SCIENTIFIC APPARATUS AND LABORATORY METHODS

A THREE-DIMENSIONAL THERMO-ISOPLETH

THE visualization of invisible phenomena has long been a problem to the student beginning his study of the atmosphere. This difficulty is materially lessened with familiarity with the methods of observation and the devices used in the graphical portrayal of climatic data. The methods of representation have become so conventionalized that the initiated has little difficulty in visualization. The various curves used to show the march of temperature through the day, the month or the year are commonplace. The grids, or coordinates, may differ somewhat depending upon the maker but the curves necessarily are much alike. Some grids are so drawn as rather to over-emphasize the range in temperature, and others made especially for a certain set of data will not accommodate data from another region. Such diagrams as these are simple two-dimensional devices and adequately serve their purpose. But there are occasions when a three-dimensional device would be useful, provided it could be simply drawn and easily comprehended.

The diagram designed by Davis[1] to show the distribution of insolation over the earth is such a device and has been widely used by other authors. The coordinates representing the months of the year and the latitude make an isometric base on which the data of insolation are shown. The effect is a model-like diagram which may be described as a three-dimensional symbol. In spite of its value as a teaching device students continue to experience some difficulty in interpreting it. However, its continued use is sufficient testimony that it is a valuable aid to the understanding of the distribution of insolation.

The accompanying diagram is the result of an experiment in the graphical presentation of mean hourly temperatures. The common method used in depicting these data is a rectangular diagram with one set of coordinates representing the months, and the other set the hours of the day. The isotherms are then drawn on this grid and the completed diagram resembles a simple contour map. Such a diagram is called an isopleth, or a thermo-isopleth.

The method used in the construction of this diagram was suggested in a paper by Dr. Mead,[2] of the department of geology, University of Wisconsin, who has used this device for giving the ordinary topographic map a relieflike appearance. The student who is familiar with a contour map experiences no difficulty in visualizing the land forms from the symbols used on the map. Similarly, the meteorologist finds it no problem at all to interpret a thermo-isopleth. But both the contour map and the isopleth are decidedly flat diagrams to the amateur.

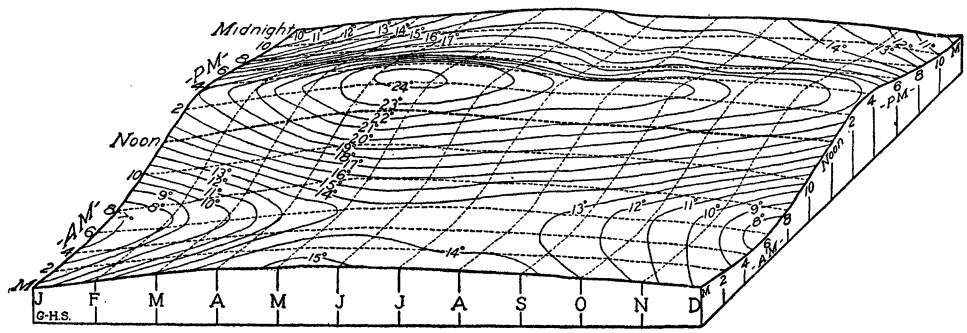

FIG. 1. A three-dimensional thermo-isopleth for Mexico City. The isotherms are drawn, one for each degree Centigrade.

The data used in the drawing of this diagram were taken from Hernández's monograph on the temperature of Mexico.[3] From the same data he constructed a conventional thermo-isopleth for Mexico City, but the accompanying diagram was made as an attempt to alter the old symbol. The construction of the diagram required two stages. The first was the devising of a base which was to be used as a grid. Instead of making the conventional grid, an isometric base was drawn, using the months for one set of coordinates and the hours as the other set. Upon this the mean hourly temperatures were plotted at the appropriate intersections. The isotherms for each degree Centigrade were then drawn, and the resulting diagram was in reality an isopleth on an isometric base, and otherwise not unlike the one made by Hernández.

[1] W. M. Davis, "Elementary Meteorology," p. 21, Boston. 1902.

[2] W. J. Mead, "A Simple Method for Making Block Diagrams," *The Wisconsin Engineer*, 25: 24–25. Nov. 1920.

[3] Jesus Hernández, "The Temperature of Mexico," *Monthly Weather Review, Supplement*, No. 23, 1923, pp. 12.

The second step in construction produced an entirely different effect. The first diagram became the basis of the new one. Along the edge of the isometric base a graduated vertical scale was drawn with the divisions —one for each isotherm—about one millimeter apart. On a new piece of tracing cloth a single marker was drawn in such a way as to coincide with the lowest division on the vertical scale. The tracing cloth was attached to a T-square in order to ensure that it could be moved the appropriate interval and maintain the same direction. With the index of the tracing on the lowest division of the vertical scale the highest, or warmest, isotherm was redrawn on the tracing. By moving the tracing upward one division on the vertical scale the next lowest isotherm was drawn, and in the same manner each lower isotherm was added to the diagram. Also the intersections of the coordinates with the isotherms were indicated, so that they could be drawn in later. After all the isotherms were drawn the ends were connected by a heavy line which had the effect of making the device appear as a block-diagram. The drawing-in of the coordinates helped to create the desired optical illusion, and the adding of a base completed the diagram except for the lettering.

A very similar three-dimensional diagram may be made on an isometric base by erecting at each intersection a vertical line representing the mean hourly temperature. The top ends can then be connected by a smooth curve more or less parallel with the corresponding coordinate. Only the coordinate curves should be shown in the completed diagram. The resulting isopleth will resemble the diagram Davis made to show the distribution of insolation.

To facilitate the construction of a block diagram from a contour map a special pantograph has been designed by Castelnau.[4] Even with the assistance of such equipment the isopleth-block diagram may require more time than its value will justify. However, the writer has found it very useful for the display of the mean hourly temperatures throughout the year.

GUY-HAROLD SMITH

UNIVERSITY OF ILLINOIS

A METHOD FOR PURIFICATION OF EXTRACTS CONTAINING THE GROWTH-PROMOTING PRINCIPLE OF THE ANTERIOR HYPOPHYSIS[1]

IN 1921 Long and Evans[2] produced gigantism in rats by daily intraperitoneal injections of saline extracts of the anterior lobe of the bovine hypophysis. In the Harvey Lectures of 1923–1924, Evans[3] described more refined methods for the extraction of the growth-promoting principle. The most potent extracts were prepared by means of extracting the ground anterior lobe tissue with sodium hydroxide and subsequently bringing the extract to approximate neutrality with acetic acid. Evans and Simpson[4] have recently reported success in obtaining growth in adult female rats with the daily administrations of as little as one eighth to one fourth cubic centimeter of such a preparation.

A modification of the method first described by Evans which made it possible for us to prepare sufficient quantity of a sterile potent extract for use in dogs has been described in a previous communication.[5]

Some months ago a study of the blood chemistry of dogs receiving this growth-promoting substance was begun, and it became desirable to free the extract from the bulk of non-protein nitrogen and certain inorganic substances. Since success had not been attained in freeing the principle from proteins an attempt to fractionate the protein was made. After a preliminary trial of salts for fractionation, sodium sulphate was selected.

Method: The usual neutralized alkaline extract is prepared as described in a previous communication. The solution is cautiously warmed to 35° C., and twenty grams granular anhydrous sodium sulphate for each 100 cc of extract is added slowly and with stirring. After about fifteen minutes the precipitate becomes flocculent and may be easily filtered. The washed precipitate is pressed as dry as possible and is taken up in one half the original volume of water.[6] The redissolved precipitate is filtered through a sterilized Seitz filter and is then ready to inject. The protein precipitate consnsts of globin euglobulin and pseudo-globulin. Further separation of the euglobulin and pseudo-globulin fractions has resulted in a division of the growth-promoting substance between the fractions. The fraction from 20 per cent. to 35 per cent. sodium sulphate which brings down nearly all of the remaining protein has not resulted in growth. The redissolved globulin extract is slightly lower in protein than the original preparation, and the sugar, phosphates, non-protein nitrogen and uric acid are reduced to traces.

[4] Paul Castelnau, "La théorie du bloc-diagrams," *Bull. de la Société de Topographie de France*, July–August, 1912, pp. 121–136.

[1] From the Surgical Laboratory of the Harvard Medical School.

[2] Evans and Long, *Anat. Rec.*, 21: 62, 1921.

[3] H. M. Evans, Harvey Lectures, 1923–24.

[4] H. M. Evans and M. E. Simpson, *Jour. A. M. A.*, 91: 18, 1928.

[5] T. J. Putnam, E. B. Benedict and H. M. Teel, *Am. Jour. Physiol.*, 84: 157, 1928.

[6] There is sufficient sodium sulphate in the precipitate to redissolve this water-insoluble protein fraction. There is also a small amount of lipoid material which does not go back into solution.