Bavarian foreland; and that as the sea withdrew the Danube was developed along its trough, engrafting into its trunk the many smaller streams that before had independent courses. As the valleys of the consequent streams were deepened, trenches were cut through the resistant strata of the white Jura, whose retreating margin was in time worn back (southeast) to form a cuesta with an infacing escarpment, while an inner lowland was opened on the weak Lias beds between the escarpment and the crystallines of the Black forest. To-day only one of the consequents (Brege-Danube) retains its course through the cuesta. The Wutach has been diverted from the Aitrach to the Rhine; the Brigach has been captured from the Elta by the Danube itself; and the Neckar has taken the Eschach from the Faulenbach. Similar changes are known for a long distance northeast of the Eschach, where the phenomena associated with the drainage of cuestas are illustrated in great variety. Penck uses the terms *Folgefluss*, *Schichtfluss* and *Gegenfluss* for consequent, subsequent and obsequent streams.

W. M. Davis.

CURRENT NOTES ON METEOROLOGY.

A NOTABLE STUDY OF ECLIPSE METEOROLOGY.

In his paper on 'The Eclipse Cyclone and the Diurnal Cyclone' (*Proc. Amer. Acad. Arts and Sci.*, XXXVI., Jan., 1901, 307–318) Clayton has gone far ahead of all previous investigators of the phenomena of eclipse meteorology. Hitherto, as a general rule, we have had little more than a few scattered observations of temperature, pressure, wind direction, etc., taken during an eclipse, and tabulated, with a brief summary of the results. In his study of the meteorological data obtained in connection with the total solar eclipse of May 28th last, Clayton has derived results of far-reaching importance, which throw light on two of the largest problems in meteorology.

The meteorological changes due to the eclipse were first separated from other changes, such as the diurnal and the cyclonic, and were then plotted on maps of the United States for 8.15 and for 9 A. M., May 28th, 75th meridian time. These maps show that the winds were practically reversed in direction as the umbra moved from one side of the continent to the other, both maps showing a distinct anticyclonic circulation and an outflow of air extending from the umbra to a distance of about 1,500 or 2,000 miles. The temperature depression due to the eclipse appears on the 9 A.M. chart as an oval area. At the central portion of this area the depression exceeds 8° Fahr., and this area of greatest cold lags behind the umbra about 500 miles. A third chart was constructed by plotting the stations at their proper distances from the path of the umbra, and plotting the successive 15-minute observations at intervals of about 500 miles, the result being a synoptic chart showing the conditions observed at any station or group of stations when they were in different portions of the eclipse area. This synoptic chart indicates distinctly an anticyclonic circulation of the wind around the center of the eclipse, extending out to a distance of about 1,500 miles from the umbra. Beyond this there are indications of another ring of outflowing winds. The isotherms show an elliptical area of cold air (inner isotherm 6° Fahr.) central about 500 miles in the rear of the umbra. There was a rise of absolute and of relative humidity during the eclipse, the shape and position of the areas showing the humidity departures being very similar to those of the temperature. The pressure changes in this eclipse, and in other eclipses, show that in normal eclipses there is a central area of relatively high pressure; surrounding this a ring of minimum pressure, and beyond this, outside the edge of the penumbra, is a ring of maximum pressure.

The low temperature, the circulation of winds and the form of the pressure curve, all proclaim the development by the eclipse of a *cold air cyclone*, as described by Ferrel. Mr. Clayton points out that the eclipse may be compared with an experiment by Nature in which all the causes that complicate the origin of the ordinary cyclone are eliminated, except that of a direct and rapid change of temperature. The result shows that a fall of temperature is capable of developing a cold-air cyclone in an astonishingly short time, with all the peculiar circulation of winds and distribution of pressure which constitute such a cyclone. The fall of temperature acts primarily to cause a cyclone, and

the anti-cyclone is a secondary phenomenon—a part of the cyclone. The eclipse cyclone, to keep pace with the eclipse shadow, must continuously have formed within the shadow, and must have dissipated in the rear almost instantly. The motion may thus be considered to have a certain analogy to wave motion.

In the light of his discovery that the brief fall of temperature in the eclipse can produce a well developed cyclone, which accompanies the eclipse shadow at the rate of about 2,000 miles an hour, Clayton believes that the fall of temperature due to the occurrence of night must also produce, or tend to produce, a cold-air cyclone. Since the heat of day produces, or tends to produce, a warm-air cyclone, there must tend to occur, each day, two minima of pressure, one near the coldest part of the day and another near the warmest part of the day, with areas of high pressure between them due to the overlapping of the pericyclones surrounding the cold-air and the warm-air cyclones, respectively. These causes must, in the opinion of the author, produce entirely, or in part, the well-known double diurnal period in air pressure, a question which has long puzzled meteorologists and for which as yet no wholly satisfactory explanation has been offered. The surface winds at Cordoba (Argentina) and at Blue Hill are in general found to be in opposite directions, and to indicate a circulation of the wind around two cyclonic centers passing along the equator, and an outflow from high pressures half way between them.

Clayton's conclusions, which are to be presented in greater detail in a forthcoming *Bulletin of the Blue Hill Observatory*, are of the greatest interest and importance. His explanation of the diurnal variation of the barometer seems to have in it many evidences of being the best yet offered to account for this puzzling phenomenon. Meteorologists will now look forward to future solar eclipses with greatly increased interest because of the importance which Mr. Clayton has shown to be attached to eclipse meteorology. It is to be hoped that Mr. Clayton may have the time and the opportunity to extend his investigation further in connection with previous eclipses.

R. DEC. WARD.

THE MAGNETIC SURVEY OF THE UNITED STATES.

ON July 1, 1899, a special division of the Coast and Geodetic Survey Office was created by the Superintendent to take charge of the magnetic survey of the United States and the countries under its jurisdiction, which up to that time had been conducted under the supervision of the Computing Division of the Coast and Geodetic Survey. Since that date magnetic observations, namely, declination, dip and intensity of magnetic force, have been made up to December 31, 1900, at about 500 stations distributed over the United States, Alaska and the Hawaiian Islands. At most of the stations permanent marks have been established for the use of the surveyor. Special consideration has also been given to the needs of the mariner, especially in Alaskan waters, where occur places of pronounced local attraction, affecting the compasses on board ship all the way from one-fourth of a point to four points.

Special stations known as 'repeat,' or 'secular variation' stations, have also been established in different parts of the country. At these, observations will be repeated at stated intervals in order to determine the amount of secular change in the magnetic elements. It is the endeavor whenever possible to establish such stations in the vicinities of colleges and universities, as experience has shown that on college grounds we may hope for a permanency of station for a fairly long interval.

Of special state surveys mention may be made first of the completion of the magnetic survey of Maryland, which was undertaken primarily by the Maryland Geological Survey, with assistance rendered by this Bureau; second, the completion of the magnetic survey of North Carolina, conducted under the joint auspices of this Bureau and the North Carolina Geological Survey; third, the completion of the magnetic survey of West Virginia, and fourth, the completion of the magnetic survey of Iowa.

Fair progress has also been made in the establishment of the Magnetic Base Stations, where the countless variations of the earth's magnetism will be recorded photographically. Thus a temporary magnetic observatory has been in operation at Baldwin, Kansas, since