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THE BRITISH ASSOCIATION.

WE reported some of the proceedings in our last, and now complete our notice. The following were, we believe, the only papers bearing upon Meteorology :—

- A.—Report of Committee on Meteorological Photography (1).
- A.—Report of Committee on Solar Radiation (2).
- A.—Report of Committee on Underground Temperature (3).
- A.—Report of Committee on the Ben Nevis Observatory (4).
- A.—Dr. A. BUCHAN.—On the Scottish Rainfall (5).
- A.—J. PARK HARRISON.—On Lunar Curves of Mean Temperature at Greenwich : and the Heat of the Moon (6).
- B.—Dr. S. RIDEAL.—Iodine Value of Sun-light in the High Alps (7).
- B.—Report on Earth Tremors (8).
- C.—Report of the Committee on Underground Waters (9).
- C.—Report of the Committee on the Volcanic Phenomena of Vesuvius (10).
- E.—Address of President (11).
- E.—Report on the Climatology of Tropical Africa (12).
- E.—Report of the Committee on Antarctic Exploration (13).
- H.—OSBERT H. HOWARTH, C.E., F.R.G.S.—Life at High Altitudes in the Great West (14).

We have prefixed the letter of the Section before which each report or paper was read ; it does not say much for organization that they should have been distributed among five Sections. Numbers 3 and 8 were given in our last ; Number 5 did not arrive ; of Numbers 6, 7, 10, and 14 we have not been able to obtain particulars. All the others are noticed below :—

Fourth Report on the Application of Photography to the Elucidation of Meteorological Phenomena. Drawn up by the Secretary, MR. A. W. CLAYDEN.

In presenting their report on the work of the last year, your committee have but little to say on the subject of the representation of clouds and lightning by photography. They consider that their collection is nearly complete as far as the different varieties of cloud form are concerned, and it is only likely to be increased slowly and at long intervals by photographs of scarce forms of clouds or by particularly interesting series. During the year, the Secretary has secured many new negatives, but since the collection already includes satis-

factory examples of the same types, it has not been thought desirable to add more duplicates, and the offers of co-operation from other photographers have not been fulfilled.

With regard to photographs of lightning also, the collection has not been increased, for your committee have not been made aware of any photographs which show any features not already familiar, and no opportunity has occurred for the Secretary to make any observations for the further elucidation of the known phenomena.

Your committee propose to invite the Royal Meteorological Society to take charge of such photographs from their collection as are not likely to be required for further investigation.

The attention of the committee has been drawn to another application of photography which seems to open up a possibility of very valuable work. This is in the measurement of cloud altitudes.

This is a question which has become more important since the acceptance by the Munich Congress of the system of cloud nomenclature devised by Hildebrandsson and Abercromby, and it is remarkable that few actual measurements have been carried out.

As far as your committee are aware, the only measurements of the kind which have been systematically organised in this country are those which were begun some years ago at Kew.

It is not only important to have more observations, but it is specially desirable to have them from other places than the vicinity of London for comparison, and in the residence of the Secretary, at Exeter, such an opportunity is presented.

In the course of experiments on methods of cloud photography, it has been found easy to secure well-defined images of clouds, even when the sun is in the middle of the field of view. If then two such photographs are taken simultaneously by a pair of cameras at some distance apart, there will be a displacement of the image relatively to that of the sun. The amount of this displacement will depend upon a number of things, but it will be increased by adding to the focal length of the lens, and by increasing the distance between the cameras. By knowing these values, and the altitude and azimuth of the sun, the distance of the cloud and its height above the ground may be calculated without difficulty.

The azimuth and altitude of the sun at the time of exposure may be ascertained by direct observation, or it may be found by calculation from the known time at which exposure was made. There seems to be a manifest advantage in thus using the sun as a fixed point of reference, and it provides a means whereby any error in the observation of altitude and azimuth may be effectively checked.

Your committee have therefore prepared a pair of cameras so constructed that they may be easily directed towards the sun. They are provided with lenses of 18 inches focus, covering a plate of whole-plate size, thereby giving a large displacement, and allowing room for a displacement of several inches. The lenses are provided with adjustable shutters which can be simultaneously freed by an electrical attachment. They are placed on stands which serve as cupboards for them when not in use.

At present for purely trial purposes they are placed in the Secretary's garden at a distance of thirty-five yards, yet even that short distance gives a displace-

ment of half an inch with clouds 3,780 feet distant. This, of course, is too small for very accurate measurement, and would be far smaller with high level clouds, the determination of the altitudes of which is most important.

The intention of your committee is to place them on a plot of level ground by the side of the London and South-Western Railway near Exeter. There is available a strip of waste ground just over a quarter of a mile in length, commanding an uninterrupted view of the sun from sunrise until nearly sunset. The ground is level, and the cameras can be placed due east and west, thereby greatly simplifying the reduction of the observations.

The directors of the London and South-Western Railway have kindly consented to allow the ground to be used under conditions which seem to your committee quite satisfactory, but which involve the payment of a nominal rent of £1 per annum. The cameras would have been placed in position by the present time had it not been necessary to get another meeting of the committee to sanction the agreement.

The method is easy to apply, and promises to yield results at least as accurate as any which have yet been tried; therefore your committee ask for re-appointment, with a grant of £10.

Dr. Hugh R. Mill gave the results of a bathymetrical survey of the English lakes. Ten of the largest English lakes were sounded by the author, assisted by Mr. E. Heawood, Mr. Shields, and others, and the final discussion of the work enabled a tabular statement to be drawn up, which showed the following and other details:—

Name.	Length, miles.	Depth, feet.		Volume, million cubic feet.
		Max.	Average.	
Windermere	10·50	219	78½	12,250
Ullswater.....	7·35	205	83	7,870
Wastwater ...	3·00	258	134½	4,128
Coniston	5·41	184	79	4,000
Crummock	2·50	144	87½	2,343
Ennerdale	2·40	148	62	1,978
Bassenthwaite.....	3·83	70	18	1,023
Derwentwater.....	2·87	72	18	1,010
Haweswater	2·33	103	39½	589
Buttermere	1·26	94	54½	537

There are two main types amongst these lakes, the shallow and the deep. The former including only Derwentwater and Bassenthwaite, are the broadest of all the lakes, and they average only 18 ft. in depth. The bed of these lakes may be roughly described as an undulating plain, grooved and ridged into shallow hollows, and low shoals running parallel to the long axis of the lake. The second, or deep type, the shallowest of which has an average depth of 40 ft., comprises all the other lakes. Ennerdale combines the characteristics of both types, conforming to the deep type in its upper, to the shallow in its lower, reach. They are long, narrow, sometimes winding like Ullswater, or slightly curved in outline like Wastwater and Haweswater. The most characteristic lie in long, narrow valleys with steeply sloping sides, and the slopes are con-

tinued under water with almost equal steepness—in some cases with greater steepness—and terminate in an almost flat floor. The typical form of this class of lake is thus a steep-sided flat-bottomed trough, diversified along the slopes by the still steeper conical mounds of *débris* thrown down at the mouths of streams.

Third Report of a Committee on the Climatological and Hydrographical Conditions of Tropical Africa. Drawn up by MR. E. G. RAVENSTEIN.

YOUR Committee, up to the end of July last, had issued five sets of meteorological instruments at a cost, including forms, carriage, &c., exceeding £100. The first of these sets was entrusted to Mr. J. W. Moir (British Central Africa), the second to Mr. Buchanan (British Central Africa), the third to Captain Gallwey (Warri, Benin), the fourth to the Rev. C. Bonzon (Lambarene, on the Ogowe), and the fifth to the Rev. R. Glennie (Bolobo, Congo). A sixth set is kept in reserve for British East Africa.

Two of these sets, namely, those in the hands of Mr. Buchanan and Mr. Glennie, include Fortin barometers, whilst that granted to Captain Gallwey includes a black bulb thermometer.

Observations up to the latest possible date have been received from Mr. Glennie, Mr. Bonzon, and Dr. Roth, as representing Captain Gallwey.

Instructions have been issued to the officials of the Royal Niger Company to make their observations in future in accordance with the rules laid down by your Committee, and the like step is contemplated by the British East Africa Company.

Summaries of meteorological returns are appended to this report. Your Committee are quite aware that these observations are not in every instance as complete and trustworthy as could be desired. In some cases the hours of observation are ill chosen (a very common occurrence), in others the instruments are defective, or the corrections to be applied to the readings are unknown. If they are published notwithstanding it is done because they refer to localities concerning which nothing or very little is known at the present time.

Quite a number of meteorological records offered to the Committee for publication have had to be rejected as being on the face of them utterly untrustworthy. It seems a pity that so much time and labour should have been wasted upon recording observations which, with a little forethought and caution, might have furnished important information on the climate of Tropical Africa.

The grant of £5 made to the Committee last year was not claimed.

[From the tables appended to this report we have prepared the following abstract.—ED. M.M.]

ABSTRACT OF METEOROLOGICAL OBSERVATIONS IN AFRICA.

Name of Station ...	Bolobo	Warri	Kips Hill	Namirembe	Fort	Ribe	Mochi	Sagala
Territory	Congo	Benim	Niger	Uganda	Salisbury		Kilimanjaro	Taita
Latitude	2° 10' S.	5° 31' N.	8° 48' N.	0° 18' N.	17° 50' S.	3° 55' S.	3° 18' S.	3° 32' S.
Longitude	16° 13' E.	5° 51' E.	6° 25' E.	32° 34' E.	31° 4' E.	39° 40' E.	37° 23' E.	38° 35' E.
Altitude.....	1080 ft.	10 ft.	—	4000 ft.	5050 ft.	500 ft.	5000 ft.	3300 ft.
Observer	Rev. R. Glennie	Capt. Gallwey	Rev. C. Paul	Rev. E. Millar	Major Forbes	Rev. T. Wakefield	Rev W Morris	Rev J A Wray
Period of Observtn.	1891-3	1891-3	1881	1893-4	1891-2	1876-77	—	—
Rar. { Time of Obs.	7, 2, 9	—	—	—	—	9, 9	—	—
at 32° { Mean pressure	28.813	—	—	—	25.398	29.492	—	—
(Time of Obs. ...	7, 2, 9	—	9, 9	—	—	6, 3, 9	—	—
Mean	77°·5	80·1	81	67·2	66·2	78.8	65	72
Mean Max.....	85·9	85·8	—	76·9	78·9	? 83	73	83
Mean Min.	70·7	74·4	—	57·4	53·5	? 76	57	61
Absolute Max..	96·6	99·0	96	85·8	93	92	82	96
Absolute Min. .	55·0	68·0	74	52·1	34	69	50	54
Mean Range ...	15·2	11·4	—	19·5	25·4	? 7	16	22
Absolute Range	41·6	31·0	22	33·7	59	23	32	42
Rain per year*	56 in.	150 in.	—	35 in.	34 in.	51 in.	—	—
Prevalent Wind ...	—	—	—	—	E. N. E.	E. S. E.	—	—

* Computed and only a rough approximation.

Address to the Geographical Section, by CAPTAIN W. J. L. WHARTON, R.N., F.R.S., Hydrographer to the Admiralty, President of the Section.

THIS address dealt exclusively with features analogous to those treated by Maury in his "Physical Geography of the Sea." We can reprint only some of the principal facts.

After long hesitation and much argument, I think that it may now be safely held that the prime motor of the surface currents of the ocean is the wind. Not, by any means, the wind that may blow, and even persistently blow, over the portion of water that is moving, more or less rapidly, in any direction, but the great winds which blow generally from the same general quarter over vast areas. These, combined with deflection from the land, settle the main surface circulation.

I do not know if any of my hearers may have seen a very remarkable model devised by Mr. Clayden, in which water disposed over an area shaped like the Atlantic, and sprinkled over with lycopodium dust to make movement apparent, was subjected to air impelled from various nozzles, representing the mean directions of the permanent winds. It dispelled the last doubt I held on the subject, as not only were the main currents reproduced, but the smaller effects and peculiarities of the Atlantic drifts were produced with surprising accuracy.

There is a small current, long shown on our charts, but which I had always regarded with suspicion. I refer to the stream which, after travelling from the Arctic Ocean southward along the east coast of Greenland, turns sharply round Cape Farewell to the northward into Davis Straits, where it again doubles sharply on itself to the southward. This is exhibited, in the model, in all its details, and is evidently caused by the pressure of the water forced by the mimic Gulf Stream into the Arctic region, where it has no escape except by this route, and is pressed against the land, round which it turns as soon as it can. This is, no doubt, the explanation of the real current.

One instance of the underrunning of one current by another is brought very plainly to our notice in the North Atlantic, to the east of the Great Banks of Newfoundland, where the icebergs borne by the arctic current from Baffin Bay pursue their course to the southward across the Gulf Stream running eastward.

These great masses of ice, floating with seven-eighths of their volume under the surface, draw so much water that they are all but wholly influenced by the under-current. A large berg will have its bottom as much as six or seven hundred feet below the surface. The only reason that these bergs continue their journey southward is the action of the cold under-current.

Our knowledge of the depth of the ocean is steadily, though slowly increasing. The whole of it has been gained during the last fifty years.

Commenced by Sir James Ross, whose means were very small, but who nevertheless demonstrated that the so-called unfathomable ocean was certainly fathomable everywhere, the sounding of the ocean has continuously proceeded. The needs of submarine cables have constantly demanded knowledge in this particular, and the different cable companies have had a large share in ascertaining the facts.

It is hopeless to do more than to briefly sketch the amount of our knowledge.

First, as to the greatest depths known. It is very remarkable, and from a geological point of view significant, that the very deepest parts of the ocean are not in or near their centres, but in all cases are very near land.

One hundred and ten miles outside the Kurile Islands, which stretch from the northern point of Japan to the north-east, the deepest sounding has been obtained of 4,655 fathoms, or 27,930 feet ($5\frac{1}{2}$ miles). This appears to be in a deep depression, which runs parallel to the Kurile Islands and Japan ; but its extent is unknown, and may be very large.

Seventy miles north of Porto Rico, in the West Indies, is the next deepest cast known, viz., 4,561 fathoms, or 27,366 feet ($5\frac{1}{4}$ miles) ; not far inferior to the Pacific depth, but here the deep area must be comparatively small, as shallower soundings have been made at distances sixty miles north and east of it.

A similar depression has been sounded during the last few years west of the great range of the Andes, at a distance of fifty miles from the coast of Peru, where the greatest depth is 4,175 fathoms ($4\frac{3}{4}$ miles).

Other isolated depths of over 4,000 fathoms have been sounded in the Pacific. One between the Tonga or Friendly Islands of 4,500 fathoms, one of 4,478 fathoms near the Ladrões, and another of 4,428 fathoms near Pylstaart Island, all in the Western Pacific. They all require further investigation to determine their extent.

To give an idea of what remains to be done, I will mention that in the eastern part of the Central Pacific there is an area of 10,500,000 square miles in which there are only seven soundings, whilst in a long strip crossing the whole North Pacific, which has an area of 2,800,000 square miles, there is no sounding at all. Nevertheless, while the approximate mean depth I am mentioning may be considerably altered as knowledge increases, we know enough to say that the Pacific is generally deeper than the other oceans. The immensity, both in bulk and area, of this great mass of water, is difficult to realise ; but it may assist us when we realise that the whole of the land on the globe above water level, if shovelled into the Pacific, would only fill one-seventh of it.

The temperature of the ocean is interesting.

The temperature of the surface is most important to us, as it is largely on it that the climates of the different parts of the world depend. This is comparatively easy to ascertain. We know so much about it that we are not likely to improve on it for many years. We are quite able to understand why countries in the same latitude differ widely in their respective mean temperatures ; why fogs prevail in certain localities, and others are subject to tempestuous storms.

On the latter point nothing has come out plainer from recent discussion than the fact that areas where great differences of surface temperature of the sea prevail are those in which storms are generated.

A remarkable point recently brought to light by the researches of Mr. John Murray in Scotch lochs is the effect of wind on the surface temperature. It has been observed that wind driving off a shore drifts the surface water before it. This water is replaced by the readiest means, that is to say, by water from below the surface rising to take its place. As the lower strata are in all cases cooler than the surface a lowering of the temperature results, and we find, in fact, that near all sea-shores off which a steady wind blows the water is cooler than further to seaward.

This has an important bearing on coral growth, and explains why on all western coasts of the great continents off which the trade winds blow we find an almost absolute dearth of coral, while on the eastern coasts, on which warm currents impinge, reefs abound, the coral animal flourishing only in water above a certain temperature.

In the meantime we can state certain known facts.

The depth of the warm surface water is small.

In the equatorial current between Africa and South America, where the surface is of a temperature of 78° , at 100 fathoms it is only 55° , a difference of 23° , and a temperature of 40° is reached at 400 fathoms. In this region, as far as knowledge goes, the fall in temperature as we descend is most rapid, but generally speaking the same variations prevail everywhere.

In the tropical Pacific the temperature falls 32° from the surface, where it stands at 82° , to 50° at a depth of 200 fathoms, and to 40° at from 500 to 600 fathoms below the surface. Below the general depth of from 400 to 600 fathoms, the temperature decreases very slowly, but there is considerable variation in the absolute amount of it when we get to great depths in different parts of the ocean.

It is interesting that the investigation into the translation of the great seismic wave caused by the eruption of Krakatoa in 1883 led to a similar and entirely independent conclusion. The wave caused by the explosion in the Straits of Sunda reached Cape Horn, where by good chance a French meteorological expedition had erected an automatic tide gauge, but instead of one series of waves being marked on the paper there were two. A little consideration showed that the South Pole having directly interposed between Sunda Straits and Cape Horn, the waves diverted by the land about the pole would arrive from both sides.

One wave, however, made its appearance seven hours before the other.

Study showed that the earliest wave coincided in time with a wave travelling on the Pacific side of the pole, with a velocity due to the known depth, while the later wave must have been retarded in its journey *via* the South Atlantic. The only possible explanation is that the wave had been impeded by comparatively shallow water.

In the great oceans the greatest cold is found on the western side of the South Atlantic, where the thermometer stands at $32^{\circ}\cdot3$ F., but temperatures of 29° F. have been obtained of recent years east of the Færoe Islands, north of the ridge which cuts off the deeper waters of the Arctic from the Atlantic.

The waves which for ever disturb the surface of the sea demand much study.

The greatest of these, and the most regular, is the tidal wave. On this many powerful intellects have been brought to bear, but it still presents many unsolved anomalies.

Lord Kelvin and Professor Darwin have demonstrated that the tidal movement is made up of many waves depending upon different functions of the moon and sun, some being semi-diurnal, some diurnal. The time of transit over the meridian, the declination of both bodies, create great variations; the changing distance and position of the moon and the position of her node, also have great effect, while the ever-varying direction and force of the winds, and the different pressure of the atmosphere, play their part, and sometimes a very large part, on what is somewhat loosely known as the meteorological tide.

Though after long observation made of the times and ranges of tides at any one spot, they can now be predicted with great accuracy, for that particular place, by the method of harmonic analysis, perfected by Professor G. Darwin, the meteorological tide excepted, no one can yet say what the tide will be at any spot where observations have not been made.

The waves due to wind, though not so far-reaching in their effects as the

majestic march of the tide wave, are phenomena which are more apparent to the traveller on the ocean.

The deep sea in a heavy gale presents, perhaps, the most impressive manifestation of the powers of nature which man can behold, and doubtless many of us have experienced feelings that may vary from awe and wonder to sheer delight, according to the temperament of each individual, at for the first time finding himself face to face with this magnificent sight, though I rather fear that discomfort is the prevailing feeling that many carry away.

The height to which storm waves may rise has never been satisfactorily determined. Apart from the difficulty of the task and the small number of people who will address themselves to it when they have the chance, it is but rarely that any individual sees really abnormal waves, even though he may be at sea all his life.

Different heights for what are called maximum waves have been recorded, and they vary from 40 to 90 feet from crest to hollow.

All we can say is that the most probable figure is about 50 or 60 feet.

These great storm waves travel very far. In some cases they convey a warning, as their velocity always far exceeds that at which the storm is travelling. In others they intimate that a gale of which no more is seen has occurred somewhere—it may be many miles distant.

When they have travelled beyond the limits of the wind which raised them, they lose the steepness of slope which characterises them when under its influence, and become an undulation which is scarcely noticed when in deep water.

On approaching shallow water, however, they are again apparent, and the “rollers” that occur unperiodically at various places in latitudes where gales never occur would seem to be caused by such waves, originating in areas many thousands of miles distant. Such appears to be the originating in areas many rollers at Ascension and St. Helena, where the rocky and exposed nature of the landing has caused this phenomenon to be especially noticed.

Other rollers are, however, undoubtedly due to earthquakes or volcanic eruptions occurring in the bed of the sea.

The variations in the pressure of the atmosphere play an important part in changes of sea level.

A difference of one inch in the barometer has been shown to be followed by a difference of a foot in the mean level of the sea, and in parts of the world where the mean height of the barometer varies much with the seasons, and the tidal range is small, this effect is very marked.

Of any secular change in the level of the sea little is known. This can only be measured by comparison with the land, and it is a question which is the more unstable, the land or the water—probably the land, as it has been shown that the mass of the land is so trifling, compared with that of the ocean, that it would take a great deal to alter the general mean level of the latter.

THE MAY FROST OF 1894.

To the Editor of the Meteorological Magazine.

SIR,—To answer the question put by Mr. Harold Smith in the August Magazine as to the strength of the wind at Easton Mauduit, on May 21st, during the daytime between the two severe night frosts, I may reply that the “wind” entries in my register (made by estimate, not by instruments,) show a force at 9 a.m. of 3, and during the whole day of 2 (on scale 0–12), *i.e.*, there was a light breeze at 9 a.m. which lessened as the day went on. It was the quietest day of the period, 19th to 24th. The 22nd showed 3 and 4 respectively, and the two next days 5 and 4, which, by estimate, means a considerable wind, but nothing like a gale. I give these figures as being good for comparison between themselves, but not as of precise absolute value.—Yours sincerely,

H. A. BOYS.

*Easton Mauduit Vicarage, Northampton, Aug. 28th, 1894.**To the Editor of the Meteorological Magazine.*

SIR,—Although it is rather late to be talking about the May frost, yet, having noticed in your Magazine for June the low temperatures given for different parts of the country on 21st of May and following nights, I cannot refrain from drawing your attention to the comparative freedom of London, and especially South London, from severe frosts during that period, the lowest temperature taken by me being 35°, on the night of the 20–21st May, the shed in which the thermometer hung being open to the N.E. wind, which was blowing at the time. I notice that this is even two degrees higher than the value given by you for North-west London on the same date.

This position is at the summit of the hill, and fully exposed, yet nothing in the garden was damaged.

I am, yours faithfully,

AN AMATEUR METEOROLOGIST.

Clapham Park, S. W., July 7th, 1894.

[This is another illustration of the variability of temperature in and around the metropolis. It was 32°·3 at Greenwich Observatory, 33°·0 at Camden Square, 35°·0 at Clapham, and 36°·0 at Acre Lane. Brixton]

AN INDICATION OF RAIN.

To the Editor of the Meteorological Magazine.

SIR,—I find hereabouts a general belief that when corn in sheaves on the field dries rapidly in the morning rain may be expected. This seems to be contrary to all sound theory. The above conditions obtained yesterday, rain following. It was triumphantly argued to me that the popular belief must be correct.—Your obedient servant,

DUCIE.

Tortworth Court, Falfield, Glos., Sept. 5th, 1894.

THE VIENNA HAILSTORM OF JUNE 7TH.

In the latest *Meteorologische Zeitschrift*, Dr. Hann, chief of the Austrian Weather Department, has given some interesting particulars relating to the terrific and destructive hailstorm, accompanied by a perfect hurricane and thunder and lightning, which visited Vienna on the morning of June 7th last. The storm is shown to have travelled from west to east. Originating apparently about 9.30 p.m. on the 6th in Wurtemberg it passed over Munich shortly before 3 a.m., the wind blowing in very severe squalls, rain and hail falling like a deluge, and in ten minutes there were more than 80 flashes of lightning. Travelling at the rate of 35 miles an hour, the disturbance reached Gmunden, but the storm was not violent here, and only a little rain fell. The distance of 120 miles from Gmunden to the Austrian capital was covered in 1hr. 40min., or at the rate of 72 miles an hour, the average rate for the whole distance from Munich being 48 miles an hour. Around Vienna the storm broke about 6.30 a.m., and a few minutes after 7 o'clock it was all over. There are a number of observers in and about the city, and few of them reported less than an inch of water, one or two from rain alone, the others from rain and melted hail. The largest totals were 1.7lin. in the Rathhauspark and 1.67in. in the Skodagasse, Josefstadt. At the central office, Hohe Warte, 0.4in. fell in 16 minutes, but at the Schmelz Reservoir the hail, which came down between 6.35 and 6.50 a.m., yielded 1.47in. of water, or at the rate of nearly six inches per hour. Further afield, at Purkersdorf, however, Mr. Francis A. Heath, C.E., had a total of 1.26in., but in five minutes, 6.45 to 6.50 a.m., he measured the enormous quantity of 1.1in., or at the rate of more than 13 inches an hour. At Mariabrunn, the Imperial Experimental Forest Station, 1.48in. was registered in 20 minutes.

INTERNATIONAL METEOROLOGICAL COMMITTEE.

The International Meteorological Committee held its meeting, as arranged, at Upsala, on August 20—24. M. Wild, the president, was unfortunately prevented from attending, owing to indisposition. M. Mascart was elected president for the meeting and Mr. Scott, as usual, secretary. The principal points dealt with at the meeting were as follows:—1. The establishment of an international meteorological bureau was recognized as impracticable. 2. It was resolved to publish in the report of the meeting a *résumé* of the measures adopted in all countries to communicate to agriculturists meteorological results likely to be useful to them. 3. The acceleration of meteorological telegrams. It was decided to address the international telegraphic bureau at Berne on this subject. 4. "The scintillation of stars as an indication of weather," a paper by M. C. Dufour, will be reproduced in the report. 5. The study of clouds. This was the great feature of the meeting. The cloud committee appointed at Munich in 1891 held a meeting at the same time as the International Meteorological Committee, and presented a report dealing with definitions for the ten classes (Hildebrandsson and Abercromby) adopted at Munich, and with instructions for cloud observations. They also proposed to prepare and issue an authoritative cloud atlas. This report was, with some modification, adopted. 6. The subject of the treatment of the wet bulb below the freezing point was discussed, and the use of Ekholm's formula was recommended *ad interim*. 7. It was decided to arrange for a conference of the same character as that at Munich in 1891, which was not an official congress, to be held in Paris in September, 1896.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1894.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		
England, London	65·8	31	28·6	3	54·2	36·0	38·9	81	108·8	22·1	1·19	9	4·8
Malta.....	68·3	14	41·7	29	62·0	51·2	46·1	74	131·6	36·6	1·49	11	5·8
Cape of Good Hope ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius.....	84·5	21	68·1	19	82·4	72·5	69·3	78	133·3	59·6	3·99	17	5·4
Calcutta.....	98·8	24	59·8	9	92·0	69·6	66·5	66	153·5	50·1	1·50	2	2·1
Bombay.....	91·0	25	67·6	12	86·4	74·3	69·7	71	140·0	61·4	·06	3	1·9
Ceylon, Colombo	90·8	15	72·0	12	88·3	74·9	72·2	77	152·0	64·0	7·44	11	4·5
Melbourne.....	93·0	8	47·3	29	75·5	56·9	54·9	69	146·5	37·9	·88	8	6·5
Adelaide	96·2	12	52·8	27	80·3	60·4	53·4	55	155·5	46·8	1·59	12	4·6
Sydney	83·0	7	57·8	26	73·8	64·2	61·2	81	143·2	48·5	11·58	25	6·6
Wellington	72·0	5a	44·3	31	67·3	55·2	51·7	72	132·0	33·0	4·07	10	4·2
Auckland	76·0	2	51·0	22	71·6	57·5	58·8	81	144·0	49·0	1·42	9	4·8
Jamaica, Kingston.....	87·7	6	61·2	9	83·9	66·6	66·4	78	...	...	·74	4	3·4
Trinidad .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	63·4	18	14·1	26	43·1	28·4	29·6	76	...	10·0	1·33	19	7·0
New Brunswick, Fredericton	64·7	6	1·5	31	40·5	20·1	23·2	68	...	...	1·87	12	6·0
Manitoba, Winnipeg ...	40·4	2	—20·5	25	29·8	9·5	...	...	...	...	1·63	10	6·0
British Columbia, Esquimalt	56·9	25	29·2	36	47·3	35·2	37·3	86	...	...	4·64	25	7·0

a And 7.

b And 6.

REMARKS.

MALTA.—Adopted mean temp. 54°·9, one degree below the average of 10 years; cloud and rainfall above the average. Mean hourly velocity of wind 9·8 miles. Thunderstorm on 13th; L on 22nd and 30th; H on 25th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·5 below, dew point 0°·5 below, and rainfall 3·97 in. below, their respective averages. Mean hourly velocity of wind 10·7 miles, or 0·8 mile above average; extremes, 29·3 on 12th, and 0·0 on 1st; prevailing direction, E.S.E. T and L on the 11th and 22nd, and L on 13th and 30th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 13th, 14th and 28th. Thunderstorms occurred on 6 days. D. G. MANTELL.

Melbourne.—Lightning on the 5th, 8th and 18th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·1 below the average of 37 years, and rainfall ·55 in. above the average. The first half of the month was warm and dry, the second half cool and wet. C. TODD, F.R.S.

Sydney.—Temperature 0°·2 below, humidity 5 above, and rainfall 5·97 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Fine up to the 6th, then showery with fine intervals up to the 18th, when 2·55 in. of R fell; fine for the remainder, except showers on 26th, 27th and 28th. Prevailing wind N.W. Mean temperature 0°·9 below, and rainfall ·97 in. above, the average. R. B. GORE.

Auckland.—An unusually fine and dry month, the rainfall being more than an inch below the average. Mean temp. slightly below, and barometrical pressure slightly above, the average. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 3·9 miles, prevailing direction S.S.E. Rainfall in Kingston half the average, but over the Island as a whole the average fall was received. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL,
AUGUST, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations,
see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2.39	XI.	Rhayader, Nantgwillt..	...
„	Birchington, Thor	1.70	„	Lake Vyrnwy	4.51
„	Hailsham	2.38	„	Corwen, Rhug	2.44
„	Ryde, Thornbrough	2.62	„	Carnarvon, Cocksidia ...	3.20
„	Emsworth, Redlands ...	1.93	„	I. of Man, Douglas	3.06
„	Alton, Ashdell	3.22	XII.	Stoneykirk, Ardwell Ho.	2.11
III.	Oxford, Magdalen Col...	2.30	„	New Galloway, Glenlee	3.91
„	Banbury, Bloxham	2.53	„	Melrose, Abbey Gate ...	5.50
„	Northampton, Sedgbrook	2.07	XIII.	N. Esk Res. [Penicuik]	5.50
„	Alconbury	2.66	„	Edinburgh, Blacket Pl..	3.83
„	Wisbech, Bank House..	2.05	XIV.	Glasgow, Queen's Park.	4.87
IV.	Southend	2.51	XV.	Inverary, Newtown	5.96
„	Harlow, Sheering	2.61	„	Islay, Gruinart School..	...
„	Colchester, Lexden.....	1.45	XVI.	Dollar	5.25
„	Rendlesham Hall	2.51	„	Balquhiddier, Stronvar..	4.99
„	Diss	2.06	„	Ballinluig	4.68
„	Swaffham	2.28	„	Dalnaspidal H.R.S. ...	6.48
V.	Salisbury, Alderbury ...	1.86	XVII.	Keith H.R.S.	5.14
„	Bishop's Cannings	2.60	„	Forres H.R.S.	3.90
„	Blandford, Whatcombe..	1.83	XVIII.	Fearn, Lower Pitkerrie.	3.86
„	Ashburton, Holne Vic....	5.32	„	Loch Shiel, Glenaladale	9.25
„	Okehampton, Oaklands..	4.40	„	N. Uist. Loch Maddy ...	4.92
„	Hartland Abbey	4.24	„	Invergarry	4.75
„	Lynmouth, Glenthorne..	4.49	„	Aviemore H.R.S.	4.84
„	Probus, Lamellyn	3.67	„	Loch Ness, Drumnadrochit	5.55
„	Wellington, Sunnyside..	3.85	XIX.	Invershin	4.47
„	Wincanton, Stowell Rec.	2.57	„	Scourie	5.21
VI.	Clifton, Pembroke Road	3.26	„	Watten H.R.S.	3.35
„	Ross, The Graig	2.97	XX.	Dunmanway, Coolkelure	3.42
„	Wem, Clive Vicarage ...	3.28	„	Fermoy, Gas Works ...	3.08
„	Cheadle, The Heath Ho..	2.61	„	Killarney, Woodlawn ...	3.14
„	Worcester, Diglis Lock	2.30	„	Tipperary, Henry Street	...
„	Coventry, Coundon	2.97	„	Limerick, Kilcornan ...	3.09
VII.	Ketton Hall [Stamford]	2.00	„	Ennis .....	...
„	Grantham, Stainby	3.90	„	Miltown Malbay	3.95
„	Horncastle, Bucknall ...	2.72	XXI.	Gorey, Courtown House	4.03
„	Worksop, Hodseck Priory	2.03	„	Athlone, Twyford	3.13
VIII.	Neston, Hinderton	3.41	„	Mullingar, Belvedere ...	3.85
„	Lancaster, Rose Bank... ..	6.61	„	Longford, Currygrane...	3.96
„	Broughton-in-Furness...	6.61	XXII.	Galway, Queen's Coll...	4.19
IX.	Ripon, Mickley	2.40	„	Crossmolina, Enniscoe..	3.13
„	Scarborough, South Cliff	3.38	„	Collooney, Markree Obs.	2.31
„	East Layton [Darlington]	2.37	„	Ballinamore, Lawderdale	2.82
„	Middleton, Mickleton...	2.97	XXIII.	Lough Sheelin, Arley ..	2.96
X.	Haltwhistle, Unthank..	5.04	„	Warrenpoint	2.10
„	Bamburgh	3.14	„	Seaforde	2.25
„	Keswick, The Beeches...	6.34	„	Belfast, Springfield	2.36
XI.	Llanfrehfa Grange	4.19	„	Bushmills, Dundarave...	2.90
„	Llandovery	4.79	„	Stewartstown	1.57
„	Castle Malgwyn	3.73	„	Buncrana	2.90
„	Builth, Abergwessin Vic.	5.58	„	Lough Swilly, Carrablagh	3.63

AUGUST, 1894.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Deg.		Date	Deg.	Date			
				Dpth	Date								
											inches.	inches.	in.
I.	London (Camden Square) ...	2·85	+ ·97	·90	23	18	79·3	14	44·3	21	c	0	
II.	Maidstone (Hunton Court)...	1·55	— ·14	·28	10	13	...	...	...	...	...	...
III.	Strathfield Turgiss	2·56	+ ·85	·72	24	22	77·1	14	39·3	21	0	0	
IV.	Hitchin	4·18	+ 2·36	1·06	10	18	75·0	26	44·0	29	0	...	
V.	Winslow (Addington)	2·32	+ ·35	·48	23	17	75·0	24	40·0	21	0	0	
VI.	Bury St. Edmunds (Westley)	3·17	+ ·97	·70	23	21	72·0	14	47·0	17d	0	...	
VII.	Norwich (Brundall)	2·17	...	·72	23	21	75·6	14	45·0	17	0	0	
VIII.	Weymouth (Langton Herring)	3·17	+ 1·24	1·62	25	12	71·0	28	47·0	17	0	...	
IX.	Torquay (Cary Green) ...	3·31	...	·94	24	14	71·6	31	50·0	7	0	0	
X.	Polapit Tamar [Launceston]..	4·11	+ 1·63	·76	25	20	74·0	31	51·0	17e	0	...	
XI.	Stroud (Upfield)	3·13	+ 1·04	·51	25a	22	71·0	1	42·0	20	0	...	
XII.	Church Stretton (Woolstaston)	3·94	+ 1·18	1·00	25	16	69·0	26b	46·0	20	0	...	
XIII.	Tenbury (Orleton)	2·72	+ ·60	1·07	25	16	72·7	30	41·0	21	0	0	
XIV.	Leicester (Barkby)	2·12	— ·32	·35	5	24	75·0	14c	38·0	20	0	0	
XV.	Boston	2·16	+ ·04	·30	25	23	75·0	10	45·0	17	0	...	
XVI.	Hesley Hall [Tickhill].....	1·75	— ·41	·51	25	17	71·0	1	41·0	21f	0	0	
XVII.	Manchester (Plymouth Grove)	3·80	+ ·71	·70	1	23	70·0	4,5	45·0	22	0	...	
XVIII.	Wetherby (Ribston Hall) ..	2·46	+ ·12	·39	9	15	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	5·33	+ 1·00	·90	2	20	...	...	...	...	...	...
XX.	Hull (Pearson Park)	2·22	— ·42	·50	25	18	71·0	30	41·0	23	0	0	
XXI.	Newcastle (Town Moor)	3·12	+ ·41	·63	9	21	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite).....	13·10	+ 4·65	2·47	2	23	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	4·96	+ 1·35	1·36	25	21	...	...	...	...	...	...
XXIV.	Haverfordwest	4·17	+ ·99	·99	24	23	70·0	1	40·9	30	0	0	
XXV.	Aberystwith (Gogerddan) ...	4·70	...	1·10	12	19	74·0	22	37·0	28	0	...	
XXVI.	Llandudno	2·66	+ ·30	·57	25	23	66·2	6	49·4	30	0	...	
XXVII.	Cargen [Dumfries]	3·38	+ ·39	1·50	2	16	69·8	9	39·0	28	0	...	
XXVIII.	Jedburgh (Sunnyside).....	5·55	+ 3·31	2·97	2	17	72·0	1	39·0	25	0	...	
XXIX.	Colmonell	3·09	...	1·28	2	17	73·0	8,24	39·0	22	0	...	
XXX.	Lochgilhead (Kilmory).....	5·89	+ 1·33	1·87	13	19	...	...	37·0	26	0	...
XXXI.	Mull (Quinish)	5·71	+ 1·56	1·76	13	24	...	...	...	...	...	...
XXXII.	Loch Leven Sluices	4·00	+ 1·06	1·40	3	11	...	...	...	...	...	...
XXXIII.	Dundee (Eastern Necropolis)	4·50	+ 1·93	1·20	2	17	70·1	29	43·0	22	0	...	
XXXIV.	Braemar	5·53	+ 2·20	1·92	2	21	66·0	29	33·1	25	0	2	
XXXV.	Aberdeen (Cranford)	4·75	...	1·87	2	18	68·0	8,13	41·0	24	0	...	
XXXVI.	Strathconan [Beaully]	4·37	+ 1·07	·72	9	17	...	...	...	...	...	...
XXXVII.	Glencarron Lodge	8·60	...	1·38	11	27	65·8	1	39·0	25	0	...	
XXXVIII.	Cawdor [Nairn]	4·51	+ 2·26	·84	9	23	...	...	...	...	...	...
XXXIX.	Dunrobin	3·76	+ 1·36	·52	11	16	65·5	1	44·0	22	0	...	
XL.	S. Ronaldsay (Roeberry).....	3·22	+ ·66	·71	19	21	62·0	7	47·0	21g	0	...	
XLI.	Darrynane Abbey	4·32	...	·76	21	23	...	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	3·19	— ·23	1·00	24	16	69·0	19	44·0	17h	0	...	
XLIII.	O'Briensbridge (Ross)	3·40	...	·58	25	21	...	...	...	...	...	...
XLIV.	Carlow (Browne's Hill)	3·14	+ ·17	1·13	25	17	...	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	3·73	+ 1·21	1·37	25	18	97·9	8	47·1	20h	0	0	
XLVI.	Ballinasloe	3·44	+ ·26	·98	25	20	68·0	5,9	47·0	16	0	...	
XLVII.	Clifden (Kylemore)	5·29	...	·70	7	24	...	...	...	...	...	...
XLVIII.	Waringstown	1·82	— 1·29	·26	25	23	77·0	4	40·0	6	0	0	
XLIX.	Londonderry (Creggan Res.)..	2·90	— 1·22	·32	8	27	...	...	...	...	...	...
L.	Omagh (Edenfel)	2·44	— 1·05	·38	9	25	67·0	2	37·0	21	0	0	

a And 27. b And 30. c And 26. d And 21. e And 30. f And 23. g And 31. h And 22.

+ Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A showery month with a large rainfall. Wild flowers very luxuriant. Harvest much impeded by R; crops generally very good, but much laid by heavy R. TS on 25th. Swifts departed on 6th.

HITCHIN.—Between 7 a.m. and 10 a.m. on 25th 1·58 in. of R fell, with a few flashes of L.

ADDINGTON.—Weather very unsettled, and hindering for the finishing of hay-making until the last week, which was fine.

BURY ST. EDMUNDS.—Twenty-one days of R in the harvest month has been most disastrous for the Eastern Counties; the most damage was done from the 22nd to the 26th, which period was very wet and almost without wind. Barley much grown and discoloured. Distant T on 9th, TS on 10th.

NORWICH, BRUNDALL.—A very unsettled month; frequent R, though heavy only on the 23rd. Day temperatures remarkably low, only reaching 70° or upwards on five days, against 18 days in 1893. T, L, R and H on the morning of the 20th.

LANGTON HERRING.—At 9 a.m. on the 25th ·89 in. of R was measured, and on the 26th 1·62 in.; the R began at 3.45 a.m. on the 25th, and ceased at 11.30 p.m. on the same day, so that 2·51 in. fell on the 25th. No damage, however, was done here, but the floods caused great destruction of property at Beaminster and Bridport. The temp. was remarkably uniform through the month, and the mean at 9 a.m. (60°·4) was 1°·7 below the average. Two heavy TSS occurred on the 25th; fogs on 4th, 8th and 23rd. The last six days of the month were very fine.

TORQUAY, CARY GREEN.—R ·39 in. above, and wet days 1 below, the average. Mean temp. 60°·1, or 0°·3 below the average. Amount of sunshine 156 hours 35 minutes, being 31 hours below the average; three sunless days.

POLAPIT TAMAR.—An unusually wet month, but the last six days were beautifully fine, dry and warm, typical harvest weather. The R on the 25th was particularly heavy, lasting not more than 3 or 4 hours.

WOOLSTASTON.—A cold and stormy month, with very little sunshine, and very unfavourable for harvest. The last week was dry and much warmer. A very heavy R with T and L occurred on the 25th. Mean temp. 56°·9.

TENBURY, ORLETON.—A very cold ungenial month. Although there was not much more than the average quantity of R, the ground never got dry because there was no sun. The ther. never reached 70° until the 26th, and only upon three days after that date. A great storm occurred on the night of the 25th, with very heavy R, T and L.

LEICESTER, BARKBY.—Continuous R till the last few days, and the nights generally warm. Mean temp. 58°·7. T and L three times in the second week.

SEATHWAITE.—More than two inches of R fell on the 2nd and 14th, and more than one inch on the 5th, 7th and 13th.

WALES.

HAVERFORDWEST.—A wet hinderable month, and much hay spoiled; the more to be deplored as the crops were fine and very heavy. The wind blew throughout the month from S. and S.W., and the climatic conditions were very relaxing, although the temp. was never high, 70° being reached only on one day. Corn crops very heavy with abundance of straw, but much beaten down during the disastrous rains which fell uninterruptedly from the 19th to 27th. Sharp TS on the night of the 24th from 10 p.m. to midnight, the L very vivid with a deluge of R. The weather changed on the 28th to N.E. wind with fine clear sky.

ABERYSTWITH, GOGERDDAN.—Very stormy throughout the month.

SCOTLAND.

CARGEN.—The first three weeks of the month were wet and damp, although the rainfall each day was generally small; the latter part of the month was fine. Sunshine was considerably deficient, and temp. much below the average. Conditions were very unfavourable for ripening the crops. TS on the 15th at 5 p.m.

JEDBURGH.—The month was marked by great unsettledness of weather, and was unfavourable to the agriculturist, whose harvest operations were much retarded. A large portion of the crop was still uncut at the close. The night temp. was generally low. T and L on the 17th. T on 28th and 29th.

BRAEMAR.—A wet cold month. Duration of sunshine 100 hours.

ABERDEEN, CRANFORD.—From 9 p.m. on the 2nd to 6 a.m. on the 3rd, 1·85 in. of R fell, and on the 8th, between 2 p.m. and 3 p.m., ·23 in. fell in five minutes, in the form of H about the size of peas, accompanied by T.

ROEBERRY.—Wet and cold until the 19th, afterwards cold and dry with northerly winds. Mean temp. 54°·6.

IRELAND.

DARRYNANE ABBEY.—Cold and wet to the 25th, thence to the end very fine and warm, with little or no wind, and remarkably calm sea.

WATERFORD, BROOK LODGE.—L at night on 24th; a heavy TS on 25th. Thick ground fog on 26th, fog on 27th, thick fog on the morning of the 31st.

O'BRIENSBRIDGE, ROSS.—R moderate during the month, but the almost total absence of sunshine made it one of the most unpleasant and difficult months on record for all harvesting operations; even in the last five rainless days there was not a gleam of sunshine.

DUBLIN.—A month of singularly cloudy skies, low mean temp., north-westerly winds, and a heavy rainfall. The ther. did not once reach 70° in the shade, while it failed to reach even 60° on as many as six out of the last seven days of the month. The mean temp. 57°·9, is 1°·8 below the average. High winds were noted on as many as 13 days, and attained the force of a gale on the 10th and 14th; T was heard on the 2nd; H fell on the 8th. A lunar halo was seen on the 21st.

EDENFEL.—Almost up to the close of the month, August was a continuance of the dull dropping sunless weather and saturated atmosphere of July; another wet month in fact, but with R 1·05 in. below the average. The saving of the late hay, as of the early, was the most difficult and expensive in 30 years, its abundance being much more than counteracted in value by its inferior condition. The magnificent harvest weather, however, which set in on the 29th and still continues (Sept. 6th), justifies for once the forecasts of the weather prophets.

ERRATA IN "METEOROLOGICAL MAGAZINE," 1893.

REGULAR TABLES.

Maidstone (Hunton Court) ..	Feby.	Total rain <i>should be</i> 3·46 in. <i>not</i> 3·65 in.
Cardiff (Ely) ..	Feby.	" " 5·86 in. " 5·72 in.
Loch Leven Sluices ..	July	" " 2·40 in. " 2·50 in.
" " ..	Sept.	" " 1·40 in. " 1·60 in.

SUPPLEMENTARY TABLES.

Northampton (Sedgebrook)...	Feby.	Total rain <i>should be</i> 2·54 in. <i>not</i> 2·51 in.
Harlow (Sheering) ..	Oct.	" " 2·75 in. " 1·75 in.
Okehampton (Oaklands) ..	Mar.	" " ·77 in. " ·73 in.
East Layton [Darlington] ..	July	" " 2·84 in. " 2·48 in.
Dalnaspidal, H. R. S.	Mar.	" " 2·61 in. " 2·39 in.
Longford (Currygrane).....	April	" " 1·00 in. " ·93 in.