helion passage occurred on the same day of April, Encke was very doubtful of the comet being visible at all in this hemisphere, and had contented himself with transmitting an ephemeris to Greenwich, to be passed on to the Cape of Good Hope. It was only after Dr. Galle had detected with the Berlin refractor, on the evening of February 8, a very faint nebulousity within $2'$ of the predicted position of the comet, that Encke communicated the ephemeris to the *Astronomische Nachrichten* (see No. 443). In 1842, on March 23, the comet was seen "distinctly in the twilight, with the moon shining brightly." At the beginning of the second week in April the condensation of light was very great, and a fine bright point was remarked: it was not seen in Europe after the 9th of this month.

BEARING OF METEOROLOGICAL RECORDS ON A SUPPOSED CHANGE OF CLIMATE IN SCOTLAND*

IT is a belief very generally entertained that the climate of Scotland has undergone considerable change in recent years, the summers being less hot and the winters less severe than they used to be. This idea was advocated by Mr. McNab in his presidential address to the Edinburgh Botanical Society in November 1873, the facts adduced in support of it referring solely to vegetation. In this paper the question is examined exclusively from a meteorological point of view, and the examination is confined to monthly mean temperatures.

The following are the records which have been made use of:—1. Monthly mean temperatures from observations made at Gordon Castle, Banffshire, from July 1781 to November 1827; 2. The monthly temperatures given in Forbes' climate of Edinburgh (Trans. Roy. Soc. Edin., vol. xxii. p. 335); 3. Observations made at Dollar from 1836 to 1856, and from 1861 to 1874; and 4. Observations made at Elgin from 1855 to 1874. The mean temperatures of the months and the year were calculated for each of these four series of observations for the interval embraced by each, and then the differences of each month's mean temperature from the general mean for that month and station were set down in a table. Since the time over which each of these series of observations extended was sufficiently long to give a very close approximation to the true mean for the hour of observation and exposure of the thermometers, and since the separate months were only compared with the means for that place, the table may be regarded as representing very closely the *monthly variations* which have occurred in the temperature of Scotland during the past ninety-four years. It may be noted that the observations were made in two districts, viz., Gordon Castle and Elgin in the north, and Edinburgh, Dunfermline, and Dollar in the south.

The variations of each year, and of each month of each year, were then projected in curves, showing graphically the fluctuations which have occurred during this long period. The coldest year was 1782, being $3^{\circ}3$ under the average, the deficiency of May of that year being $6^{\circ}7$, and August $5^{\circ}9$; then follow 1799 and 1816, being $2^{\circ}3$; 1838, being $2^{\circ}0$; and 1860, being $2^{\circ}4$ under the average. The two warmest years were 1794 and 1846, the excess being respectively $2^{\circ}7$ and $2^{\circ}9$. During the nine years from 1787 to 1795, the temperature was generally above the average; the mean annual excess of the nine years being $1^{\circ}5$. For the next quarter of a century temperatures were generally under the average. From this period to the present time there have occurred five fluctuations in the annual temperature above and below the average, differing in amplitude and duration, but giving no indication of a steady permanent change either way. Exceptionally warm and exceptionally cold months

are distributed over the period in such a manner as to show that substantially no permanent change has taken place in the temperature of any of the months.

Since, however, the eye may not be able easily to detect any steady rise or fall that may be going on owing to the sharply serrated character of the curves, other averages were calculated on the method of taking as the average of, say, January 1784, not the average of that year, but the average of the five years 1782, 1783, 1784, 1785, and 1786. All the averages were dealt with in this way, and the results projected in a set of thirteen new curves. From these consecutive five years' averages, it is seen that mild Decembers prevailed from 1787 to 1797, from 1822 to 1845, and from 1862 to 1867; and cold Decembers from 1798 to 1821, from 1846 to 1861, and from 1868 to the present time. It may be noted that in 1821 the remark might have been made from the previous forty years' observations, that the character of Christmas weather had undergone a great change, the Christmases of the latter part of the period being generally much more severe; and again, in 1843, looking at the long period of forty-seven years, beginning with 1796, it might have been said that the old-fashioned Christmas weather had almost ceased to occur in the latter half of this long period, and that the climate had undergone some great permanent change. Now, while both would have been right as to the facts (whether these facts were based on numerical data or on recollections), both would have been wrong in inferring a permanent change, even though the inference was based on the observations of half a century. Looking, however, at the ninety-four-years' period, we can only conclude that the weather of December, as regards temperature, is subject to large fluctuations, which differ both in intensity and duration, and that there is no tendency to a permanent increase or decrease.

One of the most interesting features of the curves is the similarity existing among them *inter se*. The curves for August and September closely resemble each other, as also do those for November and December, while that for October combines the main features of the two sets. The curve for January combines the main features of the curves for November and December on the one hand and February and March on the other, and so on with the other months.

The general result of the inquiry then is, that though large annual fluctuations of temperature have occurred, yet the warm and the cold cycles, extending over longer or shorter periods, are so distributed over these long intervals as to give no indication that there has been any tendency towards a steady increase or decrease in the temperature, or that any permanent change has taken place in the climate of Scotland. And since the same remark applies with equal force to the observations of the separate months, it follows that meteorological records give no countenance to the idea of a permanent change having occurred in the climate of Scotland either as regards summer heat or winter cold. It may be added that during the past seven years the temperature of July has been above its average respectively $2^{\circ}8$, $1^{\circ}7$, $2^{\circ}0$, $0^{\circ}2$, $1^{\circ}7$, $1^{\circ}0$, and $1^{\circ}8$, and that of December, as compared with its average + $1^{\circ}5$, - $4^{\circ}2$, - $5^{\circ}6$, - $1^{\circ}1$, - $0^{\circ}8$, + $3^{\circ}4$, and - $7^{\circ}4$; results quite in the opposite direction of the popularly entertained belief that the summers are colder and the winters milder than formerly.

ALEXANDER BUCHAN

NATURAL PHENOMENA IN SOUTH AMERICA*

THE following notes may, I hope, possess some interest for the readers of NATURE. They were made during an expedition which took place last

* Abstract of a paper read at the General Meeting of the Scottish Meteorological Society, held on 10th Feb.

* Notes of some observations made by a telegraphist during a cable-laying expedition from Pará to Cayenne.