in faint aurora.
,, ,,	,, ,,	2 43 53	−10	.	17 11.5	0 55.3	...	5	C	
,, ,,	,, ,,	3 7 41	− 8		16 19	0 7.8	....	10	Fy	
,, ,,	,, ,,	3 8 21	.	. .	16 48.2	.. .	0 24.9	10	Pr	
,, ,,	,, ,,	3 10 36	−10	...	14 45.5	1 36.5	..	5	C	
,, ,,	,, ,,	3 16 35	−13	. .	15 33.1	0 27.7	..	1	F	Repeating circle.
,, ,,	,, ,,	3 25 6	−10	. .	14 22.5	1 5.5	.	5	B	
,, ,,	,, ,,	3 36 9	..	.	13 31.9	1 25.4	.	5	C	
,, ,,	,, ,,	3 44 48		...	13 35.5	0 51	.	5	B	
,, ,,	,, ,,	3 52 45	.	..	13 16.5	0 51.8	....	5	C	
,, ,,	,, ,,	4 10 42	− 8	...	13 18.5	.	0 8.1	10	P	
,, ,,	,, ,,	4 10 56.3	−13	...	13 21.3		0 10.3	1	F	Repeating circle
,, ,,	,, ,,	4 22 50.3	..	..	12 48 7	..	0 2.6	1	F	Ditto, * in bright aurora.
,, 10	,, ,,	1 49 25	−30	30.17	26 13.5	....	2 13	7	R	
,, ,,	,, ,,	1 58 28	−29	...	25 13	... .	2 22.4	6	Pr	
,, ,,	,, ,,	2 2 30	−30	.	24 55.2	....	2 19.9	7	R	
,, ,,	,, ,,	2 16 13	.	..	23 41	... .	2 29	7	R	
,, ,,	,, ,,	2 20 6	−29	...	.....	....	1 25.5	7	Fy	
,, ,,	,, ,,	2 31 51	−30	. .	21 56.8	....	2 2.1	7	R	
,, ,,	,, ,,	2 44 22	..	...	20 45.6	....	1 52.9	7	R	
,, ,,	,, ,,	2 59 18	..	...	19 43.9	....	1 57.7	7	R	
,, ,,	,, ,,	3 1 0	−29	...	18 24	....	0 46.7	7	Fy	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued*

DATE	Stars observed	Apparent Altitude	Therm (Farht)	Barom	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1823		° ′ ″	°				′ ″			
Feb 10	Capella and Sirius	3 9 7	−30	30 17	18 2 6		0 40 1	7	Pr	
,, ,,		3 8 58			18 40		1 32 2	7	R	
		3 18 28			18 9 6		1 31 8	7	R	
,,		3 28 10			17 35 2		1 38 2	7	R	
,, ,,		3 38 4			16 52		1 5 7	7	R	
,,		3 42 47			15 27 3		0 28 3	7	Pr	
,, ,,		3 45 38			15 55 6		0 58 8	7	R	
,, ,,		3 51 56			15 24 2		0 37	7	R	
,, 16		2 35 5	−41	29 32	20 40 5		0 59 0	7	Pr	
,,		2 41 35			18 24 4	0 11 2		7	Fy	
,, ,,		3 11 30			16 13 7	0 12 8		7	Pr	
,, ,,		3 11 41			16 57		0 1	7	Fy	
,,		3 19 44	−45		15 1 8		0 5 5	1	F	Repeating circle (rather hazy)
,, ,,		4 0 19			14 56 5		0 13 2	1	F	Ditto
		4 9 8			14 18 2		0 51 0	1	F	Ditto
,,		4 9 59	41		13 51 4		0 11 2	7	Pr	
,, ,,		4 19 12	−45		14 13 0		0 58 2	1	F	Repeating circle (on meridian)
,, 18	,,	1 5 25	−44	29 73	24 53 6		1 16 8	7	Pr	
,, ,,	,,	1 56 16			24 10		1 56 8	7	Fy	
,, ,,	,, ,,	2 32 13			20 53 3		1 6 8	7	Pr	
,, ,,		2 39 52			19 14		0 31 8	7	Fy	
,, ,,	,,	3 3 15			17 30 4		0 13 5	7	Pr	
,,	,, ,,	3 3 10			16 51 5	0 27 7		7	Fy	
,, ,,	,,	3 19 16	−39		16 12 3	0 19 8		1	F	Rep circle (rather hazy about stars)
,, ,,	,,	3 41 1			15 27		0 10 2	1	F	
,, 19	,, ,,	4 5 0	−31		14 29 8		0 37 1	7	Pr	
,, ,,	,, ,,	4 5 0			14 29		0 36 8	7	Fy	
,, 20	,, ,,	4 7 20	−39		13 58 1		0 4 2	1	F	Repeating circle
,, ,,	,, ,,	4 18 36			13 38 3		0 13 2	1	F	Ditto
,, ,,	,, ,,	4 22 54			13 47.3		0 24 5	1	F	Ditto (on meridian)

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1822.		° ′ ″	°		′ ″		′ ″			
Feb. 19	Capella and Sirius	1 57 18	−35	29.79	23 49.8	....	0 42.8	7	Pr	
,, ,,	,, ,,	1 57 24	..	...	24 1	...	0 53	7	Fy	
,, ,,	,, ,,	3 0 55	..	..	18 34.7	....	0 58.1	7	Pr	
,, ,,	,, ,,	3 0 49	..	.	18 32	...	0 55.2	7	Fy	
,, ,,	,, ,,	4 7 33		..	14 3.3	....	0 15.2	10	Pr	
,, ,,	,, ,,	4 7 16	.	...	13 45	0 7.3	....	10	Fy	
,, 21	,, ,,	3 1 13	−21	29.51	16 58.5	....	0 3.8	7	Pr	Clear weather
,, ,,	,, ,,	3 1 28	..	...	17 1	...	0 7.0	7	Fy	
,, ,,	,, ,,	4 0 18	.	...	13 1.1	0 9.6	....	7	Pr	
,, ,,	,, ,,	4 10 29	.	.	13 12	...	0 1 3	7	Fy	
,, ,,	Sirius.	4 23 5	−23	...	13 9.2	...	0 26.4	1	F	Rep. circle (meridian observation).
,, ,,	Rigel .	12 18 8	.	29.65	4 57.3		0 1 6	1	F	Ditto ditto
,, 21	α Pol. and Arcturus	3 41 32	..	.	18 11.7	..	3 6 0	7	P	
,, ,,	,, ,,	3 41 17		..	13 20.4	.	0 57.4	7	P	
,, ,,	,, ,,	5 1 32		..	12 34.7	.	0 47.7	7	P	
,, ,,	,, ,,	5 14 57	.	..	4 31.1	...	0 13.3	7	P	
,, ,,	,, ,,	3 3 30	..	.	17 36.5	...	0 24	7	Pr	
,, ,,	,, ,,	3 3 [illegible]		...	17 11	....	0 [illegible]0	7	F	
,, ,,	,, ,,	5 30 7	..	..	10 51.6	0 2.8	....	7	P	
,, ,,	,, ,,	5 43 33	..	...	10 12.0	0 39.3	....	7	P	
,, ,,	,, ,,	5 57 4	.	...	9 33.6	0 25 6	...	7	P	
,, ,,	,, ,,	3 48 2	..	...	14 47	0 1.3	....	5	Bd	
,, ,,	,, ,,	3 49 0	..	..	15 42.1	....	0 46.4	5	Rds	
,, ,,	,, ,,	4 9 22		...	14 0.6	.	0 13	7	Pr	
,, ,,	,, ,,	4 9 7	..	...	13 44	0 4	....	7	Fy	
,, ,,	,, ,,	4 21 59	..	...	13 34.8	....	0 17 9	1	F	Repeating circle (meridian observation). Light clouds and calm weather.
,, ,,	,, ,,	4 23 17	..	...	12 44.3	0 22.3	....	7	Bl	
,, ,,	,, ,,	4 24 21	..	...	13 58.4	....	0 46.3	7	Rds	
,, ,,	Rigel. . . .	12 18 19	..	...	5 [illegible].6	0 1.3	....	..	,,	Rep. circle (meridian observation).
,, 27	α Pol. and Arcturus	3 33 49	−40	30.00	16 37[illegible]	....	0 38.8	5	P	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1823		° ′ ″	°		′ ″	′ ″	′ ″			
Feb 27	α Pol. and Arcturus	8 51 4	−40	30.00	15 53.1	....	1 48.6	7	P	Fine clear evening
,, ,,	,, ,,	3 56 32	..	..	15 9.4	....	0 31.1	7	P	
,, ,,	,, ,,	4 8 14	..	...	14 25	....	0 23.8	7	P	
,, ,,	,, ,,	4 18 11	..	...	13 41	....	0 5.3	7	P	
,, ,,	,, ,,	4 28 21	..	...	13 6	0 5.8	....	7	P	
,, ,,	,, ,,	4 35 23	.	..	12 30.3	0 24.8	....	7	P	
,, ,,	,, ,,	4 45 56	.	.	11 54	0 37.7	..	7	P	
,, ,,	,, ,,	4 56 16	..	...	11 0.7	1 13.4	....	7	P	
,, ,,	Rigel . .	12 18 27	−43	...	5 9.5	0 2.8	....	1	F	Repeating circle (on meridian)
,, ,,	Sirius and Capella	3 0 49	−38	...	18 3.2	.	0 12.4	7	Pr	
,, ,,	,, ,,	3 41 54	..		16 54.5	....	1 30.3	7	Bd	
,, ,,	,, ,,	3 39 15	..	...	14 32.9	0 53.7	....	7	Rds	
,, ,,	,, ,,	4 5 38	..	...	14 28.2	....	0 23.9	7	Pr	
,, ,,	,, ,,	4 23 21	..	...	13 21.6	0 8.1	...	7	Bd	
,, ,,	,, ,,	4 22 51	.	...	13 20.4	...	0 0	7	Rds	
,, ,,	Sirius . . .	4 23 31	.	...	11 10.7	..	0 41.1	1	F	Repeating circle (on meridian)
,, 28	Sirius and Capella	3 32 28	−37	29.93	16 45	...	0 52.8	5	P	
,, ,,	,, ,,	3 7 47	−36	..	18 5.9	.	0 23.3	7	Pr	
,, ,,	,, ,,	3 2 18	..	...	18 29	....	0 49	7	Fy	
,, ,,	,, ,,	3 46 5	..	...	15 35.8	..	0 33.6	7	B	
,, ,,	,, ,,	3 46 16	.	. .	15 54	....	0 49.8	7	Rds	
,, ,,	,, ,,	4 4 26	..	...	15 30	....	1 26.8	7	Fy	
,, ,,	,, ,,	4 3 51	..	...	14 53.2	....	0 49.3	7	Pr	
,, ,,	,, ,,	4 18 41	..	...	12 41.2	0 40.8	....	7	Bd	
,, ,,	,, ,,	4 18 27	..	...	13 2.3	0 23.0	..	7	Rds	
,, ,,	,, ,,	4 24 43	..	...	14 21.6	....	1 9.8	3	Rds	
Mar. 3	,, ,,	4 17 14	−36	30.02	13 40.9	....	0 10.6	7	Pr	
,, ,,	,, ,,	4 16 34	..	...	13 1.0	0 31.6	....	7	Fy	
,, ,,	,, ,,	4 20 45	..		13 37.7	....	0 16.1	7	Pr	
,, ,,	,, ,,	4 20 0	..	...	12 53.0	0 29.7	....	7	Fy	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr (Farht.)	Barom	Observed Refraction	Tables in Excess	Tables in Defect	No of Observations	Observer	REMARKS
1828			°		′ ″	′ ″	′ ″			
Mar 8	Sirius and Capella	1 24 6	−36	30 00	18 36 2		0 21 5	7	Bd	
,, ,,	,, ,,	1 23 21			18 5 2	0 10 6		6	Rds	
,, ,,	,, ,,	1 21 50			14 50 4		1 31 5	6	Rds	
,, ,,	,, ,,	1 21 25			14 25 9		1 5 2	7	Bd	
,, 4	,,	4 21 19	−35	30 10	12 57	0 4 1		7	Fy	
,, ,,	,, ,,	1 22 38			13 43 7		0 25 3	7	Pr	
,, ,,	,, ,,	1 22 59			12 54	0 3 9		7	Fy	
(Feb. 28)	,, ,,	2 20 30	−37	29 95	22 49		1 49	7	R	
,, ,,	,, ,,	2 31 54			20 5 8		1 0 7	7	R	
,, ,,	,, ,,	2 10 38			19 23		0 13	7	R	
Mar 7	,, ,,	4 21 55	−27	30 11	13 1 6	0 1 6		7	Pr	
,, ,,	,, ,,	4 21 38			12 50	0 17 3		7	Fy	
,, ,,	,, ,,	1 23 11			18 8 6		0 4 9	7	Pr	
,, ,,	,,	1 22 37			12 30	0 35 3		7	Fy	
,,	,,	1 21 41			13 9 6		0 1 8	7	Bl	
,,	,, ,,	1 20 23	−28		14 3 1		0 48 3	7	R	
,, ,,	,,	4 17 19		.	13 2 1	0 20 3		10	C	
,,	,, ,,	1 17 13			14 37 2		1 25 1	7	R	
,,	,,	1 14 52			15 10 2		1 42 4	7	R	
,, ,,	,,	1 8 59			15 21 8		1 41 8	7	R	
,,	,, ,,	4 3 37			15 47 3		1 49 3	7	R	
,,	,, ,,	3 58 14			16 10 3		2 7 4	7	R	
,, ,,	,, ,,	3 49 18			14 15 7	0 31.3	....	7	C	
,,	,, ,,	3 31 29			16 47.7		1 14 8	7	R	
,, ,,	,, ,,	3 26 26			17 6 6	.	1 10 9	5	R	
,, ,,	,, ,,	3 23 45			15 12 3	0 56 8	.	5	C	
,, ,,	,, ,,	3 15 51			17 26 1		0 50.3	7	R	
,, ,,	,, ,,	3 13 26		.	18 35.5	1 5 6	....	5	C	
,, ,,	,, ,,	3 6 40	.	.	17 54.3	.	0 45 8	7	R	
,, ,,	,, ,,	2 56 40	.	.	18 3	.	0 50	7	R	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No of Observations	Observer	REMARKS
1828		° ′ ″	°		′ ″	′ ″	′ ″			
Mar. 7	Sirius and Capella	2 47 22	−28	30 11	18 0 9	0 38		5	C	
,, ,,	,, ,,	2 46 27			19 28 7		0 45 7	7	R	
,, ,,	,, ,,	2 38 15			19 18 6	0 29 5		5	C	
,, ,,	,, ,,	2 36 46			20 41 4		1 19 4	7	R	
,, ,,	,, ,,	2 28 46			21 41 7		1 15	7	R	
,, ,,	,, ,,	2 12 22			23 32		1 58 2	7	R	
,, ,,	,, ,,	2 0 0			25 14 2		2 39 8	7	R	
,, ,,	,, ,,	1 47 30			27 32 3		3 28 3	7	R	
,, ,,	,, ,,	1 18 5			31 25 3		3 24 1	7	R	
,, 10	,, ,,	4 22 51	24	29 95	12 24	0 35 7		7	Pr	
,, ,,	,, ,,	4 22 37			12 20 6	0 35 8		7	Py	
,, ,,	,, ,,	1 23 9	−27		13 16 7		0 16 9	1	Pr	Rep circle (meridian observation)
,, ,,	,, ,,	1 22 0	−24		13 53 2		0 54 3	7	Bd	
,,	,, ,,	4 7 52			13 6 4	0 26 7		6	Pr	
,, ,,	,, ,,	4 7 26			12 38 2	0 57 7		6	Py	
,, ,,	,, ,,	3 56 26			14 11 9		0 53 5	7	Bd	
,, ,,	,, ,,	2 59 46	−28		19 3 3		1 28 1	7	R	
,, ,,	,, ,,	2 45 28			19 27 6		0 48 6	7	R	
,, ,,	,, ,,	2 34 58			20 35 [illegible]		1 [illegible] 2	7	R	
,, ,,	,, ,,	2 22 23			21 45 6		1 17 2	7	R	
,, ,,	,, ,,	2 8 52			23 8		1 26 4	7	R	
,, ,,	,, ,,	1 55 53			24 58 7		1 51 1	7	R	
,, ,,	,, ,,	1 41 50			26 27 5		1 47 7	7	R	
,, ,,	,, ,,	1 27 43			28 1 2		1 27 2	7	R	
,, ,,	,, ,,	1 12 13			29 39		1 0	7	R	
,, ,,	,, ,,	0 58 49			32 4		1 18 6	7	R	
,, ,,	,, ,,	0 43 14			36 24 8		2 31.6	7	R	
,, ,,	,, ,,	0 29 25			40 29		3 54 2	7	R	
,, 11	,, ,,	4 13 50	−33	30 05	12 56.4	0 29.4	...	7	Pr	
,, ,,	,, ,,	4 13 28			12 29 6	0 56 3	..	7	Py	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1823.		° ′ ″	°		′ ″	′ ″	′ ″			
Mar. 11	Sirius and Capella	4 5 53	−33	30.00	13 22.9	0 25.1	....	7	R[d]	
" "	" "	4 5 35	..	...	13 35.2	0 18.7	....	6	R[ds]	
" "	" "	3 53 49	.	...	14 46.9	....	0 17	7	P[r]	
" "	" "	3 52 56	..	...	13 51	0 39.2	....	7	F[r]	
" "	" "	3 33 33	.	..	16 32.7	....	1 3.1	7	R[ds]	
" "	" "	3 31 54	..	...	11 54.2	0 39.4	....	7	B[d]	
" 12	" "	4 6 17	−31	29.96	14 51.2	....	0 55	7	R	
" "	" "	4 3 23	..	...	15 40.6	....	1 42.5	7	R	
" "	" "	3 59 23	.	...	15 47.2	....	1 36.1	7	R	
" "	" "	3 39 27	.	...	17 41.2	....	2 26.1	7	R	
" "	" "	3 33 57	..	..	18 9	....	2 12.5	7	R	
" "	" "	3 25 55	..	...	18 24.6	....	2 5.3	7	R	
" "	" "	2 38 58	..	...	21 2.1	....	1 46.2	7	R	
" "	" "	2 30 48	.	...	21 59.2	....	2 4.1	7	R	
" "	" "	2 22 25	..	...	22 50.2	....	2 13.7	7	R	
" "	" "	1 39 28	..	...	27 43.3	....	2 39.7	7	R	
" "	" "	1 29 45	..	...	28 41	....	2 28.6	7	R	
" "	" "	1 20 7	..	...	30 53.5	....	3 27.1	7	R	
" 18	" "	4 9 3	−20	30.65	14 30.8	....	0 50	7	R	
" "	" "	4 4 7	..	..	14 44.9	....	0 50.3	7	R	
" "	" "	3 58 49	..	...	14 58.6	....	0 49.4	7	R	
" "	" "	3 52 32	..	...	15 26.5	....	0 48.5	7	R	
" "	" "	3 45 29	..	...	15 56.8	....	1 1.8	7	R	
" "	" "	3 38 1	.	...	16 22.6	....	1 8	7	R	
" "	" "	3 28 56	..	...	16 51.6	....	1 5.6	7	R	
" "	" "	3 20 46	−24	...	17 16	....	0 53.6	1	F	Repeating circle.
" "	" "	3 20 4	20	...	17 19.7	....	1 0.2	7	R	
" "	" "	3 9 17	..	...	17 50.7	....	0 52.3	7	R	
" "	" "	3 7 34	−24	...	17 25.7	....	0 17.4	1	F	Repeating circle.
" "	" "	3 6 24	−17	...	17 5	....	0 14.2	7	P[r]	

TABLE I.—OF THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Thermr. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1823.		° ′ ″	°		′ ″		′ ″			
Mar. 18	Sirius and Capella	2 54 56	−24	30.65	18 20.3	....	0 24.2	1	F	Repeating circle.
" "	" "	2 40 17	−17	...	19 2	...	0 13.8	7	B[1]	
" "	" "	2 40 29	..	...	19 7.4	....	0 16.5	5	R[ds]	
" "	" "	2 37 2	−20	...	20 31.8	....	1 8.4	7	R	
" "	" "	2 24 41	..	...	21 49.1	....	1 29 7	7	R	
" "	" "	2 11 28	..	...	22 24 3	..	0 56.3	7	R	
" "	" "	2 4 36	..	...	22 21.1	.. .	0 29.5	7	P[r]	
" "	" "	1 58 19	..	...	23 38.4	.. .	0 54.6	7	R	
" "	" "	1 43 36	..	...	25 39.7	....	1 19.7	7	R	
" "	" "	1 35 50	−17	...	26 5	....	1 3.9	5	R[ds]	
" "	" "	1 36 0	..	..	26 15	....	1 8.6	5	B[d]	
" "	" "	1 28 54	..	..	26 54	....	0 42	7	R	
" "	" "	1 11 33	..	...	29 49.1	.. ..	1 2	7	R	
" "	" "	1 9 24	..	...	31 11	.. .	2 30.7	4	P[r]	
" "	" "	0 58 22	..	...	33 26 5	....	2 35.3	7	R	
" "	" "	0 56 41	.	...	35 47	. .	3 11.5	2	R[ds]	
" "	" "	0 45 33	.	...	37 23	. .	4 12.5	7	R	
" "	" "	0 33 45	..	...	42 14	...	7 4.7	1	R[ds]	
" "	" "	0 30 55	..	...	42 8	.. .	5 44.4	7	R	
" (12)	" "	4 13 44	−31	29.90	14 39 5	.	1 7.8	7	H	
" "	" "	4 11 19	..	...	15 22 8	....	1 45.2	7	H	
" "	" "	3 54 46	..	...	16 43 7	....	2 16.7	7	H	
" "	" "	3 49 40	..	...	17 3.4	.. .	2 15.2	7	H	
" "	" "	3 45 17	..	...	17 26.3	. .	2 27.1	7	H	
" "	" "	3 4 38	..	...	19 31 8	....	2 16.3	7	H	
" "	" "	2 56 44	..	...	19 42.2	....	1 53.9	7	H	
" "	" "	2 48 16.5	..	...	19 58.5	....	1 29	7	H	
" "	" "	2 11 18	..	...	22 58.9	....	1 25.2	7	H	
" "	" "	2 2 57	..	...	23 49.6	....	1 24.2	7	H	
" "	" "	1 53 29	..	...	24 45.7	....	1 21.5	7	H	

TABLE I.—ON THE OBSERVED REFRACTIONS OF STARS, &c.—*continued.*

DATE	Stars observed	Apparent Altitude	Therm. (Farht.)	Barom.	Observed Refraction	Tables in Excess	Tables in Defect	No. of Observations	Observer	REMARKS
1823.		° ′ ″	°		′ ″	′ ″	′ ″			
Mar. 12	Sirius and Capella	4 18 41	−8°	29.93	12 41.2	0 40.8	...	7	B[d]	
,, ,,	,, ,,	4 18 27	..	...	13 2.3	0 23.0	..	7	R[ds]	
,, ,,	,, ,,	4 24 43		...	14 21.6	. .	1 9.8	3	R[ds]	

TABLE II.

CONTAINING the MEANS of the OBSERVATIONS of each OBSERVER, principally upon the Star SIRIUS, when or near the Meridian.

Observers	No. of Observations	No. of Nights of Observation	Thermometer	Barometer	Tables in Excess	Tables in Defect	Apparent Altitudes
			°		′ ″	′ ″	° ′ ″
Captain PARRY .	166	11	−36	29 95	.....	0 26.3	4 31 46
Lieutenant PALMER	177	25	−27 5	29.88	0 4 3	.	4 14 29
Mr. HOOPER . .	41	4	−41.1	29.80	...	1 51.8	4 37 7
,, ROSS . . .	126	11	−39 6	29.72	. . .	1 22 5	4 20 25
,, RICHARDS . .	12	5	−35.3	29.97	. ...	0 22.5	4 20 10
,, BIRD . . .	56	7	−32	29.98	... ..	0 5 8	4 20 0
,, FYFE . . .	147	16	−29	29.86	0 13.4	.. ....	4 20 52
,, FISHER	42	4	−25.4	29.31	.....	0 2.4	4 15 24

TABLE III.

CONTAINING the MEAN RESULTS from the OBSERVATIONS of all the OBSERVERS when taken Collectively.

Apparent Altitude	Thermometer	Barometer	Observed Refraction	Error of the Tables	No. of Observations
0° 31′ 22″	−21°.7	30.40	0° 41′ 37″.1	Table in Defect 5′ 38″.5	15
0 43 55	16.0	30.08	0 36 7 9	„ 8 27.3	16
0 56 9	21.7	30 26	0 31 21.3	„ 3 21.2	23
1 18 15	25.1	30.09	0 31 56.4	„ 3 28.1	100
1 29 11	27.9	30.07	0 29 24.1	„ 3 7 8	96
1 42 44	30.1	30.05	0 27 31 6	„ 2 52.2	104
1 55 47	28.2	30.00	0 21 41.2	„ 1 35.8	108
2 5 13	31 0	29.96	0 24 1.2	„ 1 17.3	110
2 14 35	31 2	29.03	0 23 20 8	„ 2 1 2	110
2 24 32	28 5	29 36	0 21 30 1	„ 1 13 5	120
2 34 41	29.9	29.92	0 20 38.2	„ 1 1 6	190
2 43 52	31.9	30.01	0 19 49.1	„ 0 51 9	117
2 55 0	30.1	29.90	0 18 54.5	„ 1 1 3	107
3 4 28	30.5	29.99	0 17 53.5	„ 0 35.9	251
3 15 41	31.0	29.92	0 16 55.9	„ 0 20.0	102
3 25 17	29.2	29 99	0 16 43.4	„ 0 15.6	126
3 35 57	29.5	30.02	0 15 59.4	„ 0 59.0	121
3 45 49	33.8	29.94	0 15 53.4	„ 0 49.3	151
3 55 7	31.2	30 03	0 14 58.7	„ 0 29.5	129
4 6 29	32.2	29 89	0 14 21.6	„ 0 29 3	256
4 15 25	32.4	29.90	0 14 1.1	„ 0 31.7	161
4 22 52	30.9	29.92	0 13 21.2	„ 0 11 8	274
4 44 14	35.0	29.87	0 13 0 1	„ 0 34.7	197
5 14 6	38.1	29.76	0 12 23.3	„ 0 55.8	166
5 46 11	36.9	29.75	0 11 5.9	„ 0 36.0	108
6 13 54	39.8	29.70	0 10 31.9	„ 0 42.9	89
6 41 14	41.9	29.65	0 10 17.3	„ 1 2.0	56
7 34 29	44.0	29.62	0 8 10.2	Table in Excess 0 4.2	61
10 19 23	24.7	29.82	0 [illegible] 42.5	„ 0 14.9	32

TABLE IV.

CONTAINING THE SOLAR REFRACTIONS AT LOW ALTITUDES AND TEMPERATURES.

NOTE.—Those Observations, with the mark I against them, were made by Lieutenant PALMER, with the Altitude Instrument by CAREY, at the height of about 9 or 10 feet above the ice on the Frozen Sea; and those marked RC, were made with the Repeating Circle by TROUGHTON, at the Observatory on Igloolik, by myself, at the height of 40 feet above the level of the Sea. Latitude 69° 21′ N.

DATE 1822.	DATE Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
			°	° ′ ″	′ ″			′ ″		
Nov. 10	Noon	29.74	−12	3 29 5	15 12	L	..	0 5	I	Clear weather.
„ 11	.	29.61	−27	3 14 25	17 18	..	.....	0 8	..	Rather hazy.
„ 13	..	29.85	−22	2 44 35	20 6	..	.....	1 44	..	„
„ 15	.	29.85	−15	2 11 15	21 38	.	....	1 13		Clear weather
„ 16	.	29.50	− 9½	2 1 45	23 41	.	....	2 07	..	„
„ 18	..	29.91	14	1 34 5	25 34	..	.....	0 52	.	„
„ 22	.	29.57	26	0 49 55	35 58	..	.....	4 10	..	„
„ 23	..	29.79	32	0 44 25	43 12	.	.....	9 29	..	„
„ 25	..	29 62	32	0 26 45	49 52	..	.....	12 31	..	„
„ 28		29.50	−34	0 26 10	50 19	U	.....	12 48		„
„ 29	..	29.70	−28	0 22 30	57 2	..	.....	19 2	..	„
1823. Jan. 19	..	29.69	−10	1 3 4	31 21	..	.....	2 55	..	Hazy—Parhelion E. and W. of ⊙ 2 Observns.
„ „	.	...	−15	1 1 32.5	30 38.8	..	.....	1 35.8	RC	„ 1 Repn.
„ „	..	...	−10	0 37 26	38 17	L	.....	4 54	I	„ 2 Observns.
„ „	..	...	−15	0 35 6.4	36 15.3	..	.....	2 31	RC	„ 1 Repn.
„ „	P.M.	...	.	0 29 31.3	41 23.3	..	.....	6 23 7	..	„ 1 Repn.
„ „	.	..	..	0 21 49.5	42 47.5	..	.....	6 5.5	..	„ 1 Repn.
„ „		...	..	0 38 32	36 32	U	...	3 21	..	„ 1 Repn.
„ 20	A.M.	29.70	15	0 12 20	51 35	..	.....	13 36	I	Clear weather—Limbs jagged.
„ „	..	...	..	0 17 0	46 15	..	.....	8 23	..	„ „

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1823.	DATE Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
				° ′ ″	′ ″			′ ″		
Jan. 20	A.M.	29.70	−19	0 21 32.7	47 49	U	.....	10 48	RC	Hazy weather—Limbs jagged
" "	..	...	−15	0 26 20	44 35	..	.....	8 3	I	Clear "
" "	..	...	..	0 10 22	51 17	L	.....	11 50	..	" "
" "	..	...	..	0 13 22	49 1	..	.....	10 18	..	" "
" "	..	...	−19	0 15 15	48 7	.	.....	9 35	RC	" "
" "	..	.	−15	0 17 42	46 33	..	.....	8 51	I	" "
" "	.	...	..	0 24 22	46 31	..	.....	10 27		" "
" "	..	..	.	0 30 42	40 10	L	.....	5 28	.	Clear weather—Limbs well def^d.
" "	..	...	−19	0 30 21	39 47	..	.....	1 12	RC	Rather hazy.
" "	..	...	15	0 57 40	31 59	U	.....	2 19	I	Clear.
" "	..	...	..	0 38 42	37 39	L	.....	4 28	..	"
" "	..	...	..	1 6 20	30 18	U	.....	1 55	.	"
" "	..	...	..	0 45 2	36 57	L	.....	4 58	..	"
" "	Noon	29.76	..	1 13 28	29 1	U	.....	1 39	..	" (2 Observ^ns.)
" "	...	...	−19	1 13 35	29 40	..	.....	2 5	RC	" (2 Rep^ns.) . . {Therm. in ⊙ − 19°.
" "		...	−15	0 48 6	36 18	L	.....	4 52	I	" (2 Observ^ns.)
" "	..	...	−19	0 45 6	35 2	..	.....	2 50	RC	" (2 Rep^ns.)
" 21	A.M	29.85	18	0 48 1.4	35 57.4	U	.....	4 23.2	..	Much haze—⊙ much distorted.
" "	.	...	.	0 53 26.4	34 20.4		.....	3 43.4	..	" "
" "	..	...	..	1 8 7	31 21	..	.....	3 2.5	.	" "
" "	Noon	29.84	−16¾	0 56 40.2	32 58.2	L	.....	2 53.4	..	Clear—Limbs tolerably defined.
" "	..	...	..	1 24 58	27 47	U	.....	1 57	..	" "
" "	..	...	−18	0 57 21	32 40	L	.....	2 43	I	" "
" "	..	...	.	1 25 17	28 2	U	.....	2 8	..	" "
" 22	A.M.	29.78	−18	0 55 34.5	32 52.9	U	.....	2 41.6	RC	Limbs tolb^ly. def^d. {Therm in ⊙ − 16½°.
" "	Noon	29.79	−17	1 7 54	29 47	L	.....	1 29.5	..	"
" "	..	...	..	1 36 20	25 50.4	U	.....	1 24.7	..	"
" "	..	...	..	1 9 2	30 32	L	.....	2 22	I	"
" "	..	...	..	1 37 20	26 18	U	.....	1 55	..	"
" "	P.M.	...	..	0 48 22	35 48	L	.....	4 10	..	"

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1828.	DATE Time of Day	Barom	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
				° ′ ″	° ′ ″					
Jan. 22	P.M.	29.79	−17	0 40 22	0 37 25	L	.....	4 21	I	Limbs well def^{d}.—Clear w^{r}.
,, ,,	.	..	..	1 2 10	0 31 39	U	.....	2 27	..	,,
,, ,,	.	.	..	0 32 2	0 41 28	L	.....	6 37	..	Limbs much distort^{d}.—Cl^{r}. w^{r}.
,, ,,	.	..	.	0 51 0	0 35 9	U	.....	4 5	..	,,
,, ,,	.	.	.	0 22 52	0 47 56	L	.....	11 9	..	,,
,, ,,	.	..	..	0 39 0	0 38 36	U	.....	5 14	.	,,
,, ,,	..	.	..	0 11 2	0 56 41	L	.....	17 8	..	,,
,, ,,	..	...	..	0 22 50	0 44 49	U	.....	8 6	..	,,
,, ,,		.	.	0 22 40	0 51 18	U	.....	14 0	.	,,
,, ,,	.	.	..	0 19 20	0 58 54	U	.....	21 22	..	,,
,, 28	A.M	30.11	−28	0 8 10	1 21 19	..	.....	39 21	..	Fine clear weather—Limbs much distorted.
,, ,,	..	...		0 10 10	1 18 23	..	.....	32 0	.	,,
,, ,,	..	.		0 15 0	1 3 2	..	.....	22 51	..	,,
,, ,,	..	.	.	0 22 0	0 59 55	..	.....	21 24	..	Fine clear weather—Limbs tolerably defined.
,, ,,	..	.	−29	0 19 31	0 49 42.5	.	.....	10 11.5	RC	⊙ much dis^{d}, LL nearly flat.
,, ,,	..	.	−28	0 26 40	0 55 29	..	.....	18 6	I	Limbs tolerably defined
,, ,,	.	.	.	0 30 0	0 17 22	..	.....	15 46	..	,,
,, ,,		...	..	0 19 42	1 5 31	I	.....	26 32	..	,,
,, ,,	..	...	..	0 20 22	0 59 49	..	.....	20 53	..	,,
,, ,,	..	...	−29	0 16 18.3	0 53 55.8	..	.....	14 11.8	RC	Much distorted. (1 Rep^{n}.)
,, ,,	..	...	−28	0 41 30	0 42 50	U	.....	8 36	I	Limbs tolerably defined.
,, ,,	.	...	..	0 28 22	0 51 22	L	.....	17 22	..	,,
,, ,,	..	...	..	0 56 40	0 36 53	U	.....	5 37	..	,,
,, ,,	.	...	.	0 40 2	0 44 33	L	.....	10 6	..	,,
,, ,,	..	..	..	1 8 20	0 32 40	U	.....	3 31	..	,,
,, ,,	..	...	..	0 50 2	0 39 47	L	.....	7 21	..	,,
,, ,,	..	..	..	1 19 20	0 30 19	U	.....	2 36	..	,,
,, ,,	..	...	..	0 59 32	0 36 42	L	.....	6 3	..	,,
,, ,,	..	...	.	1 29 20	0 28 54	U	.....	2 35	..	,,
,, ,,	..	...	..	1 9 42	0 34 48	L	.....	5 38	..	,,

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1823.	Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
			°	° ′ ″	° ′ ″			′ ″		
Jan. 23	A.M.	30.11	−28	1 38 52	0 27 55	U	.....	2 54	I	Clear wr.—Limbs tolbly defd.
„ „	Noon	30.12	..	1 50 50	0 25 57	..	.....	2 16	..	„
„ „	..	...	..	1 22 42	0 39 21	L	.....	8 6	..	„
„ „	..	...	−29	1 22 38	0 31 33	..	....	4 20.2	RC	„ (2 Repns.)
„ „	..	...	..	1 50 28.3	0 26 12	U	.....	2 31	.	„ ditto.
„ 24	A.M.	30.32	−28	1 10 40	0 32 55	..	.....	4 24	I	„ Limbs well defd.
„ „	.	...	..	1 19 40	0 31 8	..	.....	3 57	..	„ „
„ „	..	...	.	1 2 2	0 36 4	L	.....	6 17	.	„ „
„ „	..	...	..	1 33 10	0 29 5	U	.....	4 5	..	„ „
„ „	.	...	.	1 12 52	0 31 54	L	.....	8 41	..	„ „
„ „	..	...	.	1 45 0	0 26 53	U	.....	3 0	.	„ „
„ „	..	..	.	1 22 2	0 31 14	L	....	4 17	..	„ „
„ „	..	...	..	1 52 40	0 25 16	U	.....	2 13	..	„ „
„ „	Noon	30.33	..	2 3 13	0 24 7	..	...	2 8	..	„ Therm. in ⊙ −26°.
„ „	.	...	.	1 31 54	0 28 20	L	...	3 10	..	„ „
„ „	..	...	−30	2 2 38.5	0 23 23.3	U	.....	0 41.5	RC	„ „
„ „	..	...	..	1 33 17	0 27 25	L	....	1 22.2	.	„ „
„ 25	A.M.	30.37		0 32 20	1 2 53	U	..	22 37	I	Fine wr.—Limbs well defd.
„ „	.	...	.	0 18 40	0 56 19	U	....	17 31	..	„ „
„ „	.	...	.	0 26 20	0 50 46	..	.....	18 46	..	„ „
„ „	..	...	..	0 17 2	1 0 19	L	....	2 11	..	„ „
„ „	..	...	..	0 39 0	0 40 20	U	.....	7 17	..	„ „
„ „	..	...	..	0 21 22	0 48 10	L	....	10 51	..	„ „
„ „	..	..	..	0 56 50	0 31 1	U	...	4 5	.	„ „
„ „	..	...	..	0 39 32	0 42 2	L	.....	8 4	..	„ „
„ „	..	...	..	2 22 20	0 21 18	☾	.....	1 12	..	The moon below the Pole near the Meridian.
„ „	..	...	..	2 20 20	0 20 47	..	....	0 32	..	Upper limb well defd.—Eq. Parallax cord for Ellipy loc.
„ „	..	...	..	2 19 20	0 21 18	..	....	0 59	..	
„ „	..	...	..	2 18 20	0 21 17	..	.....	0 54	..	
„ „	..	...	..	2 17 40	0 21 [illegible]	..	....	0 54	..	

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1828.	DATE Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
			°	° ′ ″	′ ″		′ ″	′ ″		
Jan. 25	..	30.87	−30	2 17 20	21 10	☾	.....	1 6	I	The moon below the pole near the meridian.
" "	..	...	.	2 16 50	21 30	..	.....	0 54	..	"
" "	..	...	..	2 17 0	21 50	..	.....	1 11	..	"
" "	..	..		1 46 22	24 15	☾	....	0 32	..	Hazy about moon's lower limb.
" "	..	...	.	1 17 22	24 59	.	.....	1 35	..	"
" "	.	...	.	1 48 2	25 22	..	..	1 37	.	"
" "	..	...	.	1 48 52	25 14	..	...	2 2	..	"
" "	..	..	..	1 19 22	25 12	..	.....	2 23	.	"
" "	Noon	...	−28	2 15 9	21 30	U	... .	0 15	.	Rather hazy about ⊙—2 Obs.
" "	..	...	..	1 46 36	25 29	L	.....	2 48	..	"
" "	.	.	..	2 15 4 5	21 45 2	U	...	0 50.9	RC	Hazy and foggy.
" "	..	. .	..	1 15 11.1	24 27.7	L	.....	0 29.1	.	"
" 26	..	30.52	−17½	2 2 39.3	27 1.3	..	....	4 58.1	..	Calm and cloudy.—Thermometer rose 14° last 6 hours.
" 31	A.M.	29.68	−19	0 18 42	46 21	.	....	8 31	I	Fine clear wr.—Limbs well defd.
" "	..	..	.	0 35 2	37 59	..	....	3 13	..	"
" "	..	.	..	1 12 20	30 1	U	. ...	2 12	..	"
" "	..	. .	.	0 54 42	32 10	L	.....	1 46	..	"
" "	..	...	.	1 50 50	23 17	U	....	0 24	..	"
" "	.	...	..	1 35 52	25 14	L	. ...	1 34	..	"
" "	..	...	..	2 15 20	21 9	U	... .	0 42	..	"
" "	..	...	−20	1 54 33.3	23 8.8	L	...	0 42.8	RC	Hazy wr.—Parhelion E. of ⊙
" "	..	...	−19	2 1 52	22 11	.	.....	0 26	I	"
" .	..	...	..	2 14 7	20 58	..	.....	0 29.2	RC	"
" "	..	...	..	2 50 40	18 31	U	.....	0 53	I	"
" "	..	. .	−18½	2 36 36.1	18 33.4	L	0 18	.....	RC	"
" "	..	...	−18	2 55 8.9	17 33.3	..	.....	0 15.5	..	"
" "	Noon	...	−17¾	3 11 5	15 55	..	0 19.1	....	..	"
" "		...	−16¾	3 42 2.9	14 12	U	0 18.6	.....	..	"
" "	..	...	−19	3 12 32	16 57	L	.....	0 39	I	(2 Observns.)
" "	..	...	..	3 43 45	15 40	U	.....	1 6	..	"

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1823.	DATE Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
			°	° ′ ″	′ ″		′ ″	′ ″		
Feb. 1	Noon	30.16	−16	3 58 27.6	11 4.0	U	.....	0 18.2	RC	2 Repns.—Rather cloudy
,, ,,	..	...	..	3 27 7 6	15 88	L	.....	0 10.7	.	,, ,,
,, ,,	..	...	−10	3 59 25	11 29	L	.....	0 15	I	3 Observns ,,
,, ,,		...	..	3 28 1	15 35	L	....	0 18	..	,, ,,
,, 5	A.M.	30.39	− 5	0 40 2	36 52	L	.....	1 20	..	Clear wr.—Limbs well defined.
,, ,,	..	...	..	1 5 42	31 9	L	....	2 57	.	,, ,,
,, ,,	..	...	..	1 49 10	21 26	L	.....	1 38	..	,, ,,
,, ,,	..	...	.	1 34 12	21 39	L	.....	0 14	.	,, ,,
,, ,,	..	...	..	2 17 20	20 33	U	.....	0 21	..	,, ,,
,, ,,	..	...	..	2 11 42	20 58	L	.....	0 25	..	,, ,,
,, ,,	..	...	..	3 3 10	17 .4	U	....	0 35		,, ,,
,, ,,	Noon	30.33	− 2	5 6 58	11 10	..	.....	0 35	..	,, ,, 3 Observns.
,, ,,	..	...	..	4 35 25	12 35	L	.....	0 30	..	,, ,, ,,
,, ,,	..	...	+ 1	5 5 33.5	11 6.1	U	.....	0 6.7	RC	2 Repns.—Calm and cloudy.
,, ,,	..	....	..	4 31 10.9	11 53.0	L	0 6 8	....	..	,, ,,
,, 6	..	30.06	− 9	1 50 11	11 32.9	..	0 5.8	....	..	,, Cloudy
,, 10	..	30.12	− 9	6 38 6.2	9 12.3	U	.....	0 20.0	..	Fine and clear.—Limbs well defined.—3 Repetitions
,, ,,	..	...	..	6 5 39.9	9 33.3	L	..	0 0.4	..	,, ,,
,, 16	P.M.	29.32	−43	6 16 29.6	9 31.6	L	0 8 8	....	..	,, Therm in ⊙ 21°.
,, ,,	..	..	..	5 52 18.8	10 12.3	..	0 7.8	...	.	,, ,,
,, ,,	.	...	..	5 11 3.1	11 43.4	..	..	11 8	..	,, Therm. in ⊙ 26°.
,, ,,	..	...	..	1 42 36.1	12 50	..	....	0 23 5	..	,, Therm. in ⊙ 33°.
,, 17	A.M.	29.40	−39	6 51 40.5	9 1.9	..	....	0 8.8	.	Hazy.—Parhel. E. and W. of ⊙.—Therm. in ⊙ 31°.
,, ,,	Noon	29.42	−38	8 24 59.5	7 39.3	..	....	0 19.5		Brilliant Parhelia E. and W of ⊙.—5 Repetitions
,, 18	A.M	29.67	−27	0 12 22	53 0	..	....	12 52	..	Fine clear weather.
,, ,,	..	...	..	0 29 52	42 52	..	.....	6 56	..	,,
,, ,,	..	...	..	0 51 12	35 53	..	.....	4 15	.	,,
,, ,,	..	...	..	1 15 22	30 49	.	.....	2 57	..	,,
,, ,,	..	...	..	2 16 52	22 35	..	.....	1 56	..	,,
,, ,,	..	...	..	3 28 22	16 [illegible]	..	.....	1 5	..	,,

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1823.	Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
			°	° ′ ″	′ ″			′ ″		
Feb. 18	Noon	29.67	−29	8 45 21	7 16.8	L	....	0 18.0	RC	6 Rep^ns.—Therm. in ⊙ −19°.
„ (13)	A.M.	29.92	−18	0 22 32	47 1	L	....	10 6	I	Fine clear weather.
„ „	..	...	..	0 38 2	88 59	L	....	5 24	..	„
„ „	..	...	.	0 59 22	32 48	..	....	3 12	..	„
„ „	..	...	..	1 28 42	27 28	..	....	1 59	..	„
„ „	..	...	..	2 11 2	21 32	..	....	0 58	..	„
„ „	..	..	.	2 11 52	18 30	..	....	0 5	..	„
„ „	..	...	.	3 21 22	16 5	..	....	0 17	..	„
„ 19	..	29.80	−40	0 16 2	59 52	..	...	18 55	..	.
„ „	..	...	.	0 51 0	40 12	U	....	7 19	.	„
„ „	..	...	..	0 37 12	17 1	L	....	11 14	.	„
„ „	..	...	.	0 51 2	38 33	L	...	5 40	.	„
„ „	..	...	..	1 36 20	28 8	U	....	2 12	..	NOTE.—Distant objects on the
„ „	..	...	.	1 37 22	29 22	L	....	3 32	..	N and SE. points of the
„ „	..	...	−43	1 46 3	26 21.8	..	....	1 33.8	RC	horizon appeared very much
„ „	.	...	−40	2 33 0	21 32	U	....	1 32	I	distorted by refraction at
„ „	..	...	−43	2 18 3	22 8.1	L	....	0 13.4	RC	noon
„ „	..	...	−40	2 31 2	21 20	..	..	1 23	I	
„ „	..	...	−43	3 24 5.9	16 51.9	U	....	0 31.8	RC	
„ „	..	.	..	3 19 15.9	17 0.9	L	....	0 18.4	..	
„ „	..	...	−40	3 40 42	16 31	L	....	1 13	I	
„ „	Noon	...	−38½	9 39 0.5	6 58.3	U	..	0 29.9	RC	5 Rep^ns.—Limbs well def^d.—Therm. in ⊙ −28°.
„ 20	..	29.64	−27½	9 27 48	7 22 4	L	...	0 13.4	..	5 Rep^ns.—Limbs well def^d.—Therm. in ⊙ −23°.
„ 21	.	29.50	−19	9 48 44.4	6 21.4	..	....	0 11.6	..	6 Rep^ns.—Fine weath^r.—Halo round ⊙.
„ 22	.	29.48	−13	10 10 17	5 56.0	..	....	0 6.0	..	5 Rep^ns.—Clear weather.
„ 23	..	29.67	−23	10 31 50	5 53.2	..	....	0 7.2	..	7 Rep^ns.—Clear weather.—Therm. in ⊙ −19°.
„ 24	..	29.79	−27	10 53 59	5 50.7	..	....	0 12.7	..	6 Rep^ns.—Fine weather.—Therm. in ⊙ −16°.
„ 25	.	29.83	−27½	11 26 26	5 49.6	..	....	0 22.3	..	6 Rep^ns.—Rather hazy.—Therm. in ⊙ −22°.
„ 26	..	29.46	−19	11 38 24	5 20.0	..	....	0 9.9	..	7 Rep^ns.—Thick weath^r. with much drift snow.—Halo round ⊙.—Th. in ⊙ −18½°.
„ 27	..	29.94	−30	12 0 22	5 29.5	..	....	0 18.5	..	7 Rep^ns.—Fine clear weath^r.—Therm. in ⊙ −27°.

TABLE IV.—CONTAINING THE SOLAR REFRACTIONS, &c.—*continued.*

DATE 1823.	Time of Day	Barom.	Therm.	Apparent Altitude	Observed Refraction	⊙'s Limb	Tables in Excess	Tables in Defect	Instrument	REMARKS
			°	° ′ ″	′ ″		′ ″	′ ″		
Feb. 28	Noon	29.98	−35	12 22 59	5 11.5	L	....	0 10 2	RC	8 Rep^ns.—Limbs well defined.—Therm. in ⊙ −31°.
Mar. 1	..	29.73	−36	13 18 1	5 2.1	U	....	0 20.6	..	8 Rep^ns.—Limbs well defined.—Therm. in ⊙ −32°.
„ 2	..	29.70	−35	13 8 0	4 51.8	L	....	0 10.0	..	8 Rep^ns.—Halo round ⊙.—Therm. in ⊙ −31°
„ 3	.	29.92	−33	14 3 27	4 41.5	U	....	0 15.1	.	7 Rep^ns.—Fine clear weather.—Therm. in ⊙ −24°.
„ 4	..	30.10	−37	13 53 41	4 45.1	L	....	0 12.5	.	8 Rep^ns.—Fine clear weather.—Therm. in ⊙ −24°.
„ 10	..	29.81	−21	16 12 27	3 18.1	.	...	0 3.3	..	6 Rep^ns.—Hazy, but limbs tolb^ly defined.—Therm. in ⊙ −16°.
„ 12	..	29.96	−22	17 32 19	3 11.9	U	....	0 13.9	.	7 Rep^ns.—Calm fine day.—⊙'s limbs tremulous and undulat^s. Therm. in ⊙ { −8°. −15°.
„ 13	.	29.90	−16	17 33 1	3 29.6	L	..	0 2.1	.	6 Rep^ns.—Clear weath^r.—Limbs well def^d.—Ther. in ⊙ { +8°. −8°.
„ 14	..	29.72	−10	18 19 9	3 26.2	U	...	0 13.0	.	6 Rep^ns.—Clear weath^r.—Limbs well def^d.—Ther. in ⊙ +18°.
„ 15	.	29.98	−11	18 10 16	3 15.7	L	0 2.0	....	.	6 Rep^ns.—Hazy & cloudy—Lb^s. tolb^ly def^d.—Ther. in ⊙ −5°.
„ 16	..	30.50	−23	19 6 20	3 23.2	U	....	0 12.7	.	6 Rep^ns.—Clear weath^r—Limbs well def^d.—Ther. in ⊙ −10.
„ 17	..	30.77	−17	18 57 10	3 15.7	L	...	0 1.0	..	6 Rep^ns.—Hazy—Limbs well def^d.—Ther. in ⊙ −14°.
„ 18	..	30.72	−18	19 53 24	3 21.2	U	...	0 16.5	.	6 Rep^ns.—Fine w^r.—Limbs well def^d.—Th. in ⊙ very variable.
„ 19	..	30.38	−6	1. 11 51	3 1.4	L	..	0 0.1	..	6 Rep^ns.—Fine clear w^r.—Th. in ⊙ sheltered from wind +11½°.
„ 20	..	30.10	−7	20 10 30	3 1.7	U	...	0 12.9	..	6 Rep^ns.—Clea. weath^r.—Ther in ⊙ very variable.
„ 21	..	30.06	−1	20 30 58	2 59.3	L	....	0 0	..	6 Rep^ns.—Clear weath^r.—Ther in ⊙ +12°.
„ 22	..	30.00	−2	21 28 13	2 51.3	U	...	0 12.9	..	6 Rep^ns.—Cl^r. weather . . } Th. in ⊙ { + 1°. + 38°.
„ 24	..	30.00	−6	21 42 18	2 37.7	L	..	0 0.2	.	5 Rep^ns.—Clear weath^r.—Ther. in ⊙ +10.
„ 26	..	29.90	−6	23 1 37	2 36.1	U	...	0 5.8	..	6 Rep^ns.—Calm hazy w^r.—Lbs. tolb^ly def^d.—Th. in ⊙ +12°.
„ 28	..	30.00	−13	23 18 9	2 36.1	U	...	0 7.9	..	4 Rep^ns.—Fine weath^r.—Limbs well defined.
„ 29	..	29.94	−13	21 12 4.5	2 31.7	..	....	0 8.2	..	6 Rep^ns.—Fine weath^r—Limbs well defined.
„ 30	..	30.08	−11	21 25 51	2 25.2	..	...	0 2.8	..	5 Rep^ns.—Fine weath^r.—Limbs well defined.
May 30	Midn^t.	30.13	+12	1 18 56	25 5.8	L	...	0 4.3	..	8 Rep^ns.—Fine cl^r w^r.—Limbs undulating but well defined.
June 2	..	30.31	+16	1 41 31	22 32.3	..	....	0 15.1	..	4 Rep^ns.—Clear weath^r.—Ther. +13° on the sea ice.
„ 23	..	30.33	+33	2 48 22.5	16 6.9	..	....	0 2.2	.	3 Rep^ns.—Fine clear weather.

TABLE V.

CONTAINING the OBSERVATIONS of the MERIDIAN ALTITUDES of STARS, by Lieutenant PALMER, with the Altitude Instrument by CAREY, made to determine the Sum of the Index and Collimation Errors in this Instrument (by which the Refraction of the Sun at Low Altitudes was determined by him, as given in Table II.) by the Comparison of the Observed Meridian Altitude, corrected for Refraction with the true Altitude of the Star, computed from the North Polar distance and Latitude of the Station.

DATE			Barom	Therm	Star	Compared Alt	Observed Alt	Error	REMARKS
				°		° ′ ″	° ′	′ + ″	
1822	Nov	27	29 55	−27	α Pegasi	34 56 30	34 46 40	9 50	Middle of horiz^l wire
,,	,,	28	29 77	−30	,,		34 46 10	9 50	,,
,,	,,	29	29 93	20			34 17 0	9 30	
,,	Dec	30	29 76	−38		34 56 33	34 46 50	9 43	
,,	,,	,,	29 78		Rigel	12 19 40	12 9 50	9 59	
	,,	,,	29 78		α Orionis	28 8 38	27 58 40	9 58	
,,		31	29 95	−41	α Pegasi	34 56 31	34 46 40	9 51	
,,	,,	,,		−41	Rigel	12 19 58	12 10 20	9 38	
,,	,,	,,		−41	α Orionis	28 8 35	27 51 0	9 35	,,
1823	Jan	3	30 00	−43	α Pegasi	34 56 31	34 47 10	9 31	Lower part of wire
	,,	1	29 97	−40		,,	34 46 20	10 11	Upper do
,,	,,	23	30 45	−32	α Orionis	28 8 32	27 54 12	9 20	Lower do
,,					,,	,,	27 53 10	10 22	Upper do

The Mean Error by these Observations is + 9′ 47″, which has been applied to the Observed Altitudes taken with this Instrument.

TABLE VI.

CONTAINING the OBSERVATIONS made with the REPEATING CIRCLE to determine the Latitude of the Observatory at Igloolik by Meridian Observations of Stars above and below the Pole, by which the Refraction of the Sun and Stars were determined at Low Altitudes, by a comparison of the Observed with the Computed Meridian Zenith Distances.

DATE			Therm.	No. of Repetitions	Star Observed	Latitude			REMARKS
			°			°	′	″	
1823.	Jan.	23	−32	4	Aldebaran	69	20	46.7	Hazy.—* tremulous.
„	„	24	−30	4	.....	69	21	10.2	Clear weather.
„	„	25	−22	6	.....	69	20	51.1	„
„	„	29	−14	5	Rigel...	69	21	1.1	„
„	„	30	−20	4	Aldebaran	69	20	58.9	Hazy
„	„	31	−23	6	.....	69	21	8.6	„
„	Feb.	21	−23	4	Rigel...	69	21	0.3	Clear weather.
„	„	„	−23	5	α Orionis..	69	20	57.6	„
„	„	23	−33	5	.....	69	20	58.8	„
„	„	24	−37	4	.....	69	20	59.6	„
„	„	„	−37	4	Rigel...	69	21	3.1	„
„	„	25	−37	4	α Orionis..	69	21	3.3	Rather hazy.
„	„	27	−43	6	.....	69	21	0.2	Clear weather.
„	„	„	−43	6	Rigel...	69	21	2.8	„
„	Mar.	1	−40	5	α Orionis.	69	21	9.5	Much wind and drift snow.
„	„	„	−40	6	α Lyræ ...	69	21	9.2	„ „
„	„	3	−43	8	.....	69	21	0.3	Clear weather.
„	„	7	−29	9	.....	69	21	6.4	„
„	„	10	−27	8	Procyon.	69	20	54.2	„
„	„	18	−24	8	.....	69	20	51.4	„
„	„	29	−23	5	Regulus.	69	20	59.7	„

The Mean of these Observations give 69° 21′ 0″.62 N. for the Latitude of the Observatory.

TABLE VII.

CONTAINING an ABSTRACT of the LATITUDES of the OBSERVATORY at IGLOOLIK, by different Stars observed with the Repeating Circle.

Name of Stars	No. of Observations	Latitude	REMARKS
		° ′ ″	
Aldebaran . . .	5	69 20 59.1	Above the Pole.
Rigel..	4	69 21 2.1	" "
α Orion..... . .	6	69 21 1.5	" "
Lyræ	3		Below the Pole.
Regulus...	1	69 21 0.2	Above "
Procyon.	2		Below "
Sun..... ..	3 U L 3 L L	69 20 59.5	Summer Sol. Declinations, per *Nautical Almanack.*
do..	do.	69 20 56.5	do. do. per *French* do.

TABLE VIII.

CONTAINING the MERIDIAN OBSERVATIONS with the Star Sirius with the Repeating Circle to determine the Refraction; the height of the Instrument above the Level of the Frozen Sea being 40 feet.

DATE	Therm.	Barom.	Apparent Altitude	Observed Refraction	Tables in Defect	REMARKS
1823.	°		° ′ ″	′ ″	′ ″	
Jan. 19	−19	29.67	4 23 7.7	13 0.0	0 18.5	Fine moderate evenr.—Star in faint Aurora.
" 31	−23	29.82	4 22 23.2	12 54.9	0 3.4	Clear weather.
Feb. 5	−13	30.26	4 22 50.3	12 48.2	0 2.1	Star in bright Aurora.—Clear weather.
" 16	−45	29.32	4 19 42.5	14 13 0	0 58.2	Moderate evening.—Rather hazy about star.
" 18	−39	29.73	4 18 36.3	13 38.3	0 13.2	do.
" "	−39	29.73	4 22 53.6	13 46.8	0 24.0	do.
" 21	−23	29.50	4 23 5.2	13 8.7	0 25.9	Fine weather.
" 24	−37	29.82	4 21 39.3	13 34.3	0 17.4	Fine calm weather with light clouds.
" 27	−48	30.20	4 23 30.6	14 10.2	0 40.6	Fine moderate weather.
Mar. 10	−27	29.95	4 23 8.9	13 16.2	0 16.4	Clear weather.

TABLE IX.

Containing the OBSERVATIONS upon the Star SIRIUS, made to the *Eastward* and *Westward* of the Meridian, with the REPEATING CIRCLE; arranged according to the Apparent Altitudes.

Apparent Altitude.	Observed Refraction	Barometer.	Thermometer	Tables in	REMARKS.
° ′ ″	′ ″		°	′ ″	
2 35 31.3	18 01.3	30.26	−13	Excess 0 51.6	Star E. of the Meridian.
3 16 35.1	15 33.1	30.26	−13	„ 0 27.7	„ „
3 19 16.3	16 12.3	29.73	−39	„ 0 19.8	„ „
3 21 08.8	15 40.8	29.82	−23	„ 0 14.6	„ „
3 41 10	15 27	29 73	−39	Defect 0 10.2	„ „
3 49 43.8	15 01.8	29.32	−45	„ 0 05.5	„ „
4 00 19.5	14 56.5	29.32	−45	„ 0 43 2	„ „
4 07 20.1	13 58.1	29.73	−39	„ 0 04.2	„ „
4 09 08.2	14 33.2	29 32	−45	„ 0 54 6	„ „
4 10 56 3	13 24.3	30 26	−13	„ 0 10 3	„ „
4 22 55.1	13 01.60	29 84	−21	„ 0 10 36	Star on the Meridian (5 ob.)
4 21 20.5	13 52 52	29 76	−40.6	„ 0 21 50	„ „ (5 obser.)
3 20 46	17 16	30.65	−24	„ 0 53 6	Star W. of the Meridian.
3 07 33.7	17 25 7	30.65	−24	„ 0 17.4	„ „
2 54 56.3	18 20.3	30 65	−24	„ 0 24.2	„ „

NOTE.—The meridian observations of this star (Table VIII.) all give the tables in defect; but when the same star was observed at different azimuths, the refraction of the tables was in excess or defect, according as the star was to the eastward or westward of the meridian, as is shewn by the above table.

The star when observed in the direction of S.E. by E. hereabouts, was generally seen through a light haze or fog, arising from the exhalations from the sea, which was more or less open during the whole of the winter in that direction. Towards the S. and S.W. it was generally clear, as there was land covered with snow in those directions.

TABLES X. AND XI.

Containing the DIFFERENCE between the OBSERVED REFRACTION of the Star RIGEL from the TABLES, and also that of the Sun at about the same Altitude, in order to shew the difference between the Refractions of each.

TABLE X.—ERRORS of the TABULAR REFRACTION by the STAR RIGEL.

DATE	Barometer	Thermometer	Apparent Altitude	Tables in	REMARKS
1823	°		′	″	
January 29	−14	29.29	12 19	Excess 0.7	3 Repetitions. Fine Weather
February 21	−23	29.50	. .	Defect 0.2	4 ,, ,,
,, 24	−37	29.82		Excess 2.6	1 ,, ,,
,, 27	−43	30.00		,, 2.3	5 ,, ,,

TABLE XI.—ERRORS of the TABULAR REFRACTION by the SUN.

DATE	Thermometer	Barometer.	Apparent Altitude	Tables in	REMARKS
1823.	°		° ′	′	
February 24	−27	29.79	10 54	Defect 12.7	L.L. 6 Rep. Fine clear weather.
,, 25	−37	29.83	11 16	,, 15.5	L.L. 6 ,, ,,
,, 26	−19	29.46	11 38	,, 9.9	L.L. 7 ,, ,,
,, 27	−30	29.94	12 00	,, 18.5	L.L. 7 ,, ,,
,, 28	−35	29.98	12 23	,, 10.2	L.L. 8 ,, ,,
March 1	−36	29.73	13 8	,, 20.6	U.L. 8 ,, ,,
,, 2	−35	29.70	13 08	,, 10.0	L.L. 8 ,, ,,
,, 3	−33	29.92	14 03	,, 15.4	U.L. 7 ,, ,,
,, 4	−37	30.10	13 54	,, 12.5	L.L. 8 ,, ,,
,, [illegible]	−21	29.81	16 12	,, 8.3	L.L. 6 ,, ,,
,, 12	−22	29.96	17 32	,, 13.9	U.L. 7 ,, ,,

TABLE XII.

Containing the MEANS of the RESULTS of the OBSERVATIONS of LIEUTENANT PALMER, to determine the SOLAR REFRACTION, with the Altitude Instrument by CAREY.

Apparent Altitude	Thermometer	Barometer	Observed Refraction	Error of the Tables	REMARKS
0° 10′ 11″	− 22°	29 92	1° 5′ 40″	Tables in defect 25′ 7″	4 Obser. { 2 U.L. 2 L.L.
0 13 31	− 24.5	29 89	0 55 43	,, 15 39	4 ,, { 2 U.L. 2 L.L.
0 16 41	− 21 5	29 97	0 54 2 2	,, 15 5	4 ,, { 2 U.L. 2 L.L.
0 17 55	− 25 4	29 89	0 55 54	,, 16 52	7 ,, { 3 U.L. 4 L.L.
0 22 44	− 22 6	29 94	0 51 24	,, 13 49	8 ,, { 3 U.L. 5 L.L.
0 27 33	− 27 7	29 90	0 49 27	,, 12 31	8 ,, { 5 U.L. 3 L.L.
0 36 39	− 21 1	29 89	0 40 21	,, 5 50	10 ,, { 2 U.L. 8 L.L.
0 44 12	− 20.4	29 90	0 38 52	,, 6 7	10 ,, { 9 U.L. 1 L.L.
0 54 42	− 25 7	30 00	0 35 19	,, 4 3	12 ,, { 5 U.L. 7 L.L.
1 5 48	− 18 5	30 00	0 32 19	,, 3 23	8 ,, { 4 U.L. 4 L.L.
1 14 49	− 24 7	30 02	0 30 53	,, 2 42	8 ,, { 4 U.L. 4 L.L.
1 25 37	24 0	30 06	0 29 12	,, 2 40	5 ,, { 2 U.L. 3 L.L.
1 35 47	− 24 3	30 01	0 27 12	,, 2 3	9 ,, { 4 U.L. 5 L.L.
1 47 5	− 20 4	30 36	0 25 36	,, 1 47	3 ,, { 2 U.L. 1 L.L.
1 51 27	− 25 0	30 01	0 24 4	,, 1 9	3 ,, 3 U.L.
2 2 17	− 18 8	29 83	0 23 21	,, 1 32	3 ,, { 1 U.L. 2 L.L.
2 15 1	− 16 7	30 04	0 21 24	,, 0 49	7 ,, { 3 U.L. 4 L.L.
2 38 22	− 3 0	29 84	0 20 22	,, 1 5	4 ,, { 1 U.L. 3 L.L.
2 57 10	− 12 0	30 02	0 17 54	,, 0 47	2 ,, 2 L.L.
3 8 28	− 23 0	29 64	0 17 8	,, 0 29	2 ,, 2 L.L.
3 25 28	− 16 7	29 87	0 15 57	,, 0 27	4 ,, 4 L.L.
3 42 13	− 29 5	29 74	0 16 7	,, 1 8	2 ,, { 1 U.L. 1 L.L.
3 59 25	− 10.0	30 16	0 14 29	,, 0 50	1 ,, 1 U.L.
4 51 11	− 2.0	30 39	0 12 7	,, 0 32	2 ,, { 1 U.L. 1 L.L.

NOTE.—Observations with this Instrument were not extended to Altitudes greater than about five degrees, the Observations at higher Altitudes were confined to Meridian Observation with the Repeating Circle

TABLE

TERRESTRIAL

DATE	Time of Day	Barometer.	Thermometer in Shade	Height above the Sea.	Observed Elevation or Depression of the Horizon.	Tabular Dip.	Tabular Dip in	SITUATION.
1821.	H		°	Feet.	′ ″	′ ″		
July 17	10 A.M.	29.93	+40	3	Elev. 5 27.5	1 39	Excⁿ. 7 06.5	In ice, Hudson's Strᵗ
,, ,,	,, ,,	. . .	. .	5	,, 5 30.8	2 08	,, 7 38.8	,, ,,
,, ,,	11 ,,	. . .	+41	86.5	,, 1 49.7	8 52	,, 10 41.7	,, ,,
,, ,,	11½ ,,	. .	. .	103	,, 4 46.7	9 42	,, 14 28.7	,, ,,
,, 20	Noon.	29.90	+45	14	,, 2 49	3 34	,, 6 23	,, ,,
Aug. 2	Noon.	29.70	+39	14	Depr. 0 27	3 34	,, 3 7	,, ,,
,, 3	Noon.	29.80	+35	15	,, 2 34	3 42	,, 1 8	,, ,,
,, 5	Noon.	30.14	+41	14	,, 3 56	3 34	Defᵗ. 0 22	In ice, Lat. 65° 25′ N. Lon. 81° [illegible] W.

XIII.

REFRACTIONS.

REMARKS, &c.
By four observations with circular transit; the alt. of the N.E. part of the horizon being 5′ 25″, and towards S.E., 5′ 30″
By four observations with the dip sector, towards N.E. and S.W. parts of horizon.
Ditto Ditto Ditto Taken from the fore-top of the Fury.
Ditto Ditto Ditto Fore-top gallant-mast head.
The thermometer in ⊙ at noon this day, stood as high as 81° on board, but when suspended from a pole perfectly detached, at + 60°. The day calm and cloudless; objects upon the horizon were much distorted by refraction, causing the ice to assume a great variety of shapes, but generally of innumerable perpendicular columns, so that the ships appeared surrounded by a distant wall of ice, making the distant horizon to appear at an elevation instead of a depression, as the observations shew. From the mast-head the appearance of the ice was very singular, for besides the distant horizon having so great an elevation, yet the ice at about a mile distance from the ships, appeared considerably depressed, causing the surface of the ice to be concave, gradually sloping down from the ships, and becoming elevated as it approached the horizon. The ships were closely beset with ice, and no water in sight.
By a mean between the observations of Captain Parry and Mr. Bushnan, on the ice with false horizon, the apparent altitude of the ⊙'s L.L. was 48° 46′ 47″ close by the ship's side; at the same time the same limb of the sun was observed by myself from the ship's gangway to be 48° 43′ 58″ above the visible horizon, (which was a close and well-defined line of ice.) The thermometer freely suspended in the ⊙ + 74° Fahrenheit.
In the same way as the above.
In the same way as the above. A dark "sea blink" upon the horizon under the ⊙, and some open water between horizon and ship. The horizon was not distorted in the usual way, but was a well-defined line of ice all round.
Observed with artificial horizon upon the ice by myself and Mr. Hooper from the ship's deck. No appearance of extraordinary refraction. Some little open water in sight.

TABLE XIII.—TERRESTRIAL

DATE	Time of Day	Barometer.	Thermometer in the Shade.	Height above the Sea	Observed Elevation or Depression of the Horizon	Tabular Dip.	Tabular Dip in	SITUATION.
1821.			°	Feet	′ ″	′ ″	′ ″	
Aug. 6	Noon	.		14	Depr. 1 42	3 14	Exc^{ss}. 1 52	Off Southamp. Island.
1822.	H.							
Mar. 22	2 P.M	29 85	− 9	18	„ 7 54.2	4 3	Def^{t} 3 51.2	At the Observatory, Winter Island.
„ „	„ „	. .	.	.	„ 8 1.1	4 3	„ 3 58 1	„ „
„ 23	0⅔ „	29 98	−13	14	„ 8 29.0	3 34	„ 4 55	„ „
„ „	3¼ „	29 99	.	. .	„ 7 33.0	3 34	„ 3 59	„ „
„ 25	0⅔ „	30 27	−17	. .	„ 8 39.5	. . .	„ 5 5.5	„ „
„ „	2¼ „	30 29	. .	. .	„ 5 51.3	. .	„ 2 17.3	„ „
„ „	3 „	30 29	. .	. .	„ 16 40.0	. .	„ 13 6	„ „
„ „	4¾ „	30 31	. .	. .	„ 15 40.0	. .	„ 12 6	„ „
„ 26	1 „	30 34	− 2	. .	Elev. 2 4.0	. .	Exc^{ss}. 5 38	„ „
„ „	2¼ „	30 38	. .	. .	Depr. 5 3	. .	Def^{t}. 1 29	„ „
„ 30	1 „	29 26	+ 8	14	„ 2 53	. .	Exc^{ss}. 0 41	„ „
„ „	„ „	. . .	.	.	„ 2 23	. .	„ 1 11	„ „
„ „	2½ „	29 33	+ 7	. .	„ 1 19	. .	„ 2 15	„ „
„ „	„ „	. .	. .	. .	„ 2 25	. .	„ 1 9	„ „

REFRACTIONS—*continued.*

REMARKS, &c.

By a comparison of the apparent altitude of the ⊙'s limb by Captain Parry, on the ice with artificial horizon, with the observed altitude of the same limb above the *ice horizon*, observed from the ship's gangway by myself. Ships closely beset with ice, but no particular appearance of refraction.

By comparing the mean of six altitudes of the ⊙'s lower limb over the visible sea horizon, with the mean of six simultaneous observations by Lieutenant Palmer with artificial horizon. The horizon a well-defined line of ice, and no open water in sight; the ⊙ bright and horizon free from haze, therm. exposed to ⊙ − 14° Fahrenheit.

By the same method as before Six altitudes over the ice horizon by Lieutenant Palmer, and six altitudes with the artificial horizon Light breezes from W.N.W. and clear

By a comparison of the computed, with the observed altitude of the ⊙'s LL The horizon a tolerably well-defined line of ice, the ⊙ bright and weather clear; thermometer in ⊙ + 3½°; light breezes N.W.

By the same method as above; a mean of five observations, thermometer in ⊙ − 3½°.

Ditto.	Ditto.	Thermometer in ⊙ − 7°; horizon free from haze.
Ditto.	Ditto.	No water in sight.
Ditto.	Ditto.	Clear weather; no haze upon horizon.
Ditto.	Ditto.	

By the same method as above. A white fog-bank upon the horizon, extending about 10° in altitude, but the horizon well-defined, the fog probably denoting the presence of open water a little beyond the extent of the visible horizon, although none in sight. Thermometer in ⊙ + 3°.

Cloudy weather, but horizon tolerably defined. Thermometer in ⊙ + 2°.

Lieutenant Palmer, with artificial horizon, compared with my own altitudes of the ⊙'s L.L. over the ice horizon which was well defined; three observations each; clear weather and much open water between the horizon and place of observation. Thermometer in ⊙ + 7°.

Lieut. Palmer over the ice horizon, and myself with artificial horizon as above; much open water.

Ditto. Stiff breeze, with much snow drift.

Lieutenant Palmer with artificial horizon, and myself over sea horizon, which was faint and distant.