overlay the Plateau region. The sky was again cloudless at Grand Junction, the temperature there fell to −19°F., the dew point was −23°, and the wind blew at the rate of 6 miles per hour from the southeast. As the district, during the preceding night, had been within the Plateau-region high, and as the atmosphere was clear and dry and, in its lower strata at least, quiescent, conditions were favorable to the setting up of strong temperature inversion.

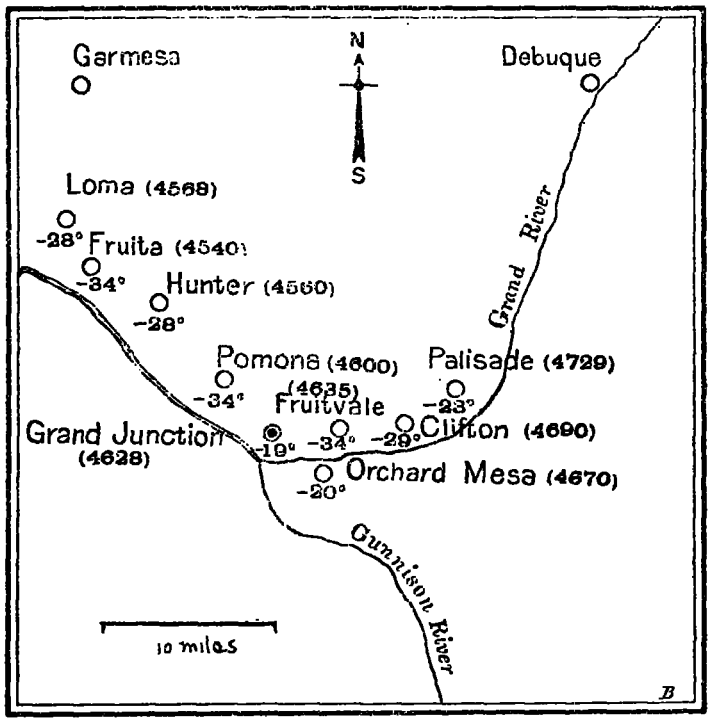

FIG. 1.—Minimum temperatures at Grand Valley stations, Grand Junction fruit district, western Colorado, January 7, 1913. (Figures in curves give altitudes in feet above sea level; temperatures in °F.)

TABLE 1.—*Minimum temperatures recorded at Grand Valley stations, western Colorado, morning of Jan. 7, 1913.*

Stations.	Elevations.	Minimum temperatures.
	Feet.	°F.
Palisade	4,729	−23
Clifton	4,690	−29
Fruitvale	4,635	−34
Pomona	4,600	−34
Loma	4,568	−28
Hunter	4,560	−28
Fruita	4,540	−34
Orchard Mesa	4,670	−20
Grand Junction (Weather Bureau)	4,628	−19

Table 1 gives the minimum temperatures recorded at the valley stations, which are arranged in order of descending elevations, except in the cases of the Weather Bureau office and the Orchard Mesa substation. These temperatures have been entered on the outline map of figure 1. Evidently the coldest air tended to accumulate close to the ground in the middle and lower parts of the district on the north side of the Grand River. This is shown by the following conditions:

1. The highest substation reading, −20°F., was taken on Orchard Mesa, the cold air from which was evidently carried, by the southeast wind that prevailed that morning, over the bluffs lying along the river on the north side of the mesa.

2. The highest substation reading on the north side of the river was −23° at Palisade in the upper end of the valley. Clifton, the next station down, reported −29°. Fruitvale, Pomona, and Fruita, still lower down, had the lowest readings, −34°.

3. The highest reading of all, −19°, was taken at the Weather Bureau office in the central part of the district but at the greatest elevation above ground.

Hunter and Loma, in the lower section, reported −28°, but this is undoubtedly higher than would have been observed in the lowlands near by. These stations are located on slight elevations in a somewhat rolling section. The same is true of the Fruita station to a less degree. Also, the office reading was unquestionably somewhat higher than would have been observed in the free air at the same elevation, on account of the influence of the office building and surrounding structures.

Assuming that the temperature in Grand Junction at a height of 5 feet above ground was −34°, the same as at Fruitvale and Pomona, above and below Grand Junction, respectively, and allowing 2° for the influence of the office building, we have a difference of 13° due to a difference in elevation of 39 feet.

Again, assuming that the temperature over that part of the valley lying on the north side of the Grand River opposite Orchard Mesa was, at the elevation of the top of the bluff on the south side of the river, the same as on Orchard Mesa, we may ascribe the difference between the Fruitvale and Orchard Mesa readings to difference in elevation. This elevation difference is not known exactly, but it is approximately 35 feet. Then we have a difference of 14° due to a 35-foot difference in elevation.

It may be noted in this connection that −19° is the lowest temperature on record at the Grand Junction office, not only for the period since the establishment of the regular station on January 1, 1899, but for the entire period of observation since records were begun by the cooperative observer in 1892. The effect of the extreme cold upon fruit trees, not only in the middle and lower portions of the Grand Valley, but also in other fruit districts of western Colorado, was, in places, serious. In places peach trees and young apple trees were killed outright. In other cases young wood on old apple trees and peach trees was killed, trunks of large apple trees were split open, and the wood of trunks and branches of large peach trees was badly discolored. A large percentage of the affected trees have since apparently recovered completely.

RELATION BETWEEN METEOROLOGICAL CONDITIONS IN THE NETHERLANDS AND SOME CIRCUMJACENT PLACES.[1]

By J. P. VAN DER STOK.

[*Reprinted from* Science Abstracts, Sec. A, Nov. 25, 1915, §§ 1494-1495.]

Atmospheric Pressure.

The methods of correlation are employed to ascertain to what extent deviations of pressure from the normal in Holland may be determined from the simultaneous deviations from the normal at certain surrounding stations. For reasons which are set forth, the three winter months December to February only are dealt with. In the first part of the inquiry 10-day means of pressure published by the "Deutsche Seewarte" are employed. Pressure variations at the Helder are correlated with those at Valencia (Ireland), Clermont, Milan, Neufahrwasser, and Christiansund. The partial correlation coefficients are worked out, and it is found that Clermont exercises the

[1] *See* Proc. K. Akad. Amsterdam, Sept. 8, 1915, 18: 310-327.

greatest influence on Helder, while Milan is the only one of the stations which has no appreciable effect. This is as might be expected when it is remembered that Milan falls within the influence of the Alps and the Mediterranean. Excluding Milan, it is found that the pressure oscillations at Helder may be accounted for to the extent of 94 per cent by means of the oscillations at the four remaining stations. It thus appears that local influences play only a subordinate part in the pressure variations at Helder, and that these latter are mainly controlled by the surges of pressure which pass over the station and the surrounding countries. The investigation covers the winter months only, so that this conclusion may not be applicable to the summer. For confirmation of these results two independent sets of three stations are taken and correlated with De Bilt. The results corroborate those already found, and it is concluded that barometric oscillations at a central point may be determined with great accuracy from as few as three well-chosen surrounding stations.

Difference of pressure and wind.

In a previous paper an investigation was made into the relation between the pressure gradient between certain stations and the surface wind.[2] The results were not entirely reliable, and in the present discussion statistical methods are employed to establish the connection. Variations from the mean value of the pressure differences between Flushing and five surrounding stations (x_1, x_2, . . . x_5) are related with the Flushing wind (x_6=north component, x_7=east component) by empirical equations of the type

$$x_6 = b_{61}x_1 + b_{62}x_2 + \ldots + b_{65}x_5,$$
$$x_7 = b_{71}x_1 + b_{72}x_2 + \ldots + b_{75}x_5.$$

The values of b_{61}, b_{62}, etc., are then determined from the observational data by the method of least squares. Making use of the resultant equations, it is found that a positive pressure gradient in the direction of Valencia produces a southeast wind at Flushing, in the direction of Biarritz an east wind, of Munich a northeast wind, of Neufahrwasser a northwest wind, and of Lerwick a southwest wind. The results both for velocity and direction of the wind are set out in a table, the surface wind which corresponds with each type of pressure gradient being given. A similar piece of work is carried out in which the average wind from four stations in the Netherlands is used in place of that from Flushing only, and by this means more regular results are obtained.—*J. S. Di*[*nes*].

[2] *See* Proc., K. Akad. wetensch., Amsterdam. Mar. 28, 1912. 14: 856-865. *Also in* Science abstracts, Sec. A, 1912, 15: § 642 (p. 207).

INTERNAL STRUCTURE OF EARTH AND MOON.[1]

By H. JEFFREYS.

[*Reprinted from* Science Abstracts, Sec. A, Nov. 25, 1915. § 1500.]

A discussion is given of the various hypotheses which have been formulated as to the internal structure of the earth, considering it to have a homogeneous metallic core surrounded by a rocky crust. The hypotheses in which either the shell or the nucleus is supposed permanently elastic have been shown to be highly improbable, so that the earth has the hydrostatic form throughout, Wiechert's hypothesis being the only possible one of this type. The paper further explains the large ellipticities of the moon by supposing it to have solidified while much nearer the earth than it is now. The fact that the moon always turns the same face toward the earth is shown to be not necessarily due to internal tidal friction, as in the absence of this the amplitude of the free libration in longitude would only increase with extreme slowness. If this amplitude had been reduced to a small amount before solidification, tidal friction would not be required in order to keep it small.—*C. P. B*[*utler*].

[1] *See* Mem. Roy. Astron. Soc., 1915, 60, 6, p. 187-217.