The number of hours of sunshine during July was 180, of which 70 hours were credited to the first seven days, the total thus having been 86 hours below the normal of 196 hours. During the first 20 days of August the number of hours of sunshine was 101 while the normal number is 116. A total of 42 hours of the entire number of hours of sunshine up to the 20tn of the month occurred during the last four days of the period. *U. S. Consular Report.*

Ergebnisse der Registrierballonfahrten ausgeführt vom Geophysikalischen Institut der Universität Leipzig und der Sächs. Landeswetterwarte in den Jahren 1926 u. 1927.—The results of the sounding-balloon ascents at Leipzig in 1926 and 1927 have been published in mimeographed form, including brief discussion and both tables and graphs for each ascent. The frequent occurrence of minor temperature inversions in the free air is striking, as is also the usual coincidence of the maximum of relative humidity with the beginning of a temperature inversion. Temperature-isopleth diagrams for certain series of days show in one instance a sharp oscillation in the course of a single day, and extending to a height of 10 or more kilometers, with approximately the same amplitude, of 5° C. at all heights. A minor low was passing.—*C. F. B.*

P. R. Krishna Rao on the distribution of temperature in the lower stratosphere.[1]—The author has shown by means of graphs and tables some striking relationships between the inversion in the lower part of the stratosphere and the temperature at the tropopause (Tc). It is found that lower values of Tc are associated with thicker and stronger inversions in the lower layers of the stratosphere. It is also shown from the mean annual lapse rates that the stratospheric inversion is only about 3 to 4 km. thick in the temperate regions but much thicker in the tropical and subtropical regions. The upper limit of this inversion in the latter regions is above the highest altitudes reached by observations thus far.

The fact is pointed out that the stratosphere is not an isothermal region as it is sometimes believed to be but a region that definitely begins with an inversion of temperature. The following qualitative explanation is given for the existence of this inversion and its latitudinal variation and for the relationship between Tc and the strength and thickness of the inversion on the basis of convection in the troposphere:

It is well known that the actual temperature distribution in the atmosphere is not determined by radiation alone but is fundamentally influenced by turbulence and convection in the region of the lower atmosphere in which the water vapor content is appreciable. The effect of superposing convection on radiation equilibrium condition is to increase the temperature in the lower layers mainly by the latent heat liberated from the condensation of water vapor. Active convection may be expected to continue up to the height at which the equivalent potential temperature [2] is the same as the equivalent potential temperature at the starting point (ground). Above this limit, there will be a certain amount of "forced mixing" due to the disturbance caused by the convection below. This mixing will cool the upper layers because the lower layers are potentially colder than the upper. The tropopause can make its appearance only above this region of forced mixing. If the convection below is sufficiently active this mixing will raise the tropopause and lower the temperature there below the radiation equilibrium temperature of the stratosphere.[3] As there can be no convection above the tropopause there will be a tendency to go back to the radiation equilibrium temperature. This approach from a lower to a higher temperature results in an inversion.

The stronger the convection the greater is the cooling in the uppermost regions of the troposphere which produces lower values of Tc and hence stronger inversions above. Since on the average there is more convection in the tropics than in the temperate regions and more in summer than in winter, it follows that the stratospheric inversion should be stronger in the tropical than in the temperate region and stronger in summer than in winter. The height range through which the approach from Tc to the radiation equilibrium temperature of the stratosphere occurs determines the thickness of the inversion above the tropopause; this is larger, the larger the deviation of Tc from the radiation equilibrium temperature of the stratosphere.

If the stratospheric inversion owes its origin to convection in the troposphere, we should expect some significant relationships of temperatures and lapse-rates in the troposphere with Tc and the stratospheric inversion. Some preliminary calculations have shown that there is a strong negative correlation between the temperature at 10 gkm. and the fall of temperature between 10 and 16 gkm. over Agra. (16 gkm. is about the mean height of the tropopause over Agra). Blair [4] has shown from American observations that the seasonal variation in the height of the region of largest lapse-rates in the troposphere is similar to the variations of the height of the minimum temperature in the free atmosphere. This seems to hold for other places also.

The author states that:

for various reasons, viz, the existence of maximum concentration of ozone in the atmosphere at a height of 30–50 km., the reflection of sound waves from the upper atmosphere and Lindemann and Dobson's theory of meteors, it is, however, fairly certain that above 40 km. there is a rapid increase of temperature with height.

This opinion is not yet held by many meteorologists since all of the phenomena mentioned can be satisfactorily accounted for in other ways.—*L. T. Samuels.*

[1] India Meteorological Department. Scientific Notes, Vol. I, No. 10.

[2] Equivalent potential temperature θ is the temperature which would be taken up by a mass of air at "equivalent temperature" θ when brought adiabatically from its pressure to a pressure of 1,000 mb. $\theta = T \times \frac{Lx}{c}$ where T is the dry bulb temperature, x the humidity-mixing ratio corresponding to the existing vapor pressure at T, c the specific heat of air at constant pressure and L the latent heat of condensation. For greater details refer to Ind. Met. Memoirs, Vol. XXIII, Part I.

[3] According to the "classical" radiation equilibrium theory the temperature distribution with height is practically isothermal at 220° A. See Die Arbeiten des Preuss: Aeronautischen observatorium bei Lindenberg Band XIII, p. 6.

[4] Bull. of Mt. Weather Obs'y, Vol. IV, p. 6.

BIBLIOGRAPHY

C. FITZHUGH TALMAN, in Charge of Library

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Davison, A. E.
Dancing conductors. 6 p. figs. 30½ cm. (Presented summer convention of A. I. E. E., Toronto, June 23–27, 1930.) [Swinging of ice-laden wires in the wind.]

Febrer, Joaquim.
Atlas pluviometricède Catalunya. Barcelona. 1930. 523 p. charts. 28½ cm. (Memòries Patxot. v. 1.)

Fleming, Robins.
Wind stresses in buildings, with a chapter on earthquakes and earthquake resistance. New York. 1930. xi, 193 p. illus. diagrs. 23½ cm.

Folse, J. A.
New method of estimating stream-flow based upon a new evaporation formula. Washington. 1929. xi, 237 p. plates. 29½ cm. (Carnegie inst. Washington. Pub. no. 400.)

Great Britain, Meteorological office.
Currents on the main trade routes of the North Atlantic ... London. 1930. charts. 40 cm.
Instructions for meteorological telegraphy, embodying the new international codes approved by the international meteorological conference at Copenhagen in September 1929. London. 1930. 62 p. plates. 24 cm. (Met'l observer's handbook suppl. no. 1 (2nd ed.).) (M. O. 191/1 (1930).)
Weather map, an introduction to modern meteorology. 2nd ed., entirely rewritten. London. 1930. iv, 83 p. figs. charts. 24½ cm. (M. O. 225i.)

Hoffmeister, Johannes.
Das Klima Niedersachsens. 2 vols. Hannover. 1930. Text. 198 p. figs. plates. 24 cm. Kartenanhang. 22 charts. 24½ cm. (Wirtschaftswiss. Gesell. zum Studium Niedersachsens E. D. Reihe B der Veröffent. Forschungen. H. 6.)

Ives, James E.
Studies in illumination. III. A study of the loss of light due to smoke on Manhattan Island, New York City, during the year 1927, especially in its relation to the nature of the weather, the relative humidity of the air, and the velocity and direction of the wind. Washington. 1930. iv, 40 p. figs. plate. 23½ cm. (U. S. Public health serv. Public health bull. no. 197. June, 1930.)

Johnstone, James.
Study of the oceans. 2d ed. London. 1930. viii, 235 p. figs. 23 cm.

Kinnison, H. B.
New England flood of November, 1927. [Washington. 1930.] p. 45–100. figs. plates (part fold.) 23½ cm. (U. S. Geol. surv., Water-supply paper 636. Cont. to hydrol. U. S. 1929.)

Lambrecht, Wilh.
Neo-Meteor-Handloch-Apparat nach Prof. Dr. L. W. Pollak. Göttingen. n. d. [3 p.] illus. 21 cm. (Liste 9.)

Taber, Stephen.
Mechanics of frost heaving. p. 303–317. illus. 24½ cm. (Repr.: Journ. geol., v. 38, May–June, 1930.)

Wagner, Arthur.
Der jährliche Gang der meteorologischen Elemente in Wien (1851–1920). Wien. 1930. 88 p. 28½ cm. (Klimatographie von Österreich. 10.)

SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING SEPTEMBER, 1930

By HERBERT H. KIMBALL

For reference to descriptions of instruments and exposures, and an account of the method of obtaining and reducing the measurements, the reader is referred to this volume of the REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged close to the normal intensity for September at Madison, Wis., and Lincoln, Nebr., and slightly below normal at Washington, D. C.

Table 2 shows an excess in the total solar radiation received on a horizontal surface directly from the sun and diffusely from the sky at all stations except Fresno for which normals have been computed. The excess was marked at Washington, Madison, New York, and La Jolla.

Skylight polarization measurements obtained at Washington on 4 days during the month give a mean of 47 per cent and a maximum of 50 per cent on the 23d. At Madison measurements obtained on 15 days give a mean of 60 per cent and a maximum of 70 per cent on the 17th. The values for Washington are decidedly below, and those for Madison only slightly below, the corresponding September averages for the respective stations.

TABLE 1.—*Solar radiation intensities during September, 1930*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.

Date	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	87.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Sept. 4	9.47	0.67	0.80	0.94							7.29
Sept. 6	16.79					1.16					10.21
Sept. 9	11.81	0.46	0.53	0.56							9.47
Sept. 11	11.81	0.56	0.66	0.82	1.02						10.59
Sept. 22	13.13				0.86						12.68
Sept. 23	14.10		0.42	0.62	0.75	0.97					11.81
Sept. 26	16.79	0.73	0.86	0.98	1.09						15.11
Sept. 29	5.36	0.81	0.92	1.02	1.24						4.75
Sept. 30	6.50				0.94	1.15	1.18	0.85	0.67	0.56	6.02
Means		**0.65**	**0.70**	**0.82**	**0.98**	**1.09**	**(1.18)**	**(0.85)**	**(0.67)**	**(0.56)**	
Departures		**−0.04**	**−0.05**	**−0.05**	**−0.07**	**−0.23**	**+0.13**	**+0.00**	**−0.06**	**−0.10**	

TABLE 1.—*Solar radiation intensities during September, 1930*—Con.

Madison, Wis.

Date	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	87.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Sept. 2	12.68					1.38	1.28				10.97
Sept. 3	7.87	0.80	0.92	1.06	1.24	1.39	1.18				6.76
Sept. 4	9.83				1.14						8.81
Sept. 8	9.14				0.99						7.29
Sept. 9	9.83				1.08	1.31					8.18
Sept. 10	10.59						0.91				7.87
Sept. 11	9.47				1.00		0.97				9.47
Sept. 12	11.38						0.73				15.11
Sept. 16	8.48		0.86	0.97	1.17		1.20				6.02
Sept. 17	6.02		0.98	1.10	1.28	1.48	1.26				6.76
Sept. 18	7.29			0.99	1.17	1.39	1.06				8.18
Sept. 19	11.38				0.97	1.32					13.13
Sept. 20	5.36				1.30	1.52					4.17
Sept. 22	7.87				1.16		1.11				7.87
Sept. 23	13.61				1.05						15.65
Sept. 27	4.57				1.28						4.75
Sept. 29	4.95						1.21				6.02
Sept. 30	5.16		1.06	1.17	1.32						4.57
Means		**(0.80)**	**0.96**	**1.06**	**1.15**	**1.40**	**1.09**				
Departures		**−0.08**	**+0.05**	**+0.04**	**−0.01**	**+0.03**	**−0.06**				

Lincoln, Nebr.

Sept. 2	8.48					1.38	1.16	0.97	0.81	0.70	7.87
Sept. 3	9.47		0.81	0.82	1.00						10.59
Sept. 5	11.81			0.74	0.98						14.60
Sept. 13	14.60		0.81	0.90	1.11	1.35					15.11
Sept. 15	8.81					1.41	1.21	0.99	0.90	0.74	7.29
Sept. 16	8.81		0.90	1.06							6.02
Sept. 17	7.04	0.84	0.94	1.06	1.21	1.46	1.16	0.97	0.79	0.69	7.04
Sept. 18	10.59		0.74	0.88	1.10	1.43					9.83
Sept. 19	9.47						1.02	0.89	0.72	0.63	9.14
Sept. 22	9.83			0.86	1.07						13.13
Sept. 27	7.04				1.23	1.44	1.25	1.05	0.88	0.76	4.37
Sept. 28	5.79						1.25	1.06	0.90	0.77	4.17
Sept. 29	6.27		0.85	0.95	1.13		1.09	0.91	0.76	0.65	8.81
Sept. 30	5.16		0.84	0.99	1.20	1.43					4.57
Means		**(0.84)**	**0.84**	**0.92**	**1.11**	**1.41**	**1.16**	**0.98**	**0.82**	**0.71**	
Departures		**+0.08**	**−0.02**	**−0.08**	**−0.07**	**+0.01**	**+0.01**	**+0.01**	**−0.01**	**−0.02**	

[1] Extrapolated.