" C H I L E A N T E M P E R A T U R E A N O M A L I E S "

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SN: Geographical Review. 45 (3): 419-422, July 1955.

SOUTH AMERICA

CHILEAN TEMPERATURE ANOMALIES. Drawing a map of the isotherms of Chile is like calculating the numerical value of the square root of a negative quantity. In general, temperature drops with increasing altitude, but in Chile it rises, at least up to 1000 or 1500

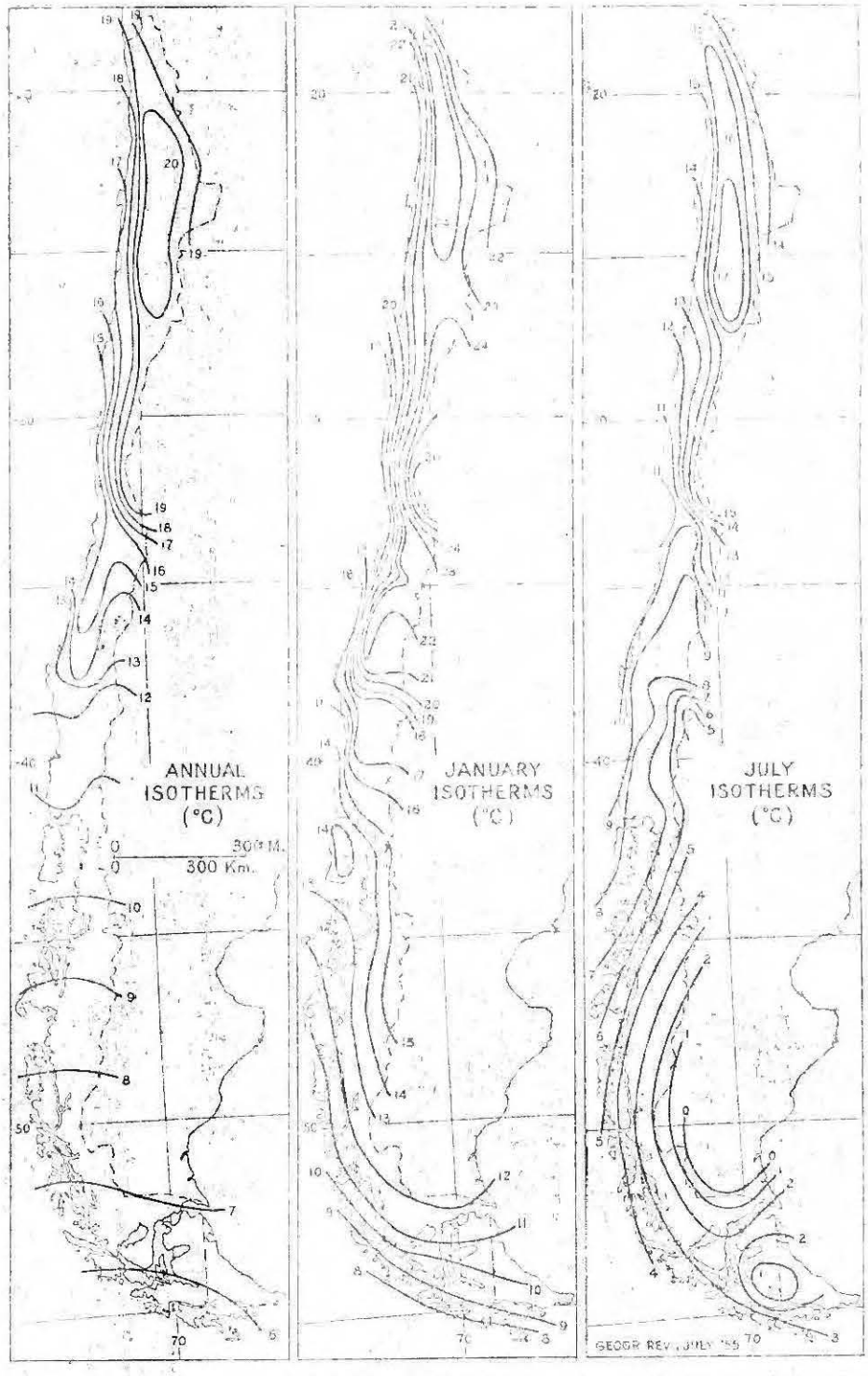

FIG. 1—Annual, January, and July isotherms of Chile, based on interval of 1° C. increase in temperature per 300 meters of altitude (see text). Tables of data used in compiling the maps are on file at the Society's building.

meters, so that reduction to sea level is meaningless if the customary rule of adding 1° C. for every 200 meters of altitude is followed.

The increase is observed not only in the valleys, as in other regions, but also in broad, level tracts. The city of Linares, for example, in the middle of a plain 50 kilometers wide, has a temperature more than 1° C. higher than that of the adjacent coast, instead of the 1° lower that it should have. At high altitudes the temperature does not actually rise, but the figures clearly indicate a marked positive anomaly. Seventeen years of observation at Refresco, in the desert at 1850 meters, shows a mean annual temperature of 14.2° C., which according to the rule should be only 8°. Canchones, at 960 meters, also in the desert on a broad plateau, has a temperature of 16.7°, whereas it should have about 13°. The Potrerillos mines, on open sloping ground at 2850 meters, show 11.2°, which should be at the most 2°; the Teniente mines, in the mountains at 2130 meters, register 9.5° instead of the 2.5° to be expected.

Under such conditions, reduction to sea level by applying the normal increase of 1° in temperature for every 200 meters of altitude would result in figures with no true significance. It has therefore seemed preferable to use a less abrupt interval, and accordingly the rate of 1° C. per 300 meters of altitude has been adopted. In this way the drawing (Fig. 1) has been simplified without concealing the influence of the cold Peru Current, which is the cause of the phenomenon. With such a method of calculation the simplification is important only in the northern half of the country, since in the southern half the influence of the cold current is small and most of the stations are situated at less than 100 meters' altitude.

The fact that the Peru Current cools the coast of Peru and of northern Chile has been known for a century and a half, ever since Humboldt observed it in the port of Trujillo; but it was not noticed that this same current, precisely because of its low temperature, warms the neighboring inland regions to the extent of causing a great anomaly in temperature. This current of cold, upwelling water creates a layer of cold and heavy air, which becomes moisture-laden by contact with the sea and forms the heavy, wet fogs characteristic of these coasts. The fogs are cooled still more by radiation, which intensifies atmospheric subsidence. The descending air is warmed by barometric compression and superimposes itself on the cold layer, which, seen from above, appears as a sea of clouds, completely separated from the clear air above it. Thus the descending air is warm when it arrives inland, where it creates not only a pronounced positive thermal anomaly on the plateau but also an anomaly in the humidity, because this air is extremely clear and dry and becomes drier as it descends. As temperatures fall in winter, the downward air movement increases, and thus we have on a small scale, at least on the Chilean desert plateaus, a condition similar to that which József Száva Kováts described for Siberia and Canada, with an atmospheric humidity less in winter than in summer.

This interesting phenomenon is not all that must be considered in drawing Chilean isotherms. When the older observations were made, the English shed with louvers entirely exposed to the sun was not used; instead, the instruments were placed in shady spots with adequate protection, and the figures thus obtained differ considerably from those obtained under current methods. At one of the old stations the present readings show an excess over earlier figures of more than 2° C. in summer and a small deficit in winter. Fortunately, at another station the present figures are higher throughout the year, somewhat more so in

summer than in winter. As this station is in a valley where the wind blows almost constantly from the northwest, the side on which the shed is warmed by the sun, the writer was led to reconsider something that has been studied a great deal, especially in Russia, but never adequately explained—the true nature of the well-known influence of sheds.

Louvers, although they prevent direct radiation over the thermometers, themselves affect the temperature. It is only natural that if the wind enters through the side heated by the sun, it will be warmed, and that in winter, when the whole shed is covered with rime, the wind will be cooled no matter from which side it enters; but more so on the shady side, where the sun does not melt the rime.

This influence is undeniable, but as reliable data obtained by the old method exist for only six or eight stations, where data obtained by the modern method are available from more than a hundred stations, it has been necessary to use the latter in full realization of their defect, which is common all over the world wherever the exposed type of shed is used.—ELÍAS ALMEYDA ARROYO