

Tropical Cyclones of the Pacific.

By E. V. NEWNHAM.

REFERENCE was made in a recent article on "The Tropical Cyclone" (NATURE, Oct. 9, 1926) to the need for a more complete knowledge of the meteorological conditions in the regions where these storms form, in order to test the correctness of the various theories of the origin of cyclones that have been brought forward at different times. It might have been added that our knowledge is very incomplete even as regards the frequency of their occurrence, the paths which they follow, and the length of life of individual storms, and this is particularly true for the Pacific Ocean. A new work has recently been published, which fills up a few of the gaps in our knowledge.¹ The materials for this work were collected in 1921-1922, when the author spent a year in visiting tropical Oceania and the Far East in order to gather information about cyclones at first hand from resident white officials; he also visited the Meteorological Bureau of the Australian Commonwealth and the Japanese Marine Observatory, as well as various other meteorological centres in the East, in order to study local synoptic weather charts and to discuss his subject with those who have made a special study of the cyclones of those regions.

It appears from Visher's work that, in defining the two remote eastern areas of cyclone-formation, it would have been better not to have restricted the eastward extension of those areas, for although it may be true that more cyclones occur in the western than in the eastern half of the Pacific, many undoubtedly occur near the western coasts of America both north and south of the equator; so many must occur unrecorded in the Western Pacific, unrecorded because of the small number of islands inhabited by educated white men and because of the small number of ships that pass westwards beyond American coastal waters, that an accurate estimate of their average annual number and of their distribution is at present impossible. Visher, indeed, lays great stress on the under-estimation that has been made of the number of storms over the tropics as a whole. If attention is not confined to the most violent and destructive storms, the season of cyclonic activity expands from the summer and autumn to the whole year, and, judging from those regions near the western border of the Pacific for which reasonably detailed synoptic charts are available, for example, the regions around Australia and Japan, the annual number must be very large. Of these a considerable proportion appear to pass out of the tropics, and, by the large exchange of air between tropical and temperate latitudes to which they give rise, exert a big influence upon the weather of both zones, and upon the general circulation of the atmosphere of the whole earth.

The idea that tropical cyclones are of rare occurrence appears to have been held by many meteorologists, and has probably arisen because, on the average, only a small proportion of the total area

within the tropics is affected annually by winds of hurricane strength, and a large part of this proportion is open ocean traversed only occasionally by ships. In considering the exchange of air between the tropical and temperate zones, the numerous lesser systems of low pressure are probably, in the long-run at least, as important as the relatively few destructive storms. Visher gives a table of annual frequencies of recorded tropical cyclones which is reproduced here. It should be noted that, in view of the large number of storms and disturbances that are

AVERAGE ANNUAL FREQUENCIES OF RECORDED TROPICAL CYCLONES AND CYCLONIC DISTURBANCES.

	Severe Hurricanes.	Lesser Hurricanes and Cyclones.	Cyclonic Disturbances.
Western North Pacific (110° to 140° E.)	10	20	50
Central Pacific (140° W. to 140° E.)	2	4	..
Eastern North Pacific (E. of 150° W.)	2	3	..
Western South Pacific (130° W. to 160° E.)	5	10	10
Australian Region (110° E. to 160° E.)	5	8	10
South Indian Ocean	8	5	..
Arabian Sea	2	2	..
Bay of Bengal	2	6	> 2
North Atlantic	3	2	> 2
Totals	39	60	> 74

not recorded, the figures are intended as conservative estimates, much below the true totals.

These give an annual total for all classes of cyclone of more than 173.

Two other points of particular interest that are brought out in the paper under notice are:

(1) The unexpectedly large number of cyclones that occur within 8° of the equator in the Pacific, especially in the neighbourhood of the East Indies.

(2) The apparent absence of any kind of direct relationship between the number of cyclones that occur in the Pacific and the physical state of the sun, as revealed by the number of dark spots that are visible.

With regard to the first point, two cases of cyclones originating not more than 4° from the equator in the North Indian Ocean during the period 1900-1912 have been recorded.² Visher was informed by T. Okada, Director of the Japanese Imperial Marine Observatory, that the meteorological conditions at Jaluit (lat. 6° 8' N., long. 170° E.) indicate typhoons west and south-west of that island, and in a table giving particulars of the place of origin of typhoons that were first reported within 8° of the equator, Visher gives one in latitude 4° N., and several in latitude 5° N. These cases are interesting in that they show that although some deflexional effect of the earth's rotation is necessary to prevent air from flowing directly into a centre of low pressure and so filling it up, the amount need only be very small.

The second point mentioned above requires little comment. All Visher's ingenuity in handling the available statistics, so as to bring out any connexion that there may be, gives negative results. Although several earlier investigators have claimed that there is a connexion, it appears very unlikely that there is a simple direct relationship, when it is remembered that the variations of the solar 'constant' of radiation between times of sunspot maximum and minimum,

¹ "Tropical Cyclones of the Pacific." By S. S. Visher. Bernice P. Bishop Museum. Bulletin 20, Honolulu, Hawaii. Published by the Museum, 1925.

² "Hurricanes and Tropical Revolving Storms." By Mrs. E. V. Newnham, Geophysical Memoir No. 19, Meteorological Office, 1922.

if any systematic variations do in fact exist, must be very small, and the effect of a variation of the intensity of solar radiation upon terrestrial atmospheric processes is likely to be complex.

Another negative or almost negative result of some practical importance relates to the varying degrees of storminess experienced in different years in the Far East. Visher has studied the question as to whether unusual storminess in the early part of a storm season is an index to the probable storminess of the remaining part of that season, and finds that the storminess of June is little or no index, whereas that of July may be of some value. There seems, in general, to be some slight positive correlation between the number of cyclones in one month and the number in the remaining months of the season. This applies to the Far East as a whole, and not to one particular district. It should be noted, however, that variations in the completeness of the information about the number of storms that occur each year would give rise to a spurious positive correlation.

There are many other items of interest in this work which cannot be discussed here, among them a section on the effect of cyclones on the dispersal of life from island to island in the Pacific. The bibliography is very extensive, containing 209 references to other works and articles, and to interviews with other meteorologists.

University and Educational Intelligence.

EDINBURGH.—We have already announced the gift to the University by the International Education Board of the Rockefeller Foundation of a sum of £74,000 for the purpose of assisting towards the establishment of a new Department of Zoology. Of this sum, £38,000 is set aside towards the cost of building, £10,000 is for equipment, and £26,000 for endowment. The University already had available from the gift of the late Dr. Laurence Pullar and from the Carnegie Trust a sum of £41,000 towards the cost of the building. The work will be proceeded with at once, and plans will be prepared by Sir Robert Lorimer in consultation with Prof. J. H. Ashworth. The new Department will be at the King's Buildings on the south side of the city, adjacent to the Departments of Chemistry and Geology.

LONDON.—The Laboratory of Civil and Mechanical Engineering at University College is to be named "The Cowdray Laboratory of Civil and Mechanical Engineering," in recognition of Lord Cowdray's generous gifts, amounting to £20,000, to the Faculty of Engineering at the College.

The title of reader in geology in the University has been conferred on Mr. George McDonald Davies, in respect of the post held by him at Birkbeck College. Mr. Davies studied at Birkbeck College. From 1908 until 1920 he was assistant, and latterly senior assistant, in the Mineral Laboratory of the Imperial Institute, and from 1906–20 he held part-time posts at Birkbeck College. Since 1920 he has been head of the Department of Geology at Birkbeck College. His published work includes "Elementary Crystallography" (with Dr. J. W. Evans, 1924), "Tin Ores" (1919), and numerous papers in geological journals.

The following degrees have been conferred:—D.Sc. in botany on Miss Nesta Ferguson (King's College and Royal Holloway College) for a thesis entitled "The *Aloineæ*—a Cytological Study, with especial reference to the Form and Size of Chromosomes"; D.Sc. in chemistry on Mr. J. W. Cook (University College and the Sir John Cass Technical Institute) for a thesis entitled "The Reactivity of *meso*-substituted Anthracenes"; on Mr. S. B. Dutt (Imperial College

(Royal College of Science)), for a thesis entitled "(1) A Theory of Colour on the Basis of Molecular Strain. The Effect of Chromophoric Superposition; (2) Ring-chain Tautomerism, Parts I. and II."; and on Mr. W. G. Shilling (East London College), for a thesis entitled "The Temperature Coefficient of the Molecular Heats of Gases"; D.Sc. in statistics on Mr. Kazutaro Yasukawa (University College), for a thesis entitled "Contributions to the Mathematical Theory of Statistics." D.Sc. (*Economics*) on Miss M. C. Buer (London School of Economics), for a thesis entitled "Health, Wealth and Population in the Early Days of the Industrial Revolution"; D.Sc. (*Engineering*) on Mr. W. D. Dye, for a theses entitled "(1) The Piezo-Electric Quartz Resonator and its Equivalent Electric Circuit; (2) A Self-contained Harmonic Wavemeter," and other papers.

A SPECIAL course of seven lectures on modern developments in regard to fuel is to be delivered at the Sir John Cass Technical Institute, Jewry Street, Aldgate, London, E.C.3, on Mondays at 6 P.M., beginning on Feb. 7. The lecturers include Mr. F. S. Sinnatt on low temperature carbonisation and Prof. J. S. S. Brame on liquid fuel.

THE Ellen Richards Research Prize of the value of 2000 dollars is being offered for award in 1928 "to a woman of any nation on the basis of distinguished scientific research." In countries where there is a national federation of university women this federation may appoint a committee of experts to nominate candidates. Where there is no such federation, nominations may be made by individual women holding university positions. Federations may each nominate three candidates, individuals one. Nominations must be in the hands of the committee before Jan. 15, 1928. Applications for information, circulars, or nomination forms should be sent to the secretary, Mrs. Samuel F. Clarke, Williamstown, Mass., U.S.A.

THE Free Place Scholarships Examination, 1926, in the County of Kent, formed the subject of a special investigation conducted, at the request of the Education Committee, by Mr. Andrew Bell. The results of the investigation have been published in a 55-page pamphlet obtainable from the Director of Education, Springfield, Maidstone (price 1s. post free). The examination, which is, in Kent, controlled in each secondary school district by the school headmaster, includes—in addition to a written examination, consisting of English, arithmetic, and intelligence test, for which the maximum total marks assignable are 250—an oral test carrying, as a maximum, 100 marks. The Kent County Association of Teachers put forward as one of a series of recommendations, which led to the demand for a special inquiry, a proposal that the oral part of the examination should carry as many marks as the written examination, and one of the objects of Mr. Bell's inquiry was to determine whether this proposal should be adopted. The chapter of the report dealing with this question is of special interest in view of its bearing on the pronouncements of the Board of Education Consultative Committee in paragraph 80 of its report on psychological tests of educable capacity, wherein emphasis is very strongly laid on the value of oral interviews as a means of discovering latent ability and promise. Mr. Bell's conclusion is that in the present state of our knowledge regarding the technique of the interview, it is undesirable that the marks for the oral examination (which each headmaster has full liberty to conduct according to his own ideas) should be increased.