and evaporation, its amount varies daily, and with locality, and on two sides of a given station it reaches a maximum at different times.

Experiments bearing upon these Suggestions.

(1) Ten men and boys, representing a load of about 1000 lbs., at a distance of 15 feet from the stone column carrying the pendulum in my house, causes it to move as if the ground had been depressed upon the side of the load.

(2) By quickly emptying a well, which is distant about 100 feet from the above column, of about two tons of water, which was run off down a hill, the pendulum moved away from the well, behaving as if the ground had been relieved of a load on that side.

(3) A self-recording tide-gauge was set up in an unused well 80 yards distant from the underground chamber. This showed that the water in the well rose and fell ¼ to ½ inch *twice* every 24 hours. The times of sinking, which occur in the morning and the evening, may correspond with the times at which the most water is being drawn from wells in the city. I have not determined whether these movements have any influence upon a small wave which is often superimposed upon the large diurnal wave.

(4) I find from experiment that on fine days the ground in my garden may lose by evaporation 4 or 5 lbs. of moisture per square yard, or from an area measuring 20 by 20 yards about 1 ton.

I also observe that during a bright fine day that, in most cases, pendulums move away from areas that are being relieved of loads in this manner, and which may therefore be rising.

(5) Because it often happens that a board which has been lying on the grass all night is found in the morning to be wet on its under side, whilst all around the grass may be dry, the following experiment was made on sub-surface condensation. Two shallow trays about 1 foot 6 inches square were filled with earth, and placed on a flat surface of earth in my garden. One of these trays had a bottom of sheet tin, whilst the other had a bottom of fine wire netting. These were weighed morning and evening, and it was found that sometimes the box with the fine wire netting had increased in weight, while the other had not changed. The inference from this is, that during a hot day the ground is sensibly heated to a depth of one foot. This was proved by diagrams from self-recording thermometers, which for periods of a week had been buried at varying depths. After sunset the surface of the ground is quickly chilled, and aqueous vapour rising into this is condensed to augment the surface weight.

An open area, which during a day may have lost more weight by evaporation than a neighbouring area which is covered, will, if both areas are connected with the same subterranean water supply, gain the most in weight, not only by an action of this sort, but also by the condensation of moisture as it escapes from the surface, and by the precipitation of moisture from the atmosphere. These actions may in part account for the retrograde motion of pendulums during the night. Although differential evaporations and condensations are apparently sufficient to account for certain observations made in Japan, other observations exist to which they are not so apparently applicable. The cause of diurnal waves is therefore not yet known with certainty.

(3) *Earth Tremors.*

The continuous photographic records taken in Japan have thrown much new light upon the occurrence of tremors, while an experiment made at Shide in the Isle of Wight, where a light horizontal pendulum has been established to record earthquakes having their origins in distant localities, has indicated a cause of movements which probably have often been attributed to movements of the ground.

We know that tremors are more frequent during the winter than during the summer, that they are frequent with a low barometer, and still more frequent when the locality of observation is crossed by a steep barometrical gradient. From these latter accompanying conditions, it may be inferred that tremors may occur whenever a strong wind is blowing, although near to the observing station the atmosphere may be perfectly calm. Recent observations in Japan have shown that tremors are more frequent during the night than they are during the day, and that maxima of motion are reached between 5 and 9 a.m. In fact, some instruments have always shown movements about these hours. One very important observation is that the greatest movements have been recorded by the lightest pendulums. For example, a pendulum having a boom from one quarter to four inches in length is a better tremor recorder than one which has a boom several feet in length.

The pendulum at Shide was set up upon a newly-built brick pier. Because moisture was given off from this, the inside of the covering case became exceedingly damp, and the bromide film became sticky. To overcome this difficulty, two trays of calcium chloride were placed inside the covering. A few minutes after this it was observed that the pendulum commenced to swing. When the calcium chloride was removed the pendulum came to rest. This experiment was repeated several times, and the conclusion arrived at was that rapid desiccation produced air currents of sufficient intensity to cause a light pendulum to move, and the diagrams of these movements are not distinguishable from those attributed to *earth* tremors. Although experiment has shown that differences in temperature of the walls enclosing a light pendulum will cause the same to swing, I have no reason to think that movements due to such causes have been recorded. All that can be said at present is that a difference in the rate at which moisture is absorbed by or evaporated from the different walls of a casing covering a light pendulum, may cause the same to swing. Before we should attempt to explain why such movements are marked at particular hours, and occur with certain meteorological conditions, the necessity of further experiments is obvious. Air currents can hardly explain a set of tremors lasting several hours, where a seventeen seconds pendulum moves back and forth with uniform amplitude and a uniform period of two or three minutes.

(4) *Earthquakes.*

At Kamakura, on the hard rock, the greatest earthquake motion has been given by the pendulum which records tilting parallel to the dip—suggesting the idea that in this direction there is an easier yielding (like the opening and shutting of a concertina) than there is in a direction parallel to the strike. The movements, even for unfelt earthquakes, are sometimes as much as 40 mm., and a disturbance may continue for several hours. On March 22, I and my colleague, Mr. C. D. West, watched an earthquake for 1 hour and 47 minutes, during which time the pendulum did not *swing*, hut was *forced* backwards and forwards intermittently, and with extreme irregularity. These earthquakes are in the form of earth waves, and usually come from a great distance. A sharp shock which may be felt throughout Tokio and at many places in the country, does not disturb the pendulums, and it is difficult to find a blurr on the photographic trace.

As in previous years, before certain local earthquakes I have observed abnormal tilting, an explanation for which is suggested in the section on the wandering of pendulums. It is seldom that abnormal tilting has taken place without local disturbances. Local disturbances, unless they are large, which fortunately is of rare occurrence, are only recorded by seismographs.

One disturbance which I recorded at three stations in Japan was one which had its origin near to the antipodes of that country in the Argentine Republic. The conclusion to be derived from this and other observations is that a large earthquake may be recorded at any point upon the surface of the earth. The preliminary tremors seem to reach distant places with a velocity twice or three times that with which mechanical vibrations can be transmitted through glass or steel. Possibly they come *through* our earth, which therefore may have a higher effective rigidity than hitherto supposed. The undulatory motions which follow the tremors may be transmitted as surface quasi-elastic gravitational waves. Their velocity of propagation lies within the limits of expectation. The chief object of the instrument established in the Isle of Wight is to determine whether it is sufficient to record the unfelt movements due to earthquakes originating in distant localities.

The first certain records of earthquakes having their origin at great distances were obtained by Dr. E. von Rebeur-Paschwitz, whose recent death has deprived the world of one of the most active workers in the new field which has been opened to seismologists.

JOHN MILNE.

THE ANTWERP METEOROLOGICAL CONGRESS.

TAKING advantage of the attendance of numerous visitors, scientific and otherwise, that the Antwerp Exhibition was likely to attract, it was proposed to hold, under the auspices of the Geographical Society of that city, a congress on meteor-

ology, aerial navigation, and allied subjects, with the particular object—as we gather from the circular convening the congress—of promoting the methodical and general observation of aerial currents. Authorities propose, but contributors decide, the result and character of the meeting, and the *compte rendu* of the congress, which has just reached us, shows that while a variety of interesting topics was brought under the notice of the members present, and discussed with greater or less detail, the ultimate aim of the promoters does not seem to have been materially advanced. Of course, the awakening of public opinion and the diffusion of information are always desirable, and the Committee responsible for the congress are to be congratulated upon the general success which has attended their efforts, though it may not be precisely in the direction they proposed to themselves.

One circumstance certainly told against the development of any complete plan, demanding the co-operation of many nationalities. The date of the congress (August 16–18) was unfortunately chosen. It clashed with the meeting of professional meteorologists, who were in session at Upsala, and thus prevented the attendance of those who could have given authority to any well-considered scheme, whose guidance would have been welcome, and whose reputation would have added weight. The President (Lieut.-General Wauwermans) had to announce, therefore, many letters of apology for non-attendance from men of science who had hoped to be present. His address was in the main historical, dealing with the progress of aeronautics and ballooning from the time of Montgolfier to the present, and a consideration of the benefits that would accrue to many mechanical applications from the more perfect knowledge of atmospheric motion and aerial currents. This address was delivered to the whole congress, which afterwards divided into two Sections—one, under the presidency of M. Lancaster, to discuss the subject of aerial currents; the other, directed by M. Van den Borren, more immediately concerning itself with aerodynamics.

To the first Section, M. Lagrange contributed a paper on the sympathetic movements of freely-suspended needles, whether magnetised or not. These practical experiments are the outcome or completion of a mathematical inquiry, published by the author in 1892, entitled, "Étude sur le Système des Forces du Monde physique." The experimental inquiry has been spread over more than two years; while two sets of apparatus—one in the cellar of the observatory, the other on a level with the ground—have been under observation. The direction in which the needles point is not constant; but both sets show a tendency to travel in azimuth from north-west to south-east from April to June, and then to retrograde towards the original position. The reason for this oscillation is discussed at great length; the author attributes it to the mechanical conditions under which a permeating fluid similar to ether would be placed when affected by all the forces, gravitational and electrical, that are continually operative. The practical result is, that further observations, conducted at a depth 30 metres below the surface, are to be prosecuted at the Royal Observatory, Brussels, and a member of the congress will carry out similar observations at the Meteorological Institute of Roumania. Canon Spée discussed the well-worn question of a possible connection between the area of spotted surface on the sun and the temperature of the earth, and, like others before him, is driven to the conclusion that any connection is not apparent. The meeting closed with a new theory of tides, both oceanic and atmospheric, but the "new" theory was not well received, and is not described in the *Compte rendu*.

At he second meeting of the Section, some papers of minor importance were read and discussed. One member read a note on the treatment of diseases of the ear by compressed air, and invoked the aid of meteorologists in a matter of aero-therapeutics. Another had something to say on the forces that affect the rotation of the earth, but this was summarily dismissed as a theory "qui aboutit à la fois à des déductions d'ordre scientifique et d'ordre philosophique." Another had arranged a system of magnetic needles with a view to the solution of the problem of weather prediction. The subjects, it will be seen, were sufficiently varied; we can only refer to two. One, by M. Lancaster, on the preparation of synoptic charts, in which he insisted on the regular publication of maps showing atmospheric currents. He indicated the progress that had been made in investigations of that character, and suggested the formation of an international bureau for the consideration of the subject. A vote of the congress supporting his views was forwarded to the Meteorological Congress sitting at Upsala.

M. Plumandon, meteorologist to the Observatory of the Puy de Dome, read a paper on the causes of storms and atmospheric disturbances. He had availed himself of the difference of altitude of the Puy de Dome (1467 m.) and of Clermont Ferrand (388 m.) to compare the variations of barometric pressure at the two levels. In summer the pressure is raised less above or falls more below the mean value at Clermont than at the summit of the Puy de Dome. The opposite rule obtains in the winter. M. Plumandon deduces from his discussion that the production of storms coincides with the greatest separation of the two barometric curves, and that storms cease when the separation is sufficiently small. Put otherwise, this means that storms occur when the ascending currents reach a sufficient intensity, and, further, that absolute values of the pressure are of less importance in producing storms than the magnitude of the separation of the barometric curves at a high and low level. M. Plumandon has also interesting remarks on the relative velocities of wind at high and low stations in the same district, derived from observations at Pic du Midi and Toulouse, at Tour Eiffel and Parc Saint Maur, Paris, and other places, from which it appears that the higher station does not always suffer most from violent winds, but that there are regions at considerable altitude where the air is on the whole less agitated than at the surface of the ground.

In the Section devoted to aerodynamics, M. Van den Borren gave an able address on the subject of aerial navigation as it stands to-day, enriched by the experiments of many able mechanicians. M. Borren, as chief of the military aerostatic service of Belgium, and having charge of the School of Aerostation at Antwerp, was able to give an interesting account of what had been there accomplished under his own eye. Experiments have been carried on to determine the resistance offered by the air to planes at different inclinations, and to surfaces of various figure, as well as to the preparation of machinery arranged for different rates of locomotion and constructed of various materials with the view of determining the friction of the air on different substances. That is to say, the problem has been studied with all the attention that experience has suggested, and the conclusion to which this expert arrives is, that the problem of aerial locomotion no longer presents any serious difficulties, that the theory is satisfactorily established, and that one may venture to proceed to execution. Neither does size offer any insuperable objection to this optimistic view. He calmly contemplates the manufacture of an aerostat 300 metres long by 30 broad, dimensions which approach, if they do not exceed, those of an Atlantic liner. An historical sketch of the progress of meteorology closed the sitting.

At the second meeting, M. Lancaster gave an account of the observations on the velocity of the wind in Belgium. In the main the author agrees with the results to which M. Hann, of Vienna, had been previously led. The paper, which is of great interest, appears in full in an annexe, forming the second part of the *Compte rendu*, being the memoirs presented to the congress. Another paper, to which we give only a brief reference here, is from M. Ventosa, astronomer at the Observatory of Madrid. It has for its object the determination of the direction of wind at high levels from observation of star images, and also that of the sun. This subject came before the meteorological committee at Upsala, and seems to have been well received, since M. Ventosa was encouraged to continue his observations (see NATURE, vol. li. p. 185; also p. 179 of this number).

THE HUXLEY MEMORIAL.

THE following is the official report of the first meeting of the General Committee, formed for the purpose of establishing a memorial to the late Right Hon. T. H. Huxley, P.C., held in the Museum of Practical Geology, Jermyn Street, on Wednesday, November 27, 1895. Present—250 Home Members of the General Committee. His Grace the Duke of Devonshire, K.G., in the chair.

The Duke of Devonshire, in opening the proceedings, said:—

My Lords and Gentlemen,—It would be in the highest degree presumptuous on my part if I were to attempt, in the presence of so many distinguished men of science as I see around me, to offer anything in the nature of an estimate of the character and work of Prof. Huxley, or of the services which he has rendered