the European horizon. The discussion of these observations in conjunction with those made in the northern hemisphere, will lead to a much more precise knowledge of the orbit than we have at present.

OLBERS' COMET OF 1815.—In a recent note upon this comet it should have been stated that, acting upon the wish expressed by Olbers at the time, Triesnecker printed his observed differences of right ascension and declination between the comet and comparison-stars in *Zeitschrift für Astronomie*, vol. ii. The Vienna observations, therefore, admit of a new reduction, in addition to those previously named.

DIURNAL OSCILLATIONS OF THE BAROMETER

IN the "Meteorological Notes" which appeared in NATURE, vol. xviii. p. 198, some interesting results are referred to, which show marked differences in the diurnal variations of the barometer at places quite near to each other, as Greenwich, Kew, Oxford. It is remarked especially that the forenoon maximum in the months of May to July occurs near 9 A.M. at Greenwich, and near 8 A.M. at Kew; while at Falmouth and Valentia it is delayed to 11 A.M., or noon, and occurs in June as late as 2 P.M. at Helder.

Having made several investigations relatively to these questions (which I have not been able to publish as yet in detail), I think it may not be without advantage to give at present conclusions relating to the results above noticed.

It is obvious that it is of the highest importance with relation to the research as to the cause or causes of the remarkable semi-diurnal oscillations of the barometer, that we should have only real variations of atmospheric pressure to deal with, and not instrumental irregularities; and that, if there is any part of the mean diurnal variations which is due to local causes, we should be able to separate that part from any other which may be due to general or cosmic causes.

When it is remembered that the range of the mean diurnal variation with us is from two to three hundredths of an inch of mercury, and that the epochs of maximum or minimum may be shifted an hour by a difference of one or two thousandths of an inch, it will be seen how essential it is that the instruments, the observations, and the corrections shall be the best, in order to be sure that we have real variations of atmospheric pressure before us.

In order to obtain the best possible results, my investigations have been limited to observations made in first-class observatories with standard instruments. From observations made during several years at Makerstoun, Dublin, Greenwich, and Brussels, I have sought by the harmonic analysis the functions of sines which represent them most accurately. I give here the equations for the means of the three months in question—May, June, and July. The variation, v, is in ten-thousandths of an inch of mercury; the origin for each of the four stations M, D, G, and B, is mean midnight ($\theta = 0$):—

$$\text{M}, \; v = 56 \sin(\theta + 355^\circ) + 68 \sin(2\theta + 143^\circ) + 21 \sin(3\theta + 171^\circ)$$
$$\text{D}, \; v = 51 \sin(\theta + 358^\circ) + 72 \sin(2\theta + 144^\circ) + 25 \sin(3\theta + 153^\circ)$$
$$\text{G}, \; v = 63 \sin(\theta + 346^\circ) + 88 \sin(2\theta + 143^\circ) + 25 \sin(3\theta + 154^\circ)$$
$$\text{B}, \; v = 43 \sin(\theta + 354^\circ) + 92 \sin(2\theta + 140^\circ) + 24 \sin(3\theta + 170^\circ)$$

The terms on the right of each equation represent the oscillations, whose superposition completes the whole diurnal variation. We find—

From the 1st term that the epochs of the maximum and minimum were the same within a few minutes at M, D, and B (as shown by the arguments 355°, 358°, and 354°), differing at Greenwich from the others by about 40m.

From the 2nd term, that of the semi-diurnal oscillation, that the epochs were the same at all the stations within a few minutes.

From the 3rd term, that they agreed at D and G and at M and B, those for the former being about 23m. different from those for the latter.

When we consider the coefficients of the different terms, which represent half the ranges of the oscillations, slight differences are found for the 1st and 3rd terms; for the 2nd the *range diminishes regularly as the latitude increases* at the rate of 0·00101 inch for each degree of latitude.

The exact agreement in the epochs of maxima and minima and the regularity of the variation of range with latitude in the semi-diurnal oscillation show that this oscillation obeys a general law. Dr. Lamont has supposed that the 1st term, or single oscillation, is due to variation of temperature; this, I believe, is not the case. When we compare the terms for different *seasons* of the year, we find that for the *same place* the epochs of maximum and minimum may vary twelve hours in the single oscillation, while the epochs deduced from the same term for the temperature variations do not differ one hour. Not only so, I have found on the South Indian Ghats that the epochs deduced from the 1st term of the barometric equations vary seven hours in ascending 6,000 feet; while those shown by the 2nd term are absolutely constant.

For all these reasons I conclude that the semi-diurnal oscillation of the atmospheric pressure is due to a cosmic cause, independent of local influences, while the single diurnal oscillation shows that part of the solar action which is modified by atmospheric conditions yet to be determined. The results for the four stations just given are a few links in a long chain of facts which tend to prove that the semi-diurnal oscillation of the barometer is due to an action of the sun, which is repeated equally, twice in each day, like the solar oceanic tide.

It will be seen, I think, from the results obtained from the Brussels, Greenwich, Dublin, and Makerstoun observations that the differences noticed at the beginning of this article cannot be allowed to enter as data into the domain of meteorology without much greater study of all the circumstances on which they depend. The facts of atmospheric variations are very difficult of explanation, but if we begin to admit results which may be purely instrumental among these facts explanation will become impossible.

It is a fact that the true temperature of the mercurial columns has not always been obtained, and when we have to discuss observations with self-registering instruments, many sources of error, including those of temperature on the apparatus itself, have to be cared for.[1] At stations near the sea, such as Helder, Valentia, and Falmouth, we have also to remember that in the varying height of the partial base of the atmosphere, through the *solar* oceanic tide, there is a real cause of diurnal barometric oscillation whose amount and epochs should be ascertained and deducted before exact comparisons can be made with observations inland. At the same time I would remark that of the stations here considered Dublin is near the sea, while the others are more or less distant from it. JOHN ALLAN BROUN

MAROCCO AND THE ATLAS[2]

THE expedition of which an account is given in this most interesting volume was undertaken by Sir Joseph Hooker and Mr. Ball in the spring of 1871, and lasted a little over two months. Many causes com-

[1] The observations here studied at the four observatories are all made by the eye.

[2] "Journal of a Tour in Marocco and the Great Atlas." By Joseph Dalton Hooker, K.C.S.I., C.B., Pres. R.S., Director of the Royal Gardens, Kew; and John Ball, F.R.S., M.R.I.A. With an Appendix, including a sketch of the Geology of Marocco, by George Maw, F.L.S. (London: Macmillan and Co., 1878.)