the latitude expressed in minutes, which is 3044, we find the approximate place of the revolved position to be at the intersection of circumference 17.2 with radial 8400 + 3044 = 11444, which intersection falls within the limits of plate 136, (fig. 6). Turning now to plate 51 (fig. 5), and plotting the hour-angle and the declination to the nearest minute, we find the position of the observed body to fall at the intersection of circumference 495.6 with radial 8411. Adding 90° minus the latitude expressed in minutes to the number of this radial we obtain 8411+3044=11455 as the number of the radial, at whose intersection with circumference 495.6, on plate 136, (fig 6), the solution is to be found by reading off the altitude with reference to the parallels and the azimuth with reference to the meridians, counting from the right-hand bounding meridian.

Solution.

Hour-angle 30° 43.5′ } ..... { Circ. 495.6
Declination 45° 54.0′ } { Rad. 8411
Lat. N. 39° 16′: colat. 50° 44′ 3044

Rad. 11455 } { 66° 36′ altitude.
Circ. 495.6 { } N. 63° 32′ W. azimuth.

True altitude by observation	66° 22′
Altitude due to estimated position	66 36
Δ_h	14
True bearing	N. 63° 32′ W.
Compass bearing by observation	N. 60 00 W.
Total error of compass for heading of ship when observation was made	3° 32′ W.

It should not escape attention that the whole work, which we have now performed, of finding the star's altitude and azimuth due to the estimated geographical position of the ship may be done before the observer goes on deck to measure the actual altitude at the prearranged instant of Greenwich mean time, and that no more time need subsequently elapse in drawing the Sumner line than is required for taking the difference of the two altitudes Δ_h and laying it off as an intercept along the line of true bearing of the observed body in the proper direction from *θ* the estimated geographical position of the observer, as has been done on the small chart, fig. 7.

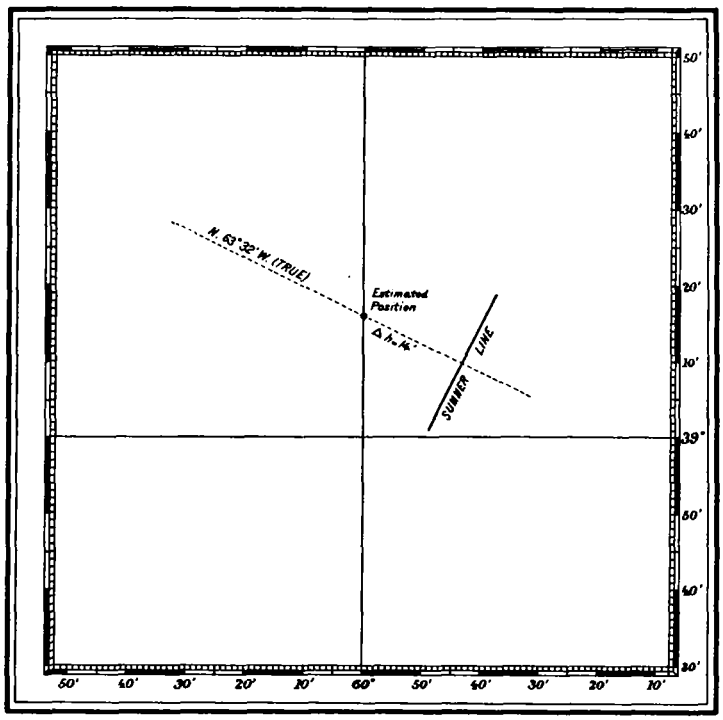

FIG. 7.

Frequently a star that is favorably placed for observation can not be identified because clouds obscure the surrounding parts of the sky. If, when the altitude of such a star is measured, its compass bearing be observed, and the approximate true azimuth be obtained by correcting the bearing for the variation and deviation of the compass, then the identity of the star may at once be ascertained by reversing the order of proceeding that has just been described for finding the altitude and azimuth from the declination and hour-angle. Having plotted the corrected altitude of the star on the meridian of the projection which makes an angle with the right-hand bounding meridian equal to the star's azimuth counted from the North Pole, note the number of the radial and the number of the circumference that pass through the point so plotted. Subtract 90° minus the latitude of the place of observation, expressed in minutes, from the number of the radial; find the intersection of the noted circumference with a second radial whose number is the remainder thus found by subtraction, and read from the graduations of the projection the declination of this point and its hour-angle from the left-hand bounding meridian. The hour-angle of the observed star thus found must be converted into right ascension. Then the star tables of the Nautical Almanac may be scanned to find the name of the star whose tabulated right ascension and declination come nearest to the values of the right ascension and declination that have been deduced. The stars that are of a sufficient magnitude to be observed by navigators are so widely separated that there will be no difficulty in making the selection from the tables, even when we proceed no further than the use of the index to plates in effecting the required solution.

It will be found upon examination that these graphical tables are also adapted to find, with very great facility, the course and distance in great circle sailing, and that they provide a sure and simple solution, with a degree of precision limited only by the scale of construction, for all those problems of trigonometry and nautical astronomy that depend upon solving a spherical triangle in which two sides and the included angle are given.—*X.*

The Editor would commend Mr. Littlehale's methods and his charts to the serious attention of all who have occasion to solve spherical triangles to the nearest minute of arc—whether in geodesy, navigation, astronomy, or general mathematical work.—ED.

RECENT PAPERS BEARING ON METEOROLOGY.

R. A. EDWARDS, Acting Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Science. New York. New Series. Vol. 22.

Bauer, L. A. Work of the department of terrestrial magnetism of the Carnegie Institution. Pp. 25-27.

Ward, R. DeC. Barometer and weather. [Note on article by van Bebber.] P. 54.

Ward, R. DeC. Marine meteorological service of Chile. [Note.] P. 55.

Ward, R. DeC. Climate of Jerusalem. [Note on work by G. Arvanitakis.] P. 55.

—— Extended explorations of the atmosphere by the Blue Hill Observatory. Pp. 57-58.

Science Abstracts. London. Vol. 8.

B[orns], H. Measuring the duration of rainfall. [Abstract of paper by T. Okada.] P. 387.

B[orns], H. Meteorology of the equator. Observations at Pará in the Museum Goeldi. [Abstract of article by J. Hann.] P. 387.

B[orns], H. Annual variation of the height of sea-level and of the barometer in Japan. [Abstract of paper by F. Omori.] Pp. 387-388.

Butler, C. P. Solar origin of terrestrial magnetic disturbances. [Abstract of article by E. W. Maunder.] P. 388.

Scientific American Supplement. New York. Vol. 60.
—— Thermometers and pyrometers, with some of their industrial applications. Pp. 24708-24710.
Popular Science Monthly. New York. Vol. 67.
Michaud, Gustave. The climate of the Central American Plateau. Pp. 231-236.
London, Edinburgh, and Dublin Philosophical Magazine. 6th Series. Vol. 10.
Eve, A. S. On the radioactive matter present in the atmosphere. Pp. 98-112.
Nature. London. Vol. 72.
Bennett, G. T. The hydrometer as a seismometer. P. 198.
Century Magazine. New York. Vol. 70.
Grosvenor, Gilbert H. Our heralds of storm and flood. Pp. 161-178.
Journal of Geography. New York. Vol. 4.
Ward, R. DeC. Autumn rainfall and the yield of wheat in England. [Note on article by W. N. Shaw.] P. 264.
—— English fogs and commerce. [Note.] Pp. 264-265.
Journal of the Meteorological Society of Japan. Tokyo. May, 1905.
Okada, T. Note on the relation between pulse-rate and the atmospheric pressure. Pp. 15-17.
Astrophysical Journal. Chicago. Vol. 22.
Clough, H. W. Synchronous variations in solar and terrestrial phenomena. Pp. 42-75.
Symons's Meteorological Magazine. London. Vol. 40.
Brook, Charles L. Partial drought in May. Pp. 81-82.
Carter, W. J. May frosts. P. 82.
Hall, William. May frosts. Pp. 82-83.
Pearson, Edward. Partial drought, May, 1905. P. 83.
Walker, Herbert J. Frost in Uruguay. P. 83.
Jones, J. R. Gethin. Glacial snow on Ben Nevis. Pp. 83-84.
Boys, H. A. The parallel between 1896 and 1905. P. 85.
Mossman, R. C. The Antarctic meteorological station in the South Orkneys. Pp. 86-89.
Scottish Geographical Magazine. Edinburgh. Vol. 21.
—— Rainfall of Ben Nevis Observatory. [Note on paper by Andrew Watt.] P. 329.
—— The Indian earthquake. [Note.] Pp. 329-331.
—— The Nile flood and barometric variations. [Note on a paper by H. G. Lyons.] P. 331.
—— The Argentine Antarctic station. [Note.] Pp. 331-332.
—— The Antarctic problem. [Abstract of address by Clements Markham.] Pp. 376-378.
Terrestrial Magnetism and Atmospheric Electricity. Baltimore. Vol. 10.
Gerdien, H. Die absolute Messung der specifischen Leitfähigkeit und der Dichte des verticalen Leitungsstromes in der Atmosphäre. Pp. 65-79.
Moidrey, J. de. Mesures magnétiques en Chine. P. 80.
Reid, Harry Fielding. Records of seismographs in North America and the Hawaiian Islands. No. 1. Pp. 81-96.
Tallquist, Hj. Karl Selim Lemström: his life and work. Pp. 97-100.
Biese, Ernst. Verzeichniss der Publicationen des verstorbenen Professors Selim Lemström. Pp. 101-102.
La Nature. Paris. 33 année.
Brandicourt, Virgile. Pluie de soufre. P. 22.
Rudaux, Lucien. L'eclipse totale de soleil du 30 août 1905. Pp. 43-46.
Ciel et Terre. Bruxelles. 26 année.
—— Les variations d'intensité de la pluie. Pp. 193-194.
—— Variation de la température quotidienne dans la haute atmosphère. [Review of work by L. Teisserenc de Bort.] Pp. 194-196.
Comptes Rendus de l'Académie des Sciences. Paris. Tome 140.
Hergesell, H. Ascensions de ballons sondes exécutées au-dessus de la mer par S. A. S. le Prince de Monaco au mois d'avril 1905. Pp. 1569-1571.
Fonvielle, W. de and Bordé, Paul. La météorologie des éclipses totales de soleil. Pp. 1665-1666.
L'Aerophile. Paris. 13 année.
Esnault-Pelterie, Robert. Expériences d'aviation exécutées en 1904, en verification de celles des frères Wright. Pp. 132-138.
La Geographie. Paris. Vol. 11.
Dubamel, H. and Vidal, L. La sécheresse de 1904 en Dauphiné. Pp. 205-207.
Baldit, Albert. La sécheresse de l'été et de l'automne 1904 dans la région du Puy-de-Dôme. Pp. 293-301.
Annuaire de la Société Météorologique de France. Paris. 53 année.
Maillet, Ed. Sur la classification des sources servant à l'alimentation des villes en France et en Algérie. Pp. 113-117.
Moureaux, Th. Résumé de trente années d'observations météorologiques a l'Observatoire du Parc Saint-Maur (1874-1903). Pp. 118-124.
Besson, Louis. L'ascension scientifique du 5 avril 1905. Pp. 124-130.
Moureaux, Th. Tremblements de terre. Pp. 136-138.
—— Sur un halo extraordinaire, observé à Paris. Pp. 138-139.
Coeurdevache, P. Vitesse moyenne du vent à Perpignan pour chaque jour de l'année. Pp. 141-142.
Coeurdevache, P. Fréquence des diverses vitesses maxima du vent. Pp. 143-144.
Annalen der Hydrographie und Maritimen Meteorologie. Berlin. 33 Jahrgang.
Grossmann, —. Die barometrische Höhenformel und ihre Anwendung. Pp. 261-274.
Naturwissenschaftliche Rundschau. Berlin. 20 Jahrgang.
Simpson, George C. Atmosphärische Elektrizität in hohen Breiten. Pp. 329-330.
Physikalische Zeitschrift. Leipzig. 6 Jahrgang.
Conrad, V. Messungen der Elektrizitätszerstreuung auf dem Sonnblick. Pp. 406-409.
Petermanns Mitteilungen. Gotha. 51 Band.
Hoffmann, Jakob. Die tiefsten Temperaturen auf den Hochländern des südäquatorialen tropischen Afrika, insbesondere des Seenhochlandes. Pp. 108-115.
Lendenfeld, R. v. Die heisen Winde in Melbourne. Pp. 118-119.
Illustrirte Aeronautische Mitteilungen. Strassburg. 9 Jahrgang.
Quervain, A. de. Ueber Finsternismeteorologie und die künftige Sonnenfinsternis vom 30 August 1905. Pp. 172-180.
Das Weltall. Berlin. 5 Jahrgang.
Linke, —. Ueber die Photographie der Sonnenkorona auf der Mont-Blancspitze. [Abstract of work by A. Hansky.] Pp. 317-318.
Gaea. Leipzig. 41 Jahrgang.
Korselt, —. Ueber die Ursachen der täglichen Oszillation des Barometers Pp. 461-472.
—— Eine Aufforderung zum internationalen Wettbewerbe in Wetterprognosen. Pp. 472-473.
—— Die tiefste Temperatur der Atmosphäre. Pp. 500-501.
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Kremser, B. Sonnenlose Tage. Pp. 97-103.
Sieberg, August. Erdbeben und Witterung. Pp. 103-113.
Stentzel, Arthur. Dämmerungsstörungen. Pp. 115-117.
Adler, Eduard Schiefer. Ungewöhnliche Hitzen in früheren Jahrhunderten. Pp. 118-119.
Bornstein, R. Wetterdienst. Pp. 119-120.
Hegyfoky, J. Die tägliche Drehung der Windrichtung. Pp. 121-128.
Quervain, A de. Aus dem Leben der Wolken. Pp. 129-137.
Wundt, W. Temperaturen auf Bergstationen und in der freien Atmosphäre. Pp. 138-142.
Bornstein, R. Wetterdienst. Pp. 143-144.
Wiener Luftschiffer Zeitung. Wien. 4 Jahrgang.
Schlein, Anton. Internationale Ballonfahrt vom 6. Juni 1905. P. 131.
—— Internationale Kommission für Wissenschaftliche Luftschiffahrt. Pp. 132-133.
Meteorologische Zeitschrift. Wien. Band 22.
Kerner, Fritz von. Zur Kenntnis der Temperatur der Alpenbäche. P. 241-248.
Busch, Friedr. Beobachtungen über die Wanderung der neutralen Punkte von Babinet und Arago während der atmosphärisch-optischen Störung der Jahre 1903 und 1904. Pp. 248-254.
O., A. v. Der Mechanismus der Entstehung der Regenwolken am Nordabhange der Pyrenäen. Einfluss der Erhebungen der Kette. Starke Regengüsse und Ueberschwemmungen. [Abstract of article by E. Marchand.] Pp. 254-261.
Maurer, J. Zur Geschichte der terrestrischen Refraktion. Pp. 262-265.
Prohaska, Karl. Die Gewitter-und Hagelhäufigkeit des Sommers 1904 in den Ostalpen. P. 265.
Conrad, V. B. Zöltz über die Elektrizitätszerstreuung in Kremsmünster 1903-04. Pp. 265-266.
Conrad, V. Bemerkung zu einer Messung des vertikalen Luftstromes. Pp. 266-267.
Simpson, George C. Potentialregistrierungen und Zerstreuungsmessungen in hohen Breiten. Pp. 267-269.
Conrad, V. Bemerkung zu den luftelektrischen Untersuchungen von G. C. Simpson. Pp. 269-270.
Hann, J. Ueber den täglichen Gang der Temperatur in der inneren Tropenzone. Pp. 270-271.
Hann, J. Resultate der meteorologischen Beobachtungen zu Addis-Abeba und Addis-Alem im Basin des Hauash in Abessinien. Pp. 271-272.
—— Teisserenc de Bort über die Schwankungen der Temperatur in grossen Höhen der Atmosphäre. [Abstract of article by Teisserenc de Bort.] Pp. 272-273.
Hann, J. Resultate der meteorologischen Beobachtungen in Buitenzorg 1901. Pp. 273-275.
Hann, J. Zum Klima von Winnipeg (Manitoba). 30 jährige Temperaturmittel, Temperaturveränderlichkeit, Temperatur-Extreme, Regenmenge. Pp. 275-277.
Hergesell, H. Drachenaufstiege auf dem Mittelländischen Meere und auf dem Atlantischen Ozean. Pp. 277-279.

Quervain, A. de. Die tiefste bisher beobachtete Temperatur der Atmosphäre. Pp. 279-280.
Busch, Fr. Der Bishop'sche Ring während der letzten atmosphärisch-optischen Störung, beobachtet zu Arnsberg. Pp. 280-282.
Busch, Fr. Niederschlag und Wasserführung der Flüsse Mitteleuropas. Pp. 282-284.
—— Gewitter und Kugelblitze in Krakau. P. 284.
Bemmelen, W. van. Messungen der lichtelektrischen Zerstreuung während der ringförmigen Sonnenfinsternis am 17. März 1904. Pp. 284-285.
Rudel, —. Unzuverlässigkeit des Gewitterregistrators. Pp. 285-286.
—— Kälte in der Sahara. P. 286.
—— Temperaturumkehrungen auf dem Ben Nevis. P. 286.
—— Blitzschlag in eine der Pyramiden. P. 286.

Hemel en Dampkring. Amsterdam. 3 Jahrgang.
Szalay, Ladislaus von. Over fotografiën van bliksemstralen. Pp. 19-23.
Hissink, C. W. Zodiakaallicht waargenomen te Zutphen, door C. W. Hissink, in het voorjaar van 1905. P. 24.
Nell, Chr. A. C. De halo's. Pp. 25-29.

Bolétim da Sociedade de Geographia de Lisboa. Lisboa. 23 série.
Osario, Augusto da Carvalho. Espectro de Brocken na Serra da Arrabida. P. 162.
Berthoud, Paul. Météorologie de Lourenço Marques. Pp. 163-164.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

R. A. EDWARDS, Acting Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

American Forest Congress.
Proceedings of the American Forest Congress. Held at Washington, D. C., January 2 to 6, 1905, under the auspices of the American Forestry Association. xi, 474 pp. 12°. Washington. 1805.

Baden. Centralbureau für Meteorologie und Hydrographie.
Deutsches Meteorologisches Jahrbuch für 1904. Baden. Sonderabdruck des II. Teiles des Jahresberichtes des Zentralbureaus für Meteorologie und Hydrographie für 1904. Bearbeitet von Prof. Dr. Ch. Schultheiss. 75 pp. f°. Karlsruhe. 1905.

France. Commission Météorologique de l'Hérault.
Bulletin Météorologique de l'Hérault. Année 1904. 132 pp. 4°. Montpellier. 1905.

France Commission Météorologique du Département de la Haute-Garonne.
Bulletin de la Commission Météorologique du Département de la Haute-Garonne. Tome I. Troisième fascicule 1903. 151-222+75-96 pp. 4°. Toulouse. 1904.

Great Britain. Meteorological Office.
Meteorological observations at stations of the second order for the year 1900. Published by direction of the Meteorological Council. xiii, 181 pp. f°. London. 1905.

Grenander, S.
Les gradients verticaux de la température dans les minima et les maxima barométriques. (Arkiv för matematik, astronomi och fysik utgivet af K. Svenska Vetenskapsakademien i Stockholm. Band 2. No. 7.) 15 pp. 8°. Upsala. 1905.

Hamburg. Deutsche Seewarte.
Deutsche überseeische meteorologische Beobachtungen. Heft XIII, 1905. Meteorologische Beobachtungen in Deutsch-Ost-Afrika. 317 pp. f°. n. p. n. d.

International Latitude Observatory of Mizusawa.
Annual report of the meteorological and the seismological observations made at the International Latitude Observatory of Mizusawa for the year 1904. 11 pp. f°. Mizusawa. 1905.

Japan. Cen ral Meteorological Observatory.
Annual report of the Central Meteorological Observatory of Japan for the year 1902. Part 1. Meteorological observations in Japan. 239 pp. 4°. Tokio. 1905.

Kremser, B.
Sonnenlose Tage. (Sonder-Abdruck aus "Das Wetter," Heft 5, 1905.) 7 pp. 8°.

Liverpool Observatory.
Report of the Director of the Observatory to the Marine Committee, and meteorological results deduced from the observations taken at the Liverpool Observatory, Bidston, Birkenhead, in the year 1904. 41 pp. 8°. Liverpool. 1905.

Meteorological Observatory, St. Ignatius College.
Tenth annual report of the Meteorological Observatory. 15 pp. 8°. Cleveland. 1904-1905.

Observatorio del Colegio de Belen.
Observaciones magneticas y meteorologicas hechas en el Observatorio del Colegio de Belen de la Compania de Jesus en la Habana. Ano de 1904. f°. Habana. 1905.

Physikalischer Verein zu Frankfurt am Main.
Jahresbericht des Physikalischen Vereins zu Frankfurt am Main für das Rechnungsjahr 1903-1904. 102 pp. 8°. Frankfurt am Main. 1905.

Prussia. Königliches Preussiches Meteorologisches Institut.
Ergebnisse der Niederschlags-Beobachtungen im Jahre 1901. Von G. Hellmann. Veröffentlichungen des Königlich Preussichen Meteorologischen Institute. Herausgegeben durch dessen Direktor Wilhelm von Bezold. lviii, 236 pp. f°. Berlin, 1905.

Russia. Meteorological Observatory of the Imperial Institute of Forestry at St. Petersburg.
Observations de l'Observatoire Météorologique de l'Institut Forestier Impériale à St. Petersbourg. 37 pp. f°. St. Petersburg. 1905.

Solar Physics Observatory.
Mean annual variations of barometric pressure and rainfall in certain regions. 16 pp. 17 plates. f°. London. 1905.
Solar Physics Observatory report, 1904. 41 pp. 8°. n. t. p.

Stacya Centralna Meteorologiczna przy Museum Przemyslu i Rolnictwa w Warsawie, r. 1904. 30 pp. 4°. n. p. 1905.

Voeikov, Aleksander Ivanovich.
Les lacs du type polaire et les conditions de leur existence. (Extrait des Archives des Sciences Physiques et Naturelles. 4 pér. T. 16. Sept. 1903, p. 300 à 309.) 10 pp.
Einige Probleme der Seenkunde. (Aus: Zeitschrift für Gewässerkunde. 5 Band. Heft 1.) 15 pp.
Referate über russische Forschungen auf dem Gebiete der Meteorologie. (Separat-Abdruck aus der "Meteorologischen Zeitschrift," Heft 10, 1903.) Pp. 451-458.

Ward, Robert DeCourcy.
The climatic zones and their subdivisions. (Reprinted from Bulletin of the American Geographical Society, July, 1905.) 12 pp.

Wilson-Barker, D.
The connection of meteorology with other sciences. (From the Quarterly Journal of the Roy. Met. Soc. v. 31.) P. 85-95.

ANNUAL RINGS OF TREE GROWTH.

By Prof. E. E. BOGUE, Agricultural College, Lansing, Mich. Dated June 25, 1905.

I made an investigation of the seasonal and annual rapidity of growth of trees in Stillwater, Okla., covering the time from October 1, 1898, to September, 1901. Twenty-seven trees were carried through the entire time. Among them were five soft maples (*Acer saccharinum*) planted along the street for shade, and the rest were fruit trees and included varieties of plum, peach, cherry, apple, quince, pear, Russian mulberry, and apricot.

Nearly all the trees were yearlings, or two-year-olds, planted in the spring of 1898. The maximum growth was not the same for any two of the three seasons. The official meteorological station is about one-half mile from where the trees grow. There is no marked difference between the elevations of the two places nor any reason to suppose that the climate of the two places would vary. Table 1 gives the average increase in girth, expressed in millimeters, for the group of 27 trees during the respective months, as also the corresponding monthly rainfall, expressed in inches.

TABLE 1.—*Average increase in the girth of 27 trees, measured monthly at Stillwater, Okla.*

Months.	1898.		1899.		1900.		1901.	
	Rain.	Girth.	Rain.	Girth.	Rain.	Girth.	Rain.	Girth.
	Ins.	*mm.*	*Ins.*	*mm.*	*Ins.*	*mm.*	*Ins.*	*mm.*
January	.....	.....	0.48	—1.37	0.23	—0.22	0.62	—1.11
February	.....	.....	0.47	0.66	0.79	0.41	0.59	1.33
March	.....	.....	1.03	0.22	0.51	—0.15	2.95	0.55
April	.....	.....	4.97	1.70	4.43	6.18	1.29	3.63
May	.....	.....	5.61	13.33	3.71	18.51	5.70	15.51
June	.....	.....	3.64	20.20	3.28	20.60	0.79	11.60
July	.....	.....	4.45	20.25	2.69	15.10	1.48	9.33
August	.....	.....	2.57	10.44	1.39	5.10	1.95	4.33
September	.....	.....	0.88	5.11	9.22	6.40	.....	.....
October	4.19	4.74	5.15	1.37	2.87	1.59	.....	.....
November	0.68	0.89	1.93	—0.15	0.65	0.51	.....	.....
December	2.68	1.11	1.60	—0.74	0.21	—0.15	.....	.....
Annual total	.....	.....	32.78	81.02	29.98	73.88	.....	.....