

THE ROYAL OBSERVATORY, GREENWICH

THIS year's Report of the Astronomer Royal refers to the work of the Royal Observatory during the period May 1, 1941–April 30, 1942. London suffered few air attacks during this time, and no further damage to the Observatory has occurred. Daylight observing is still carried on at Greenwich, but the larger instruments will, of course, remain dismantled for the duration of the War.

The public time service continues to function from two out-stations, each maintaining, in case of breakdown at the other, a complete time service involving transit observations, clock maintenance, and transmission of time signals to the Post Office and the B.B.C. The Rugby vernier signals, which are the precision British time signals, have up to the present normally been transmitted from Station B, since the clocks at station A are mounted in temporary fashion and suffer from serious mutual interference. During the year, however, the three free-pendulum clocks and a quartz clock at station A have been remounted in a specially constructed building, and it is hoped that their behaviour will now be sufficiently improved to allow this station to share regularly in the transmission of the rhythmic signals. The published corrections to the Rugby signals and to foreign signals are now based on some or all of nine clocks—seven Shortt clocks and two quartz oscillators—mounted in various parts of the country. By working on a "mean clock" and by making certain changes in the routine of signal transmission, a distinct advance has been made in the precision of the Rugby signals, the value of which as a day-to-day frequency standard has thereby been increased. Accurate allowance for land-line lag is now made before each signal is transmitted. Comparison of the signals against the clocks, or of one clock against another, is now facilitated by the use of thermionic panel units which eliminate the variation of lag inevitable with mechanical relays. Inter-comparison of the clocks has shown that in the matter of small erratic changes of rate even the best free-pendulum clocks are inferior to quartz clocks.

The Chronometer Depot has settled down into its new quarters, and repair, rating and issue of chronometers and watches to the Royal Navy have continued without interruption. A vibration machine constructed in the Observatory workshop has been brought into use for testing aircraft watches under service conditions. Tests of the effect of magnetic fields of strengths up to 8.5 gauss on the rates of chronometers and watches have been instituted, no doubt with war conditions in mind, and are now nearing completion.

The last report of the Observatory stated that work with the Airy transit circle had been terminated after ninety years continuous observation. Since then, news has been received of the destruction of Pulkovo Observatory during the bombardment of Leningrad. This will be such a serious loss to fundamental positional astronomy that observations are to be resumed with the old Greenwich instrument on a restricted programme, including particularly transits of the sun. Minor damage to the housing of the instrument has therefore been made good, the instrument has been overhauled, and work will be resumed shortly. Analysis of previous observations with this instrument arranged according to wind

direction shows that declinations south of the zenith are measured larger by about $0.10''$ when the wind is north-east than when it is south-west. The observations of latitude variation had already given a similar result. This agreement shows the advisability in positional astronomy of applying locally determined latitude variations so as to eliminate spurious annual terms due to systematic seasonal fluctuations in wind direction. The division errors of the fixed circle of the new reversible transit instrument show on analysis a cyclic error, recurrent every $2\frac{1}{2}^\circ$, which may reach $0.19''$; thus emphasizing the need of determining the division error of each graduation.

The photoheliograph observations show that the expected decline in solar activity continues, though there have been four notable periods of resuscitated activity. Of the four big spot groups the area of which exceeded 1,000 millionths of the hemisphere, two exhibited bright eruptions in H α light which were later followed by great magnetic storms on the earth. Assuming that the magnetic storms were caused by solar corpuscles emitted at the time of maximum intensity of the chromospheric eruptions, the mean time of travel of the particles is calculated as 20 hours.

The Nautical Almanac Office continues its essential work. Last year's report referred to the destruction by fire of the type and plates for most of its publications: during the early part of the year under review printing delays due to this circumstance and to a change of printing contract caused a dangerous accumulation of arrears. The Nautical Almanac for 1942 was in fact not published until November 3, less than two months before the date to which it refers, but the arrears are being wiped off so satisfactorily that the 1943 edition appeared on April 3. The failure of communications with many of the other ephemeris offices has led to a small increase of computational work; but duplication is avoided so far as possible by interchanging information with such of the offices as are still free to collaborate. The War has hastened a decision which would have been reached in any event, namely, to abandon the indiscriminate provision of occultation reduction elements. The observations for 1938 and 1939 show that the majority of the computed reduction elements are never in fact used, owing to the particular occultation not being observed; and of the remainder most are used once only. In future the Office will do the individual reductions for all observations actually made, provided that observers will do that portion of the reduction depending solely on their position and that of the star. A revision of the Air Almanac has recently been planned in conjunction with the Air Ministry: the effect will be to redistribute the data on the two pages allotted to each day, one of which now becomes a "night" page and the other a "day" page. The change should result in greater simplicity in use, at the expense of a slightly larger page. The present R.A.F. Star Charts are based on a recent investigation carried out by the Office on the optimum method of identification of the stars used in aerial navigation.

The Magnetic Department of the Observatory, in addition to the regular daily observations of the magnetic elements, is at present engaged in preparing charts for the Admiralty showing the iso-magnetic lines in declination, horizontal intensity, inclination and vertical intensity. The declination charts, of which the previous edition was published in 1937, are now ready; those for H and dip, for which the

previous editions are dated 1922, are well advanced. Vertical-intensity charts are a novelty.

Features of the year's weather observed at Greenwich include a very wet August (4.146 in.) followed by an unprecedented lack of rain in September and October, during which only 1.41 in. fell. The winter was conspicuous for cloudiness, the sunshine recorded being only 55 per cent of the average, and for consistently low temperatures in January and especially in February, which had a record number of days (twenty-six) on which temperatures below freezing were recorded.

Visitors to Greenwich Park will miss the famous 24-hour clock dial at the shattered main gates of the Observatory, and the daily fall of the time ball; but the familiar domes are still there, though somewhat perforated, and the Wren building still stands guard over the all too characteristic bend in the river. Meanwhile, as the familiar, never-failing "six-pips" testify, the work of the Royal Observatory goes on.

RELICT VEGETATION OF THE SHILLONG PLATEAU, ASSAM

AN account has been given by Dr. N. L. Bor, forest research botanist at the Dehra Dun Institute (*Ind. For. Rec.*, vol. 3, No. 6, Govt. of India Press, New Delhi, 1942), of the vegetation of the Shillong plateau. The broad divisions are evergreen forest, pine forest and grassland. The status of each type is discussed. An analysis of the evergreen species in three widely separated groves shows that floristically they are related. The conclusion reached is that the climax is the evergreen forest, while the pine forest and the grassland are seral in status. This is a bald summary by the author; for there is much that is fascinating, and some important lessons to be learnt from the record.

Shillong, the summer capital of the Province, is situated in the Khasi and Jaintia Hills district. The portion here dealt with is the elevated tableland stretching from Cherrapunji, reputed the rainiest spot in the world (900 in. have fallen in a single year), in the south to Shillong in the north; it consists of a wide plateau of rolling downs intersected here and there with narrow gorges and some 4,000-6,400 ft. in elevation, the latter near Shillong.

The three great divisions of the vegetation are grassland, pine forest and evergreen forest, and here as in so many other parts of the world their distribution or survival has been due to man and his actions. Thirty years ago, the *Imperial Gazetteer of India* stated of the Khasi and Jaintia Hills: "At an elevation of 3,000 ft. the indigenous pine (*Pinus khasya*) predominates over all other vegetation and forms almost pure pine forests. The highest peaks are clothed with clumps of oak, chestnut, magnolia, beech and other trees, which superstition has preserved from the wood-cutter". Both Hooker, 1849 ("Himalayan Journals") and Griffith (1837) recorded their impressions of the scenery, and both were struck with the bareness of the country, the great expanse of grassland on the rolling downs. Bor states that after the lapse of a century they have very much the same appearance to-day. The clumps of evergreen forest mentioned in the *Gazeteer* of thirty years ago also still exist, solely because they are regarded as sacred. Hooker has recorded that

the flora of the Shillong plateau, in comparison with the area it occupies, is probably richer in the number of flowering plants than any other area similar in size in the whole of Asia.

The inhabitants of the plateau are of Mongolian stock and have maintained themselves intact for many centuries. By nature and practice they are shifting cultivators, termed Jhuming in Assam and Bengal. All the hill tribes in Assam live in this way, the most wasteful of all forms of cultivation. As Bor correctly points out, in the distant past when populations were small and forest areas extensive, little harm was done, but he writes: "it is a very different tale when the cultivators live in stationary settlements and their numbers continue to increase. What one may call 'saturation point' has now been reached by most of the hill tribes and one of their most urgent problems is that of the exhausted soil which must produce more at more frequent intervals. Some tribes solve this question by having permanent fields which they can irrigate, others manure their fields, while the Khasis go to the trouble of growing forests [of pine] which can be cut down and the area occupied by them cultivated".

Since the evergreen groves are sacred, it is the pine forest areas which are selected for cultivation. It is impossible to follow the author in his interesting descriptions of the methods used; he mentions that the introduction of the potato in 1830 has greatly increased the pine forest cultivation. Immigration by Nepali graziers, encouraged by the chiefs for the revenue they bring, has taken place for many years past and the graziers, says Bor, "are undoubtedly responsible for the devastation of forest over very large areas. In areas which were covered with forest a century ago, nothing but grassland remains, and on the whole it is very poor grassland. This grassland is composed of rather coarse species and it is fired by the graziers as soon as it is dry enough in order to obtain the new flush, which is eaten by cattle. Under treatment of this kind grassland degenerates rapidly and loss of soil by erosion is very considerable". This might equally be written of Africa.

From the forest-botanical point of view the interesting part of Bor's paper is his investigations into the evergreen forest or groves. It is stated that the pagan Khasi regards these groves as the abode of his tribal gods and is forbidden by tribal custom to fell, lop or damage a tree in any way; no flower may be plucked, no fires lit, no cattle grazed. He believes that the deity inhabiting the grove deals out punishment to those who break the tribal custom in this respect. This punishment is usually sudden death. Bor expresses the fear that with the conversion work of the missionaries—he might have added the inevitable arrival of Western civilization, so-called—there will result the loss of tribal veneration for the sacred groves, which will then fall to the evils of the axe, fire and so forth; a regrettable loss of what in his opinion are the remnants of the former forest which spread over much of the region. For Bor's reasons the paper must be consulted, but he shows quite definitely that the climate of the region is a 'forest' one as opposed to a 'grass' one. But surely it should not be beyond the power of a present-day administration to protect by other means what the uncivilized tribesman has for so long safely protected, even when that strict guardianship was due to what the Western peoples regard as purely pagan faith. A study of the depreciated grassland and pine