thousand times the received signal, and higher in special cases. New wireless apparatus, shown by the Marconi International Marine Communication Co., Ltd., embraced direction finders for use in ships, a special installation for ships' lifeboats including direction-finding equipment, and a duplex telephone set—designed to enable ships within 50 miles of land to communicate by telephony with offices on land, utilising on land the ordinary telephone installation. The last is at present under trial at Southampton in co-operation with the General Post Office. Other very recent apparatus included a small X-ray spectrograph (Adam Hilger, Ltd.), made to the design of Dr. A. Müller, embodying details valuable for the analysis by crystal structure of crystals and powders, and a barograph of special construction for survey work (by Negretti and Zambra). The latter has a range of 4 inches on the chart to represent 1 inch variation of barometric pressure, and the instrument can be set to a standard barometer, anywhere from 25 in. to 31 in. of mercury, the temperature compensation being effective over this range. Mr. S. G. Brown's frenophone was another exhibit on which attention was focussed. This is a new "loud speaker" in which magnification of sound is obtained by an ingenious mechanical device dependent on the great friction existing between cork and glass.

But, in the space of a short article, justice cannot be done to all the interesting and instructive exhibits contained in the convenient and well-illustrated handbook issued by the exhibition committee. The local officers of the Association, the exhibition committee, and, in particular, the chairman of the committee, Capt. F. W. Bain, are to be congratulated on the success of this new departure, and it is to be hoped that they may be rewarded by seeing the present exhibition as the first of a long series in future years.

M. A. GIBLETT.

Terrestrial Magnetism in France.[1]

A DECREE of July 28, 1921, created an Institute of Geophysics attached to the Faculty of Science of the University of Paris, and the new institute has assigned to it the work in terrestrial magnetism previously entrusted to the Meteorological Service. There was established at the same time a Central Bureau of Terrestrial Magnetism for France and her colonies. The director of both bodies is the editor of the volume under notice, Prof. Ch. Maurain. He contributes an historical account of magnetic observations in France, and a study of disturbances due to electric traction. Recent magnetic history in France, as elsewhere, is mainly a tale of the devastating effects of electric traction. Parc St. Maur, which commenced its career as a magnetic observatory in 1883, had to be replaced in 1901 by Val Joyeux, and fears are now entertained for the future of Val Joyeux. There are already two electric lines in the district, one coming within 4400 metres, the other within 3000 metres of the observatory.

A discussion by M. Baldet of observations made at Berizaréa in Algeria represents magnetic work done in the colonies. The greater part of the volume, pp. 38-249, is, however, devoted to a discussion by M. Ch. Dufour of the magnetic observations at Val Joyeux from 1915 to 1921. This practically represents seven years' work rolled into one. In the earlier part of the memoir the results of the same species for the seven years appear in immediate succession. Thus we have 9½ consecutive pages of Fourier coefficients for the diurnal variation of D (declination) and H (horizontal force) calculated for every month from January 1915 to December 1921, while pp. 60-94 are devoted to a description of the magnetic disturbances recorded during the 84 successive months. The principal magnetic storms are dealt with in 23 plates at the end of the volume, Z (vertical force) curves being reproduced as well as D and H. The time scale is only 1 cm. to the hour, and details of rapid oscillations are difficult to follow, especially for the largest storms, among which the storm of May 14-15, 1921, is pre-eminent. A rather unusual feature is that movement up the sheet represents decrease in all three elements. On p. 95 is a résumé of mean absolute values of seven elements at Val Joyeux from 1901 to 1921. The plan of the work then alters, the years being treated separately. The material given for each year has some special features. There are, first, for each month mean daily values for D, H, and Z, and hourly values confined to 6h, 12h, 18h, and 24h. The absolute daily maximum and minimum of D and their times of occurrence are included, and a word or two describes the character of the day. Then follow diurnal inequalities for the 12 months, apparently from all days, for 7 elements, and a table containing mean values for the 24 hours of the representative day of the year, derived respectively from all days and from quiet days. Following this is a most elaborate presentation of results from the five international quiet days of each month. Absolute values are given for each hour of each day for six elements.

The last part of the volume, pp. 250-298, contains a most valuable discussion of the magnetic results at Parc St. Maur and Val Joyeux from 1883 onwards by the veteran magnetician, M. A. Angot, late director of the Meteorological Bureau. This is a perfect mine of information for the magnetician. We have first diurnal inequalities for D, H, Z, and I (inclination) for the twelve months, derived independently from 18 years' records at Parc St. Maur, and from 17 years' records at Val Joyeux, stations both in the neighbourhood of Paris. Then we have diurnal inequalities for seven elements based on the whole 35 years, and ascribed to Paris. Following this there are Fourier coefficients for the 24-, 12-, 8-, and 6-hour waves corresponding to these inequalities. An elaborate investigation is made into the possibility of representing the annual change in the amplitude and phase of the several Fourier waves in terms of the longitude of the sun in its apparent annual path.

Another question minutely considered is the annual variation, meaning thereby the variation left in the mean monthly values of the elements after the elimination of the secular changes, assumed to progress at a uniform rate throughout the year. Use is made of mean monthly values of seven elements from 1883 to 1920, recorded in tables on pp. 278-284. The range obtained for the annual inequality in D, 0·23′, seems the smallest found anywhere as yet, but a suspicious feature in previous results has been the tendency for the apparent range to diminish as the number of years available has increased. For most of the other elements there are quite substantial ranges, *e.g.* 0·80′ in I (maximum in November, minimum in June), and 17·37γ in H (maximum in June, minimum in November). The ranges for these two elements are somewhat larger than those found for Kew[2] from a shorter period of years, but the

[1] Annales de l'Institut de Physique du Globe de l'Université de Paris et du Bureau Central de Magnétisme Terrestre. Publiées par les soins de Prof. Ch. Maurain. Tome Premier. (Paris: Les Presses universitaires de France, 1923.)

[2] Roy. Soc. Phil. Trans., vol. 216, p. 238.

maximum and minimum occur in the same months at the two stations.

A very complete investigation follows into the secular change, based on a table, on p. 287, of mean annual values at Parc St. Maur reduced to Val Joyeux, and at Val Joyeux, extending from 1883 to 1921. Some small differences may be noticed from M. Dufour's table on p. 95. On p. 288 reference is made to the possible influence of sunspots on secular change. As several magneticians have supposed such an influence to exist, it is important to note that M. Angot's results are wholly negative: "il semble impossible de retrouver . . . la moindre trace d'une périodicité de onze années." Secular change has followed almost identical courses at Paris and London. The change of D in late years has been very rapid, the easterly movement at Paris from 1916 to 1921 being 48·1′. H attained a maximum in Paris in 1912. Afte falling continuously until 1913, I has been rather oscillatory, there being a rise from 1914 to 1918, but a fall since.

As a final contribution to the subject of secular change, M. Angot has tried to represent the value of D at Paris from 1541 to 1921 by a simple harmonic fluctuation about a mean value. The formula giving the best results is

$$D = 6{\cdot}55^\circ + 15{\cdot}85^\circ \cos 2\pi(t - 1814)/480,$$

t being the date in years. The agreement between this formula and observation is quite good from 1541 to 1891; but since 1881 the excess of the observed westerly declination over that calculated has steadily increased until in 1921 it was 3·2°. The publication of this volume promises well for the future of the new Institute of Geophysics of the University of Paris.

C. CHREE.

University and Educational Intelligence.

THE Department of Aeronautics of the Imperial College of Science and Technology, which was established in 1920–21, has issued a pamphlet showing the courses available during the session 1923–24. The work is conducted in three sections, design and engineering, meteorology, and navigation, and a complete course normally occupies two years, the second often including research and experimental work.

THE university extension division of the University of Colorado exemplifies the wide range of services offered by a modern state university in America. This "division," described as "simply a vehicle by means of which the various departments of the university may be made available to the people of Colorado," includes not only a department of instruction (correspondence, class, vocational, and visual), but also a "department of public service" comprising bureaus of community organisation (for promoting public health, child welfare, recreation, and kindred subjects), business and governmental research, library extension, home-reading courses, high school debating league, high school visitation, and supply of public speakers. The range of public service which the university is willing to undertake is, in fact, limited only by its capacity to perform them.

FOR many years an admirable system of continuative education has been given in Great Britain in H.M. Dockyard Schools. Boys enter the dockyards as the result of competition, and the effect of this is a high standard of teaching in the primary and secondary schools of dockyard towns. When the apprentice has entered the dockyard, he has to attend school for eleven hours each week, partly in the afternoons in his working hours, and partly in the evenings. He is under strict naval discipline during these educational periods, and absence from school without sufficient cause leads to loss of pay, or to suspension or dismissal if the offence is repeated. Attendance is compulsory for every apprentice in the first year, but at the end of each of the four years of the normal course the least successful students are sent away from school. There is thus a continual weeding out of the mentally unfit, with the result that, at the end of the fourth year, the students who remain represent the best products of a wise combination of theoretical and practical training and are able to compete successfully for any scholarships in which applied science and mathematics are given prominence. The announcement of the result of this year's competition for Whitworth senior scholarships and Whitworth scholarships affords a remarkable example of this fact. The number of competitors for the former—of an annual value of 250*l.* tenable for two years—was 19, and for the latter—annual value of 125*l.* tenable for three years—was 142. Of the two senior scholarships awarded, one was to a former dockyard apprentice, now at the Royal Naval College, Greenwich. Of the six other scholarships, four were awarded to dockyard apprentices, and of the twenty-five Whitworth prizes of 10*l.* each given to unsuccessful candidates, twenty-one were awarded to dockyard apprentices. These splendid results are most creditable to the instructors in H.M. Dockyard Schools, and they show that the Admiralty system of education is a potent force for technical training and development in Great Britain.

THE prospectus for 1923–24 of university courses in the Manchester Municipal College of Technology contains the new regulations for the B.Sc. Tech., which provide for higher courses, distinct from, and at least one year in advance of, the ordinary degree courses, to extend over three years from the standard of the present intermediate examination for the degree, or the Higher School Certificate. The college offers courses of post-graduation and specialised study and research in various branches of engineering, applied chemistry and chemical technology, textile industries, applied physics, and mining engineering. The calendar of the Merchant Venturers' Technical College, Bristol, gives particulars of university degree courses, including the Bristol "sandwich" scheme of training for engineers. This comprises three periods of ten months each in the university, followed severally, the first by 14, the second by 2, and the third by 14 months in certain engineering works to which the university undertakes to recommend suitable students. Loughborough College, which has on its Board of Governors representatives of the Universities of Cambridge and Birmingham as well as of the Leicestershire County and Loughborough Town Councils, publishes full details of its equipment and courses in engineering and chemical technology and of its School of Industrial and Fine Art, Junior College, and extra-mural department, together with a list of some 250 students who qualified in 1922 for the College diploma, conferred for the first time in that year. The diploma course covers five years and its special feature is that, unlike the various "sandwich" systems, it provides for continuously concurrent training in engineering theory and practice. The Sir John Cass Technical Institute, London, announces, among others, special courses of higher technological instruction in brewing and allied industries, petroleum technology, colloids, alternating currents and electrical oscillations, metallography, foundry practice, mining and surveying.