the actual data when they come to hand. A comparison of the two would soon show that weather prediction for more than a few hours ahead was impossible in present conditions.

While, however, long forecasts are, for the most part, mere untrustworthy guesswork, there are many meteorological subjects now neglected which might be investigated with success, but concerning which at present practically nothing is known. Such are the origin of the variation of electric potential in the air, the origin of thunderstorms and lightning, the coalescence or non-coalescence of cloud particles, the origin of hail and the causes which determine the shape and size of snow crystals or the volume of raindrops, the forms of clouds, and many others. Also there are more general questions still to be answered concerning trade winds and the circulation in equatorial regions. All investigations on these subjects should include the proper scales of comparison and attempts to produce corresponding phenomena on a small scale. A. MALLOCK.

New University Club, June 28.

The Rate of Ascent of Pilot-Balloons.

IN NATURE for June 17 Dr. van Bemmelen directs attention to the excess rate of rising which pilot-balloons often show in the first few minutes of their ascent, and refers to two explanations of this phenomenon which have been put forward. These are that the rapid rising may be due (1) to turbulence in the lower layers of air or (2) to the tendency of balloons to be drawn into rising columns of air and thus to partake of their upward motion. The curves reproduced by Dr. van Bemmelen, which indicate the relation between rising velocity and height under different conditions, are of great interest, and show that the effect is not found when working on a small island in the Java Sea.

As double-theodolite observations over a sea exposure are not numerous, it may be of interest to refer to

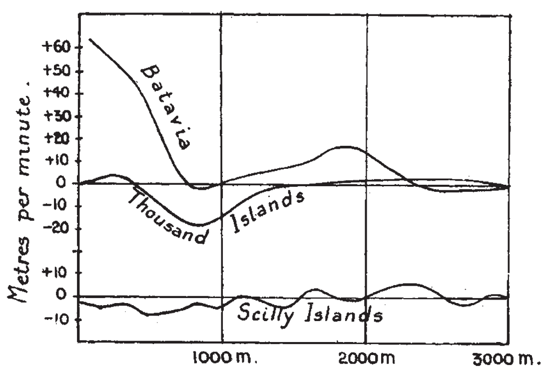

FIG. 1.

the results obtained by Capt. C. J. P. Cave and the present writer in some ascents made from the Scilly Islands during two winter months, November and December, some years ago. Particulars have recently been published by the Meteorological Office in Geophysical Memoir No. 14. The mean rate of ascent of the balloons used was found to be 160 metres per minute. Mean departures from this value for each minute of the ascent measured from the start are shown in Fig. 1. Dr. van Bemmelen's diagrams for the Thousand Islands and Batavia (0–3 p.m.) are also reproduced for comparison. It will be seen at once that the rate of ascent at Scilly, like that at the Thousand Islands, shows no excess above the normal in the first kilometre of height; if anything, the effect is slightly the other way.

Ascents in the Scilly Islands are of particular interest in this connection. The area of the islands is so small that no convection effects due to solar heating would be expected, at any rate in the winter. On the other hand, the group contains a great number of small islands of a rocky and hilly nature, and these are spread over an area of some ten miles by five. They might naturally be expected to produce some turbulence in the air passing over them, and such turbulence is, in fact, shown by the records of the pressure-tube anemometer on St. Mary's, the largest of the islands. If the excess rate of rising so frequently noticed in the first kilometre over land is due to turbulence, as suggested by Wenger, we should expect to find it in the Scilly ascents; if it is due to convection currents caused by solar heating, we should not expect to find it. The evidence afforded by this example seems clear. J. S. DINES.

66 Sydney Street, S.W.3, June 22.

Diamagnetism and the Structure of the Hydrogen Molecule.

IN a letter to NATURE of June 24 (p. 516) Dr. J. R. Ashworth has pointed out a possible origin of the diamagnetism of hydrogen by assuming oscillations or rotations of Bohr's paramagnetic hydrogen atom or molecule. Granted that such motions tend towards a diamagnetic effect, it is important to examine the plausibility of such a view in the light of recent experimental data. We know that:

(1) The specific susceptibility (χ_H) of *gaseous hydrogen at* 16° *C.* is $-19{\cdot}8(2)\times10^{-7}\pm0{\cdot}15\times10^{-7}$, with a mean error of 0·76 per cent. (Také Soné, Science Reports, Tôhoku, vol. viii., p. 115, 1919). *No variation of this, within the limits of experiment, could be detected over a pressure range of* 1 *to* 68 *atmospheres.*

(2) The value of χ_H for *liquid hydrogen at a temperature less than* $-253°$ *C.* is -27×10^{-7} (Onnes and Perrier, Proc. Amsterdam Acad., vol. xiv., p. 121, 1911).

(3) The value of χ_H for atomic hydrogen in various types of chemical combination, as deduced from the additive law of atomic diamagnetism for the hydrocarbons, is $-30{\cdot}5\times10^{-7}$ (Pascal, *Ann. de Chim. et de Phys.*, vol. xix., p. 5, 1910).

(4) There is no definite evidence that the diamagnetic susceptibility varies simply with temperature over a range $-180°$ C. to 20° C. Such small variations as do occur never change the sign of χ (except in the case of tin), and are attributable to changes of molecular grouping, *e.g.* crystallisation or aggregation (Ishiwara, Science Reports, Tôhoku, vol. iii., p. 303, 1914; A. E. Oxley, Phil. Trans. Roy. Soc., vol. ccxiv., A, p. 109, 1914).

(5) The theory of molecular rotation developed by Honda and Okubo (Science Reports, Tôhoku, vol. vii., p. 141, 1918), which is similar to that proposed by Dr. Ashworth, accounts for the diamagnetism of hydrogen and helium only if we suppose molecular rotations of angular velocity $6{\cdot}54\times10^{14}\,\text{sec}^{-1}$ and $3{\cdot}80\times10^{15}\,\text{sec}^{-1}$ respectively. In the case of the paramagnetic oxygen molecule it is necessary to suppose that *there is no rotation whatsoever* in order to obtain