political sciences, many as teachers using our work as a supplement to geography, while there are a few preparing for the bar. These are in addition to details from the nearby balloon school at Ross Field, and the reserves.

"Needless to say the work is extremely interesting."

In December, Dr. Carpenter wrote that there were over 100 students enrolled not counting the Air Service officers who come in from near-by fields. One, on Mexican border-patrol work, flies to class from San Diego.

CLIMATOLOGY AT CAMBRIDGE UNIVERSITY, ENGLAND.

A discussion of "Geography at Cambridge University, England," published in the September, 1920, *Journal of Geography* (pp. 207–210), contains the following references to climatology:

Part I, sec. 1, Physical Geography. (*a*) The Atmosphere: Distribution or pressure, temperature, and humidity; climatic zones and provinces; changes of climate in historical times. (*b*) The Hydrosphere. (*c*) The Lithosphere.

Part II, sec. 3, Oceanography and Climatology. Oceanography... Climatology (in addition to the subjects in Part I, 1 (*a*)); discussion and reduction of series of observations of different length and value; detection of periodicities; preparation of climatological maps; changes of climate; influence of climate on distribution of animals and plants.

BRITISH LECTURES ON METEOROLOGY.

"The arrangements for lectures and classes in the current term of the School of Meteorology in connection with the Aeronautical Department of the Imperial College of Science and Technology are as follows:

1. *Mr. C. T. R. Wilson, F. R. S.*—A course of 10 lectures on Atmospheric Electricity.....

2. *Captain D. Brunt.*—A course of lectures on Dynamical Meteorology on Tuesdays and Thursdays.....(2 terms.)

3. *Sir Napier Shaw, F. R. S.*—Continuation of the course on Instruments and Methods (weather maps, forecasts, gale warnings, fog-warnings, and the artificial control of weather); lecture on Mondays..., with (daily practical work.....

4. *Sir Napier Shaw, F. R. S.*—Course of lectures for the University of London on "An Historical Review of Meteorological Theory," on Fridays....

"On March 10th and 17th, 1921, the Director of the Meteorological Office, Dr. G. C. Simpson, F. R. S., will deliver two lectures on "The Meteorology of the Antarctic" at the Royal Institution."—*The Meteorological Magazine, Jan., 1921, p. 268.*

PAPERS AT THE CHICAGO MEETING, DEC. 28–30, 1920.

(*Continued from Feb. Bull., p.* 29.)

Differences between the readings of sheltered and unsheltered thermometers in field work. H. J. Cox.

[Because of the difference of exposure, thermometer readings may vary widely. In the Wisconsin cranberry marshes openly exposed thermometers read lower than sheltered ones; and in the Carolina mountains, the readings were the same in cloudy weather but showed the same variation in clear weather as in the cranberry marshes.]

The Briggs and U. S. Weather Bureau evaporation pans compared. G. A. Loveland. (*Mo. Weather Rev.*, Dec., 1920.)

[The Briggs Pan has a relatively large amount of water in a tank set in the ground with the top of the tank near the surface of the ground. The Weather

Bureau Pan has much less water and is placed all above the ground. The Weather Bureau Pan evaporates from 30 per cent. to nearly 50 per cent. more water than the Briggs Pan. The difference seems to depend more on the air temperature than on any other weather element. (It has since been found that the difference is about what theory requires.)]

The discussion was participated in by Messrs. Marvin Cox, Patterson and Brooks, and was concerned chiefly with the merits of methods of determining evaporation. Dr. Patterson pointed out that the greater the body of water the less the evaporation, for the air is moister over the leeward portion of the lake than over the windward part. In quiet weather the relative humidity is actually lower over the middle of a lake than around the edges, owing primarily to the freer wind movement and descending air over the middle.

The distribution of climatological stations. Clarence J. Root. Read by title. (*Mo. Weather Rev.*, Dec., 1920.)

[In Illinois, where the topography is generally uniform in character and where the influence of Lake Michigan is felt only in extreme northeast, it is believed to be more valuable to reduce the number of temperature-precipitation stations and increase the number of crop-season precipitation stations. The variations of rainfall are important over small distances but other weather elements are not. The effect of the 25-mile limit between stations in Illinois and the 40-mile limit are contrasted, and both show that the number of stations could well be reduced.]

Reduction of a century of temperature observations to homogeneity. Eric R. Miller.

[Temperature records reaching back to 1819 made by the Army Medical Corps, Smithsonian observers and others in the vicinity of Madison, Wis., were reduced to Madison. A comparison of some of the data show that some of the early thermometers were exposed in the sun, but that the instrumental errors were small.]

The marked differences which can occur within short distances was illustrated by Prof. Cox in the mean temperature between the present and former location of the Chicago Weather Bureau, three blocks apart, of 1.6° F.

The normal temperature as a function of the latitude, elevation, time of day and day of the year. F. L. West. (By title.)

[In an earlier contribution (see *Mo. Weather Rev.*, July, 1920, pp. 394–396, summarized in *Science*, Dec. 24, 1920, p. 611) it was shown that the following empirical equation gives the normal temperature at any hour of any day with an average error of 2.75° F.:

$$T = Ma + \frac{Ra}{2}\cos t + \frac{Rd}{2}\cos\theta + \frac{Vv}{4}\cos\theta\cos t,$$

in which Ma is the average annual temperature, Ra the annual range, or the difference between the mean of the day with the highest normal temperature and that with lowest. Rd the daily range, Vv the difference between the daily ranges at the coldest and warmest times of year, t the time of year, and θ the time of day. t and θ are expressed in degrees, 0 to 360, beginning at the time of maximum temperature, and with 180 at the time of minimum temperature, even though this makes each degree of θ from 180 to 360 represent shorter intervals of time than does each from 0 to 180.

In this new paper, the temperatures at about 100 cities in the eastern United States, and at a number in the arid west have been grouped by latitude and altitude of the stations. It was found that in both eastern and western groups there was an average decrease in mean annual temperature amounting to 1.4° F. per degree of latitude northward. The change with altitude averaged 1° F. for 500 feet rise (from sea-level to 2000 feet) in the East, and 1° F. for 300 feet rise (from 3000 to 6000 feet) in the arid west. It was found also that in the East

the average annual temperature decreased about 0.2° F. for each 10-inches increase in average rainfall.

The average annual range increases 1.8° F. per degree of latitude northward in the East, but there is practically no change in the arid west, the range being close to 46° F. The daily range averages about the same (18° F.) throughout the East, and throughout the arid west (22° F.). The variation in daily range from winter to summer is practically zero in the East, but 12° F. in the arid west. Thus the values of *Ma*, *Ra*, can be expressed in terms of latitude φ and elevation h, while *Rd* and *Vv* are constants.

With all substitutions the general equations become:

$T = 110 - 1.4\varphi - 0.002h + (0.9\varphi - 12)\cos t + 9\cos\theta$ . . . (east).

$T = 121 - 1.4\varphi - 0.0033h + 23\cos t + 11\cos\theta + 3\cos\theta\cos t$. . . (west).

These formulae give a temperature usually within 3.5° F. of the normal for the selected time, and usually within 5° F. of the actual temperature at a particular hour on a particular day.

"The equation has practical value in such cases as the determination of early morning temperatures where heating to protect crops from frost is practiced, in calculating hourly values where thermograph records have not been taken, and for engineers engaged in laying concrete in determining the normal time in the spring and fall when freezing temperatures are experienced during working hours."—C. F. B.]

Vol. 1, page 118: In the formula the divisor 2 should have been under *Va* instead of under *Ma*.

The energy of cyclones. Alexander McAdie. (By title.)

[The problem of the origin of the energy of cyclones has long attracted the attention of meteorologists. No entirely satisfactory explanation exists, but Sir Napier Shaw has recently put forth in *Nature*, December 2, 1920, an explanation on a mechanical basis. Granting initial solar and terrestrial radiation as the cause of atmospheric motion, he considers the transformation of the energy. Convection is regarded as a *prime mover up* in connection with the prevailing westerly winds in high levels. Above the level of equal density winds flow from equator to pole and below this level from pole to equator. He postulates the existence of two great counterflows. The geostrophic wind is regarded as the main flow and surface winds are geostrophic winds lessened by friction. The actual trajectories of pilot balloons are seldom vertical, hence mental pictures of vertical convection need revision. The function of the stratosphere is conservative but not constructive. Briefly the energy of a cyclone is due originally to convection in a region with variation of wind velocity with height. There is a slow loss of energy at the ground by friction but a reinforcement by additional convection. A travelling cyclone does not carry its supply of rain a long distance but probably makes it in the low levels as it journeys on. An anticyclone is regarded as a region of descended air *if the month is taken as the unit of time.*]

At the close of the session the following resolution drawn up by a resolutions committee, consisting of Messrs. Fassig and Clough, was adopted unanimously:

Chicago, Illinois,
Dec. 29, 1920.

To the University of Chicago, and the Local Committee of Arrangements of the A. A. A. S.:

The American Meteorological Society desires to express its appreciation of the admirable arrangements made for the meetings of the Society and for courtesies extended during the sessions of December 28 and 29.

Meteorological Papers at Joint Meeting with Association of American Geographers, Dec. 30, 1920.

Rainfall Maps of Latin America. Eugene Van Cleef.

[The lack of rainfall stations and the lack of homogeneity in the periods of years covered by the observations at different places makes it impossible to con-