AIR MINISTRY.

M.O. 298

Annual Report of the Meteorological Committee to the Air Council

For the Year ended 31st March 1927

The Seventy-second Year of the Meteorological Office

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:
Adastral House, Kingsway, London, W.C. 2; 120, George Street, Edinburgh;
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;
15, Donegall Square West, Belfast;
or through any Bookseller.

1927

Price 2*s.* 0*d.* Net.

40-41-0-27.

CONTENTS

METEOROLOGICAL COMMITTEE.

1926-7

Appointed by the Air Council

Chairman :—The Under Secretary of State for Air.

Vice-Chairman :—Sir ARTHUR SCHUSTER, F.R.S. Nominated by the Royal Society.

Rear-Admiral H. P. DOUGLAS, C.M.G., R.N. Hydrographer of the Navy. Nominated by the Admiralty.

Captain W. ELLERY. Nominated by the Board of Trade.

Mr. J. E. W. FLOOD. Nominated by the Colonial Office.

Lieut.-Colonel J. U. HOPE, D.S.O., R.A. Superintendent of Experiments, Shoeburyness. Nominated by the War Office.

Colonel Sir HENRY LYONS, D.Sc., F.R.S. Nominated by the Royal Society.

Mr. H. W. W. MCANALLY, C.B. Principal Assistant Secretary, Air Ministry. Nominated by the Air Ministry

Mr. L. V. MEADOWCROFT, Assistant Secretary, Air Ministry. Nominated by the Air Ministry.

Sir THOMAS MIDDLETON, K.B.E., C.B., LL.D., Development Commission. Nominated by the Ministry of Agriculture and Fisheries.

Mr. P. J. G. ROSE, C.B. Assistant Under-Secretary for Scotland. Nominated by the Scottish Office.

Professor R. A. SAMPSON, M.A., D.Sc., F.R.S., Astronomer Royal for Scotland. Nominated by the Royal Society of Edinburgh.

Dr. G. C. SIMPSON, C.B., F.R.S., Director, Meteorological Office.

Secretary:—Mr. D. BRUNT, M.A.

A2

(1375). Wt.6055/132/340. 500 10.27. B.&F.,Ltd. G93.

COMMITTEE OF THE METEOROLOGICAL OFFICE, EDINBURGH

The Director of the Meteorological Office (*Chairman*).

Dr. J. E. CROMBIE. Nominated by the University of Aberdeen.

Professor J. R. CURRIE, M.D., D.P.H. Nominated by the University of Glasgow.

Commander LESLIE FISHER, R.N. Nominated by the Fishery Board for Scotland.

Sir W. L. MACKENZIE, M.D., LL.D. Nominated by the Scottish Board of Health.

Professor W. PEDDIE, D.Sc. Nominated by the Royal Society of Edinburgh.

Mr. J. M. RAMSAY, O.B.E. Nominated by the Board of Agriculture for Scotland.

Professor R. A. SAMPSON, F.R.S. Nominated by the Royal Society.

Professor E. M. WEDDERBURN, M.A., D.Sc., W.S. Nominated by the Royal Meteorological Society.

THE GASSIOT COMMITTEE, 1926

Appointed by the Royal Society in accordance with Treasury Letter of 26th February, 1910, to administer the Gassiot Trust, and to promote the scientific study of the branches of science to which the Trust relates, viz.:—Meteorology, Terrestrial Magnetism, Atmospheric Electricity, Seismology and the cognate subjects.

Sir ERNEST RUTHERFORD, O.M., D.Sc., G.B.E. (*President of the Royal Society*).

Colonel Sir HENRY LYONS (*Chairman*).

The Astronomer Royal.

Professor S. CHAPMAN.

Dr. C. CHREE.

Dr. J. H. JEANS.

Sir G. LENOX-CONYNGHAM

Sir ARTHUR SCHUSTER.

Sir NAPIER SHAW.

Dr. G. C. SIMPSON.

Professor G. I. TAYLOR.

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION

Dr. G. C. SIMPSON, C.B., F.R.S. (*Chairman*).
Dr. T. L. BAILEY (*Chief Alkali Inspector*).
Captain C. J. P. CAVE. (*Past President of the Meteorological Society*).
Mr. J. G. CLARK, F.I.C. (*Chemist, Gas, Light & Coke Company*).
Professor J. B. COHEN, F.R.S., Ph.D., B.Sc. (*Professor of Organic Chemistry, Leeds University*).
Dr. H. A. DES VOEUX (*Chairman, Coal Smoke Abatement Society*).
Dr. MARGARET FISHENDEN (*Fuel Research Board*).
Dr. J. S. OWENS (*Hon. Secretary*).
Sir JOHN RUSSELL (*Director of Rothamsted Experimental Station, Harpenden*).
Sir NAPIER SHAW, F.R.S. (*Late Director of the Meteorological Office*).
Mr. W. B. SMITH (*Member of Departmental Committee on Smoke Abatement*).
Mr. F. J. W. WHIPPLE (*Superintendent, Kew Observatory*).
Dr. J. CATES (*Medical Officer of Health, Surrey*).

Sir JOHN ROBERTSON ..	*Nominated by*	Corporation of Birmingham.
Mr. G. P. MITCHELL	,,	,, Corporation of Blackburn.
Mr. J. K. BEST	,,	,, Messrs. Cadbury Bros.
Mr. A. R. TANKARD	,,	,, Corporation of Hull.
Dr. J. J. JERVIS	,,	,, Corporation of Leeds.
Dr. W. HANNA	,,	,, Corporation of Liverpool.
Dr. W. J. HOWARTH	,,	,, Corporation of City of London.
Mr. HENRY MILLS, J.P. ..	,,	,, London County Council.
Mr. W. OSBORN THORP ..	,,	,, Corporation of Malvern.
Professor W. HALDANE GEE..	,,	,, Corporation of Manchester.
Dr. R. W. SIMPSON	,,	,, Corporation of Newcastle-on-Tyne.
Dr. J. B. WILKINSON ..	,,	,, Corporation of Oldham.
Dr. J. R. ASHWORTH	,,	,, Corporation of Rochdale.
Dr. F. HAUXWELL	,,	,, Corporation of St. Helens.
Mr. J. BAXENDELL	,,	,, Corporation of Southport.
Mr. J. FYFE	,,	,, Corporation of Stirling.
Dr. G. P. JOHNSON	,,	,, Corporation of Stoke-on-Trent.
Dr. H. OSBORNE	,,	,, Corporation of Salford.

THE STAFF OF THE METEOROLOGICAL OFFICE, ITS OBSERVATORIES AND BRANCHES, MARCH, 1927

THE STAFF AT HEADQUARTERS

DIRECTOR:

G. C. Simpson, C.B., C.B.E., LL.D., D.Sc., F.R.S.

Assistant Directors .. R. G. K. Lempfert, C.B.E., M.A , F.Inst.P
E. Gold, D.S.O., F.R.S.
Senior Professional Assistant Miss E. E. Austin.

GENERAL SERVICES DIVISION

Chief Clerk .. .. .. H. L. B. Tarrant.
Clerk, Grade I .. .. F. M. Dean.
Clerks, Grades II & III .. 9
Officekeeper 1

MARINE DIVISION

Superintendent .. .. L. A. Brooke-Smith, Captain, R.N.R., R.D.
Senior Professional Assistants E. W. Barlow, B.Sc.; J. Hennessy, Cdr., R.N.R., R.D.
Clerk, Grade I .. .. H. Keeton.
Clerks, Grades II & III .. 10

BRITISH CLIMATOLOGY DIVISION

Superintendent .. .. R. Corless, O.B.E., M.A.
Assistant Superintendent .. M. T. Spence, B.Sc.
Senior Professional Assistants J. Glasspoole, Ph.D., A.I.C; P. I. Mulholland, B.Sc.
Clerk, Grade I .. .. A. G. W. Howard.
Clerks, Grades II & III .. 15
Draughtsman 1

GENERAL CLIMATOLOGY DIVISION

Superintendent .. .. C. E. P. Brooks, D.Sc.
Senior Professional Assistant Miss E. H. Geake, M.Sc.
Junior Professional Assistants T. W. V. Jones, B.Sc.*; Miss G. L. Thorman, B.Sc.
Clerk, Grade I .. .. A. T. Bench.
Clerks, Grades II & III .. 7

* Held against vacancy for Senior Professional Assistant.

FORECAST DIVISION

Superintendent .. .. J. S. Dines, M.A.
Assistant Superintendents .. J. Crichton, M.A., B.Sc.; C. K. M. Douglas, B.A.; E. V. Newnham, B.Sc.
Senior Professional Assistants F. H. Dight, B.Sc.; Miss L. F. Lewis, B.Sc.; S. C. Russell, LL.B.; Miss L. D. Sawyer, B.A.
Junior Professional Assistants W. H. Bigg, B.Sc.; G. A. Bull, B.Sc.; L. Dods, B.Sc.
Clerk, Grade I .. .. W. Hayes.
Clerks, Grades II & III .. 20
Telephone-Typists 8

AVIATION SERVICES DIVISION

Superintendent	F. Entwistle, B.Sc.
Assistant Superintendent ..	R. S. Read, M.A., B.Sc., A.R.C.S.
Senior Professional Assistants	W. C. Kaye, B.Sc.; R. H. Mathews, B.A.; S. T. A. Mirrlees, M.A.; S. F. Witcombe, B.Sc.
Clerks, Grades II & III ..	5

AIRSHIP METEOROLOGY DIVISION

Superintendent	M. A. Giblett, M.Sc.
Senior Professional Assistant	C. S. Durst, B.A.

NAVY SERVICES DIVISION

Superintendent	L. G. Garbett, Commander, R.N. (retd.).

ARMY SERVICES DIVISION

Superintendent	D. Brunt, M.A., B.Sc.

INSTRUMENTS DIVISION

Superintendent	E. G. Bilham, B.Sc., A.R.C.S., D.I.C.
Senior Professional Assistant	J. E. Belasco, B.Sc.
Junior Professional Assistant	A. H. Nagle, B.Sc., A.R.C.S., D.I.C.
Clerk, Grade I	P. N. Skelton.
Clerks, Grade III	6
Draughtsman	1
Instrument Designer ..	1
Storeman, Packer and Porter	3

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION, 47, Victoria St., S.W.1.

Superintendent	J. S. Owens, M.D., A.M.I.C.E., F.G.S., F.R.S.I.
Junior Professional Assistant	

THE STAFF AT OBSERVATORIES AND BRANCH ESTABLISHMENTS

METEOROLOGICAL OFFICE, 6, Drumsheugh Gardens, EDINBURGH

Superintendent	A. H. R. Goldie, M.A., F.R.S.E.
Assistant Superintendent ..	A. Watt, M.A., F.R.S.E.
Senior Professional Assistant	R. A. Watson, B.A.
Clerks, Grade III	5

METEOROLOGICAL OFFICE, MALTA

Superintendent	W. A. Harwood, D.Sc.
Senior Professional Assistant	H. St. G. Dyke-Marsh, B.A.
Clerks, Grades II & III ..	4

METEOROLOGICAL OFFICE, MIDDLE EAST

Superintendent	J. Durward, M.A.
Senior Professional Assistant	J. Wadsworth, M.A.
Clerk, Grade I	R. Pyser.
Clerks (locally entered) ..	Three vacancies.

KEW OBSERVATORY, Old Deer Park, Richmond, Surrey

Assistant Director	F. J. W. Whipple, M.A., F.Inst.P.
Senior Professional Assistants	F. J. Scrase, M.A., B.Sc., A.I.C.; R. E. Watson, B.Sc.
Junior Professional Assistant	D. N. Harrison, D.Sc.
Clerk, Grade I	E. Boxall.
Clerks, Grades II & III ..	5
Caretaker and Handyman	2

KEW OBSERVATORY (Upper Air Section), Richmond, Surrey

Assistant Superintendent ..	L. H. G. Dines, M.A., A.M.I.C.E.
Instrument Maker	1
Mechanic and Carpenter ..	2

VALENTIA OBSERVATORY, Cahirciveen, Co. Kerry

Assistant Superintendent ..	C. D. Stewart, B.Sc.
Clerks, Grade III	4
Messenger	1

THE OBSERVATORY, ESKDALEMUIR, Langholm, Dumfries-shire

Assistant Superintendent ..	H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.
Senior Professional Assistant	C. H. Kellett, B.Sc.
Clerks, Grade III	3
Housekeeper, Mechanic and Handyman	3

THE OBSERVATORY, King's College, ABERDEEN

Clerk, Grade I	G. A. Clarke.
Clerks, Grade III	2

THE OBSERVATORY, LERWICK, Shetlands

Senior Professional Assistant	A. W. Lee, M.Sc., A.R.C.S., D.I.C., A.Inst.P.
Clerks, Grade III	2
Caretaker	1

PORT METEOROLOGICAL OFFICE, Liverpool

Senior Professional Assistant	M. Cresswell, Lt.-Cdr., R.N.R.
Clerk, Grade II (Temp.) ..	1

AVIATION SERVICES STATIONS

ALDERGROVE.

Senior Professional Assistant	W. Gillon, M.A., B.Sc.
Clerks, Grades II & III ..	3

BIGGIN HILL

Clerks, Grades II & III ..	3

CALSHOT

Assistant Superintendent ..	H. F. Jackson, M.S.E.
Junior Professional Assistant	W. D. Flower, B.Sc.
Clerks, Grades II & III ..	4

CATTEWATER

Clerks, Grades II & III ..	2

CRANWELL

Assistant Superintendent ..	W. H. Pick, B.Sc.
Junior Professional Assistant	J. S. Farquharson, M.A.
Clerks, Grades II & III ..	4

CROYDON.

Assistant Superintendent ..	G. R. Hay, M.A.
Senior Professional Assistants	N. H. Smith, B.Sc ; A. Walters.
Clerks, Grades II & III ..	7
Telephone-Typists	2

FELIXSTOWE

Senior Professional Assistant	C. W. Lamb, B.Sc.
Clerks, Grades II & III ..	2

HOLYHEAD

Clerks, Grades II & III ..	3

LEUCHARS

Senior Professional Assistant	J. M. Stagg, M.A., B.Sc.
Clerks, Grade III	2

LYMPNE

Senior Professional Assistant	R. M. Stanhope, B.A.
Clerks, Grades II & III ..	6

RENFREW

Senior Professional Assistant	Held by Junior Professional Assistant—W. J. Grassick, M.A.
Clerks, Grade III	2

SEALAND

Senior Professional Assistant	J. J. Somerville, B.A., B.L.
Clerks, Grades II & III ..	3

SOUTH FARNBOROUGH

Senior Professional Assistant	E. Taylor, M.A., B.Sc.
Clerks, Grades II & III ...	3

WORTHY DOWN.

Senior Professional Assistant	C. V. Ockenden, B.Sc.
Clerks, Grades II & III ..	2

AIRSHIP METEOROLOGY STATIONS

CARDINGTON

Senior Professional Assistant	S. P. Peters, B.Sc., A.Inst.P.
Special Research Assistant	B. C. V. Oddie, B.Sc.
Clerks, Grade III	2

PULHAM

(Staff transferred as required.)

ARMY SERVICES STATIONS

METEOROLOGICAL OFFICE, SHOEBURYNESS

Senior Professional Assistant	C. E. Britton, B.Sc.
Junior Professional Assistant	A. C. Best, B.Sc.
Clerks, Grades II & III ..	12

METEOROLOGICAL OFFICE, LARKHILL

Senior Professional Assistant	M. J. Thomas, B.Sc.
Clerks, Grades II & III ..	4

METEOROLOGICAL OFFICE, PORTON

Clerks, Grades II & III ..	5

SECONDED FOR DUTY WITH OTHER BODIES

Senior Professional Assistants	R. P. Batty, B.A. (R.A.F., India).
	E. L. Davies, M Sc (War Office, Porton Experimental Station).
	L. G. Hemens, B.Sc., (War Office, Porton Experimental Station).
	N. K. Johnson, M.Sc., A.R.C.S. (War Office, Porton Experimental Station).
	R. F. Budden, M.A., (War Office, Porton Experimental Station).
	R. G. Veryard, B.Sc. (R.A.F., India).

ANNUAL REPORT

OF THE

METEOROLOGICAL COMMITTEE

TO

THE AIR COUNCIL,

For the year ended 31st March, 1927 (the seventy-second year of the Meteorological Office).

The Meteorological Committee met three times during the year: on July 14th, 1926, November 25th, 1926, and March 9th 1927. There were no changes in the personnel of the Committee during the year.

General Work of the Office.—For the first time since the war there are no major changes in the organization or work of the Office to report. The Office appears now to have settled down into normal conditions and the work is proceeding smoothly. The chief difficulty which has to be faced is the constant growth of the work, not only on account of new demands but also on account of the ever-increasing mass of data which has to be handled.

Review of the Work of the British Climatolcgy Division.—It is the duty of the British Climatology Division to collect, tabulate and publish all available information bearing on the climate of the British Isles, and, what is of equal importance, to study the data collected in order to supply information on any aspect of the British climate. The constant establishment of new stations, the increased frequency of observations and the increase in the subjects of observation have all resulted in more and more data flowing into the Climatology Division. The consequence has been that so much time has to be devoted to the mere checking and tabulating of the data that little time remains for studying and discussing the information collected. It has been clear for some time that either the staff of the Division must be increased or the Division must be relieved of some of its responsibilities. The Meteorological Committee, therefore, decided to appoint a sub-committee under the chairmanship of Sir Arthur Schuster, to investigate the whole work of the Division. The sub-committee reported in November and the Meteorological Committee accepted their recommendations, the most important of which are the following :—

(*a*) The weekly issues of the *Weekly Weather Report* are to be discontinued and the publication will in the future be prepared as an annual volume.

(*b*) In the work of the British Rainfall Organization the inch is to be recognised as the unit of measurement of rainfall and in *British Rainfall* the rainfall data will be published in inches only.

(*c*) The Director is given considerable discretion as to what data should be published and simpler methods of checking returns from the climatological stations are approved.

It is expected that the changes now approved will relieve the pressure on the staff of the Division, and that investigations which have long been held up for want of time will be resumed. The revision of normals which is long overdue will be proceeded with as the changes become effective.

The Establishment of a Civilian Meteorological Service in Egypt and Palestine.—It was the intention, when the meteorological service was re-organized after the war, that the personnel of the service should be entirely civilian, the needs of the Navy, Army and Air Force being met during peace time by establishing meteorological stations staffed by civilians wherever necessary. This policy was carried out at once within the British Isles; but it was found difficult at the time to meet the need of the Royal Air Force in the Middle East and Iraq by attaching civilian staff to the Royal Air Force establishments in those countries. On the termination of the war there were a number of Royal Air Force officers and men who had had considerable experience in meteorological work, and these were sufficient to provide the staff of the meteorological service in the Middle East and Iraq. The difficulties have, however, increased as time has passed, chiefly due to the unsatisfactory prospects of both officers and men in the Royal Air Force who take up meteorological work. It was therefore decided to proceed with the original intention and, as a first step, to establish a civilian meteorological service in Egypt and Palestine, leaving Iraq to be dealt with later if the experience in Egypt and Palestine should prove successful. In August, 1926, the Treasury sanctioned the following establishment:

Headquarters at Heliopolis	1 Superintendent.
	1 Senior Professional Assistant.
	1 Grade I Clerk.
	3 Locally Recruited Clerks.
At each of the outstations at Aboukir, Abu-Sueir, Ramleh, Amman.	1 Grade II Clerk.
	2 Locally Recruited Clerks.

At the end of the year under review the Superintendent, Senior Professional Assistant, and Grade I clerk had proceeded to Egypt to organize the service, the intention being to effect the change from service to civilian staff as opportunity offers.

International Meteorology.—Meetings of a number of the Commissions appointed by the International Meteorological Organization (Conference of Directors) met in Zürich during September, 1926. The Director and Colonel Gold represented the Meteorological Office. Immediately on the termination of the meetings in Zürich a meeting of the International Meteorological Committee was held in Vienna, September 23rd to 29th. This meeting received the reports from the Commissions and passed a large number of resolutions, mainly submitted by the several Commissions. It is difficult to exaggerate the importance of the work done by the International Meteorological Committee consisting as it does of the directors of national meteorological services. Without the closest co-operation in matters of methods of observations, form of codes and times of issues of wireless weather reports, it would be impossible to carry on the work of any of the national meteorological services, for every service depends on the information and data received from surrounding services.

Up to the present the International Meteorological Organization has had no permanent home and no permanent staff. The increasing importance and complexity of the work done by the Organization has emphasised the need for some permanent establishment. At Vienna it was decided to create a small Secretariat under the direction of the President of the International Meteorological Committee. The functions of the Secretariat were defined as follows: "The Secretariat will organize the meetings of the Committee and of the Commissions and will publish their Reports. It will act as a centre for the collection of information regarding the various national meteorological services. So far as possible the Secretariat will provide the Presidents of the Committee and Commissions with help in carrying out their international work." It was further decided that the permanent home of the Secretariat should be in one of the smaller European countries; either Holland, Belgium or Switzerland. As the International Meteorological Organization is entirely unofficial, these decisions can only be carried through if approved by the several Governments concerned.

Staff.—The most important changes in the distribution of the staff that have occurred during the year have arisen from the establishment of a civilian meteorological service in the Middle East to which reference has already been made. Mr. J. Durward, the Assistant Superintendent in charge at Calshot, was selected for the senior post at Heliopolis, with acting promotion to the grade of Superintendent. He proceeded overseas early in January and was followed in March by Mr. J. Wadsworth, Senior Professional Assistant. The vacancy at Calshot arising from Mr. Durward's transfer has been filled by the transfer of Captain H. F. Jackson from Sealand with acting promotion to the grade of Assistant Superintendent. Mr. J. J. Somerville, formerly in charge at Renfrew has been transferred to Sealand, and Mr. W. J. Grassick has taken charge at Renfrew. The distributive station established at Aldergrove has been placed in charge of Mr. W. Gillon, formerly at Leuchars; Mr. J. M. Stagg being in turn transferred to Leuchars. The following promotions to the grade of Senior Professional Assistant have been made:—Mr. J. E. Belasco, Mr. F. H. Dight and Mr. R. F. Budden. There have been two retirements from the professional staff and the following new appointments to the grade of Junior Professional Assistant have been made: Mr. L. Dods, B.Sc. (London), Mr. D. N. Harrison, D.Ph. (Oxford), Mr. A. C. Best, B.Sc. (Wales), Mr. W. H. Bigg, B.Sc. (London), Mr. A. H. Nagle, B.Sc., A.R.C.S., D.I.C. (London), Mr. W. D. Flower, B.Sc. (Bristol).

Mr. B. C. V. Oddie, B.Sc. (London), has joined the staff as temporary research assistant.

The senior clerical post at Heliopolis has been filled by the transfer of Mr. R. Pyser from the General Services Division at Headquarters. The vacancy in the General Services Division arising from the transfer of Mr. Pyser has been filled by Mr. F. M. Dean, on promotion to a grade I clerkship. Messrs. A. E. Pycock and W. Andrews have been promoted to grade II clerkships, the latter on an acting basis. The continued increase in the amount of drawing work required in the office has led to the regrading of two grade III clerical posts assigned respectively to the Instruments and the General Climatology Divisions, as draughtsmen posts. There have been nine retirements from the

clerical staff, one through ill-health, two on account of marriage and two by reason of the selection of the officers concerned who were graded as temporary clerks, for permanent posts in other departments under the Southborough scheme, and the others for miscellaneous causes. In the list of retirements is included that of Mr. M. Sugrue, after completion of 52 years service at Valentia Observatory. Death, as the result of a motor-cycle accident while on his way home from duty, has robbed the Office of the services of Mr. W. A. Lambert, and the death of Mr. A. C. Garrick, the officer who retired earlier in the year from ill-health must also be recorded. As arrangements for the permanent recruitment of clerical staff have not yet been completed all these vacancies and also those arising from the creation of new posts at Aldergrove and in the Middle East have had to be filled on a temporary basis; 15 clerical officers have joined the office on that basis during the year.

The Committee record with regret the death of Mr. Charles Harding who for many years held the post of Principal Assistant in the Marine Division. Mr. Harding joined the staff as a boy-clerk in 1861 and was the last survivor of those who worked under Admiral Fitzroy in the days when the Office was attached to the Marine Department of the Board of Trade. He retired in 1911, but returned to part time duty during the war and continued to work until March 31st, 1920. His active connexion with the Office thus extended over nearly sixty years.

Finance.—The year under review, **1926**–7, is the seventh in which the cost of the Meteorological Office has been borne on Air Ministry Votes. The accounts are not yet closed, it is therefore impossible to give the exact amounts for the expenses and receipts of the Meteorological Office, but the following tables give the approximate figures :—

APPROXIMATE STATEMENT OF EXPENDITURE AND RECEIPTS IN RESPECT OF METEOROLOGICAL SERVICES DURING THE YEAR **1926**–7

Expenditure	*Amount* £	£
Salaries and Wages—H. Q. Establishments	48,244	
,, ,, —Out-station Establishments ..	43,863	
		92,107
Fuel and Light		495
Transport of Personnel and Equipment		2,835
Instruments, Equipment and Stores		5,693
Minor Works Services, Rents, Repairs and Maintenance of Buildings		3,630
Research		225
Telegrams, Cables and Telephones		9,890
Subventions and Reporting Stations		2,230
Miscellaneous		1,150
Superannuation		2,042
Total ..		£120,297

Receipts	
Receipts from Royal Society	880
,, ,, National Debt Commissioners (Annuities)	400
Sale of Instruments, Carriage, etc.	3,002
Daily Weather Reports, Forecasts, etc.	2,046
Receipts from War Office	6,232
Total ..	£12,560

Divisional Reports.—The following reports have been prepared in the Divisions. As certain subjects are dealt with by more than one Division there is some repetition, but it has been thought best to make no change as the report of each Division is then complete in itself and reference to other parts of the Report is avoided.

MARINE DIVISION.

Notwithstanding the difficulties encountered by shipping and seamen due to the general strike and the coal stoppage, the high standard of observation reached last year, which was without precedent, has been maintained: in addition a great many more marine observers have taken the initiative and by the use of wireless telegraphy have themselves extended the application of the work as an aid to navigation.

The geographical distribution of observational activity has been still further extended during the year.

Voluntary Observing Fleet and Observers.—The number of regular voluntary observing ships, has been maintained at 500 throughout the year, of which approximately 150 are equipped with sets of Meteorological Office instruments for keeping the meteorological log and making coded wireless weather reports to the Office.

Arrangements have been made for four H.M. Surveying Ships in home waters, keeping meteorological logs, to be replaced by H.M. Ships on foreign stations and making ocean passages.

The various branches of activity at sea have been continued. The comparative table on page 21 shows the numbers of ships engaged in the various branches, the disposal of sets of instruments on loan, and the returns made for the past eleven years.

Obituary.—The following deaths of marine agents, marine observers and former marine observers are noted with regret:—

Captain M. H. Clarke, O.B.E., R.D., R.N.R., Marine Agent at Dublin.
Captain N. R. de la Cour Cornwall, R.D., R.N.R., New Zealand Shipping Company.
Captain W. B. Palmer, late Commodore of the P. & O. Company.
Captain W. Davies, Ship *Monkbarns*.
Captain G. E. Butler, s.s. *Mantua*.
Captain G. C. M. Oakley, late Pacific Steam Navigation Co.
Captain S. G. Dale, Hain Steamship Co.
Captain J. Davies, White Star Line.
Captain W. H. Hatcher, Cunard Line.

Excellent Observers.—A list of captains and officers who have been granted awards for "Excellent" meteorological logs and wireless telegraphy weather report registers is given in the June, 1927, number of the *Marine Observer*.

Marine Agents and Old Marine Observers.—The Meteorological Office is indebted to many master mariners and others resident at ports throughout the British Empire and especially to the marine agents for their great assistance to marine observers. In October last, Captain J. McIntyre, Harbour Master at Belfast, undertook an agency, there being one short in the number allowed, owing to the death of Captain M. H. Clarke, who had been agent at Dublin from 1923.

Lieut.-Commander O. C. G. Leveson-Gower, R.N., became marine agent at Hong Kong, on taking over the Admiralty Chart and Chronometer Depot, *vice* Lieut.-Commander C. R. H. Harvey, R.N., in June, 1926.

Port Meteorological Office, Liverpool and Visiting Officer, London.—The Port Meteorological Office at Liverpool has continued of great value to the service. The officer in charge at that port, and the visiting officer, London, have been engaged in giving a course of instruction to officers in drawing weather charts on board regular observing ships at the docks, wherever assistance has been desired in this branch of the work.

Collection of Data.—*Meteorological logs (4-hourly) used with instruments lent by the Meteorological Office.*—Commencing from 1st April, 1926, a higher standard of classification was used, and about the best 40 logs in every 100 have been classed "Excellent." Of 274 logs received the following classification has been allotted.

Excellent	109
Very Good	164
Good	1
Not classed	0
Total	274

This is the first year since 1922, when "not classed" was first used to indicate inferior observation, that *all* logs received have contained observations made with official instruments, in the standard form required.

There is a marked improvement in the recording of wireless reports made to "all ships" and other evidence of the practical application of the work in the form of weather charts, additional remarks, etc., attached at the end of the logs.

Ships' meteorological reports Form 911 *(twice daily) used with ships' instruments.*—During the year this form was revised. The provision for recording wireless weather reports made to "all ships" by those selected, with reliable mercurial barometers in their outfit, and the space provided for "additional remarks" are being brought into more general use.

Classification	1926–7	1925–6	1924–5
Excellent	439	416	393
Very Good	1,623	1,641	1,721
Good	33	32	75
Not classed	0	2	0
Total Received ..	2,095	2,091	2,189

As the above table shows, the work of keeping these most useful forms is steadily maintained, and as we shall show later, ships detailed in the list to keep these forms are now also playing an important part

in the development of the practical application of the work at sea for the general benefit of shipping and seamen, as well as assisting some of the meteorological services of British Dominions and Colonies overseas.

North Atlantic Wireless Telegraphy Weather Report Registers, used with instruments lent by the Meteorological Office, Ships coded reports.—As shown by the comparative table below, the standard of these registers continues to improve.

Classification	1926–7	1925–6	1924–5	1923–4
Excellent	212	157	162	155
Very Good ..	102	143	100	90
Good	0	0	0	5
Not Classed ..	0	0	2	0
Total Received ..	314	300	264	250

Cross-Channel steamers' telegraphic reports.—Ten Packet Steamers on the Newhaven-Dieppe, Guernsey-Weymouth and Holyhead-Dublin services have made these reports of observations taken at mid-Channel.

During the year 674 reports have been received.

This work has been carried out in a highly satisfactory manner.

Sea water samples.—Twelve ships in the South American, West Indian, and North Atlantic trades have collected water samples, for the Ministry of Agriculture and Fisheries. This work is arranged by the Port Meteorological Officer, Liverpool, to ensure that there shall not be duplication of effort in voluntary marine observation in British ships for the British Government.

Miscellaneous contributions.—A number of interesting papers have been received from marine observers and others in addition to the logs, registers and Forms 911, including extracts from the remarks books of H.M. ships forwarded by the Hydrographer of the Navy

The Use made of the Data Collected.—In the "Marine Observer" all useful information received from the voluntary marine observers has where possible been worked up and returned in a form suitable for the information of seamen.

This information included charts of currents for the Trans-North Atlantic tracks, and for the routes from the Channel to the West Indies and Panama; charts of percentage frequency of fog in the North Atlantic, north of Latitude 30°N.; and mean sea surface temperatures for the North and South Atlantic.

The revision of the "Admiralty Wind Charts of the World" for the use of H.M. ships mentioned in last year's report, has been completed.

Date extraction, compilation and research.—During the year 78,180 sets of observations were extracted from logs and punched on Hollerith cards. In addition to these complete sets of observations, 8,242 observations of set and drift of current, dating back to 1910, on the

in the development of the practical application of the work at sea for the general benefit of shipping and seamen, as well as assisting some of the meteorological services of British Dominions and Colonies overseas.

North Atlantic Wireless Telegraphy Weather Report Registers, used with instruments lent by the Meteorological Office, Ships coded reports.—As shown by the comparative table below, the standard of these registers continues to improve.

Classification	1926–7	1925–6	1924–5	1923–4
Excellent	212	157	162	155
Very Good ..	102	143	100	90
Good	0	0	0	5
Not Classed ..	0	0	2	0
Total Received ..	314	300	264	250

Cross-Channel steamers' telegraphic reports.—Ten Packet Steamers on the Newhaven-Dieppe, Guernsey-Weymouth and Holyhead-Dublin services have made these reports of observations taken at mid-Channel.

During the year 674 reports have been received.

This work has been carried out in a highly satisfactory manner.

Sea water samples.—Twelve ships in the South American, West Indian, and North Atlantic trades have collected water samples, for the Ministry of Agriculture and Fisheries. This work is arranged by the Port Meteorological Officer, Liverpool, to ensure that there shall not be duplication of effort in voluntary marine observation in British ships for the British Government.

Miscellaneous contributions.—A number of interesting papers have been received from marine observers and others in addition to the logs, registers and Forms 911, including extracts from the remarks books of H.M. ships forwarded by the Hydrographer of the Navy.

The Use made of the Data Collected.—In the "Marine Observer" all useful information received from the voluntary marine observers has where possible been worked up and returned in a form suitable for the information of seamen.

This information included charts of currents for the Trans-North Atlantic tracks, and for the routes from the Channel to the West Indies and Panama; charts of percentage frequency of fog in the North Atlantic, north of Latitude 30°N.; and mean sea surface temperatures for the North and South Atlantic.

The revision of the "Admiralty Wind Charts of the World" for the use of H.M. ships mentioned in last year's report, has been completed.

Date extraction, compilation and research.—During the year 78,180 sets of observations were extracted from logs and punched on Hollerith cards. In addition to these complete sets of observations, 8,242 observations of set and drift of current, dating back to 1910, on the

routes to the West Indies and Panama, were extracted. The average rate of preparing and coding observations, of 81 sets per man per day, including Sundays and holidays in the time expended, reached for the first time last year, has been maintained.

Sixty-two per cent. of logs received, reaching the standard of "very good" or above, have been prepared for extraction; while observations of special interest and unusual phenomena in all logs and Forms 911 received during the year have been indexed.

Marsdens Charts showing the distribution and number of sets of observations extracted from logs during the past twelve months, and for the whole period from April, 1920, will be found in Volume IV., No. 42 of the *Marine Observer.*

The comparative table below shows the data extracted during the last five years from logs received :—

	1926–7	1925–6	1924–5	1923–4	1922–3
Percentage of Logs reaching the required standard, completely extracted and phenomena indexed.	64	64	55	66	73
Number of complete sets of observations extracted and punched on cards, with currents entered in data books and phenomena indexed.	78,180	75,852	65,060	74,749	97,533
Current observations prior to April, 1920, extracted and entered in data books.	8,242	8,210	5,746	4,259	1,826

Exchange of data.—This year more marine meteorological data have been supplied to other services than ever before.

This shows the great advantage for international purposes of the British system with the use of the Hollerith machine, the principal information contained in a meteorological log kept on board a British ship being made available to all maritime nations at the cost of sorting the cards and postage. It is unnecessary for the officers of these ships to keep more than one record.

During the year the following data have been supplied to the services indicated.

To the Royal Dutch Meteorological Institute at De Bilt, 1,112 sets of observations for all months in the year 1925, in selected squares in the Atlantic, Indian and Pacific Oceans.

To the French National Meteorological Office at Paris, 536 sets of observations for the period 25th April to 10th May, 1924, in the North

Atlantic and North Sea, between latitude 20° and 55° N. Longitude 10° E., and 35° W.

To the Geophysical Institute at Bergen, 1496 sets of observations in the North Atlantic north of latitude 10°N., for the periods 28th September to 4th October, 1923, 7th to 13th October, 1923, and 18th to 26th October, 1923.

To the International Bureau of Vulcanology at Naples copies of all reports of submarine earthquake phenomena received during the year ending March 31st, 1926.

To the Réseau Mondial—monthly means of pressure and air temperature for Watling Island, West Indies and Cape Pembroke, Falkland Islands, for the year 1922; monthly means of air and sea temperature for the area latitude 57°–62° N., longitude 15°–20° W., for the year 1925; monthly means of pressure, air and sea temperature for the areas latitude 45°–50°N., longitude 30°–35° W., and latitude 48°–53° N., longitude 15°–20° W. for the year 1924; and the same information for the area latitude 50°–55° N., longitude 25°–30° W., for 1923 and 1924.

To the International Upper Air Commission, 283 observations of wind and pressure at 8 a.m. on selected days in April, May and June, 1923, in all oceans south of the Equator.

The percentage frequency of sea and swell disturbance, computed from 6,153 observations taken in the years 1921 to 1925, along a projected seaplane route, was supplied for the purpose of British aviation.

Two hundred and thirty-seven sets of observations for 8 a.m. ships' time for the week February 13th to 19th, 1925, between longitude 25° W., and 100° E., were provided for the purpose of investigating the projected airship route to India.

To the Fishery Board for Scotland, 372 observations of the set and drift of current in the North Atlantic between latitude 40° and 60° N., for the year 1925.

Many inquiries calling for information of conditions prevailing at sea, at the times of casualties, have been answered by providing extracts from meteorological logs and ships' meteorological reports, Forms 911, for the purpose of the law courts and other tribunals.

Wireless Telegraphy Coded Reports from North Atlantic Liners.—During the last twelve months 4,714 weather reports were received from the 32 North Atlantic liners.

Upon examination of the registers in the Marine Division, it was found that 1,254 reports were received within one hour of observation, 1,230 reports in one to two hours, 1,080 in two to four hours, while 1,150 were over four hours in transmission.

Two thousand, one hundred and sixty-two reports were sent by ships to the westward of longitude 40°W., through Bar Harbor and other American coast stations direct to the United States Weather Bureau at Washington, D.C. A selection of these reports re-transmitted from Washington through Paris to England, are used with those received direct, for obtaining the distribution of pressure and weather right across the North Atlantic.

Three hundred and eighty-one errors in transmission were corrected by the check system, the registers proving that the check had only failed in 14 cases.

Atlantic and North Sea, between latitude 20° and 55° N. Longitude 10° E., and 35° W.

To the Geophysical Institute at Bergen, 1496 sets of observations in the North Atlantic north of latitude 10°N., for the periods 28th September to 4th October, 1923, 7th to 13th October, 1923, and 18th to 26th October, 1923.

To the International Bureau of Vulcanology at Naples copies of all reports of submarine earthquake phenomena received during the year ending March 31st, 1926.

To the Réseau Mondial—monthly means of pressure and air temperature for Watling Island, West Indies and Cape Pembroke, Falkland Islands, for the year 1922 ; monthly means of air and sea temperature for the area latitude 57°–62° N., longitude 15°–20° W., for the year 1925 ; monthly means of pressure, air and sea temperature for the areas latitude 45°–50°N., longitude 30°–35° W., and latitude 48°–53° N., longitude 15°–20° W. for the year 1924 ; and the same information for the area latitude 50°–55° N., longitude 25°–30° W., for 1923 and 1924.

To the International Upper Air Commission, 283 observations of wind and pressure at 8 a.m. on selected days in April, May and June, 1923, in all oceans south of the Equator.

The percentage frequency of sea and swell disturbance, computed from 6,153 observations taken in the years 1921 to 1925, along a projected seaplane route, was supplied for the purpose of British aviation.

Two hundred and thirty-seven sets of observations for 8 a.m. ships' time for the week February 13th to 19th, 1925, between longitude 25° W., and 100° E., were provided for the purpose of investigating the projected airship route to India.

To the Fishery Board for Scotland, 372 observations of the set and drift of current in the North Atlantic between latitude 40° and 60° N., for the year 1925.

Many inquiries calling for information of conditions prevailing at sea, at the times of casualties, have been answered by providing extracts from meteorological logs and ships' meteorological reports, Forms 911, for the purpose of the law courts and other tribunals.

Wireless Telegraphy Coded Reports from North Atlantic Liners.—During the last twelve months 4,714 weather reports were received from the 32 North Atlantic liners.

Upon examination of the registers in the Marine Division, it was found that 1,254 reports were received within one hour of observation, 1,230 reports in one to two hours, 1,080 in two to four hours, while 1,150 were over four hours in transmission.

Two thousand, one hundred and sixty-two reports were sent by ships to the westward of longitude 40°W., through Bar Harbor and other American coast stations direct to the United States Weather Bureau at Washington, D.C. A selection of these reports re-transmitted from Washington through Paris to England, are used with those received direct, for obtaining the distribution of pressure and weather right across the North Atlantic.

Three hundred and eighty-one errors in transmission were corrected by the check system, the registers proving that the check had only failed in 14 cases.

Some of these ships have repeated the same observations *en clair* addressed to "all ships" so as to make the reports more easily available to all ships desiring observations synchronised with those of the nearest coast. R.M.S. *Cedric*, Captain V. W. Hickson and R.M.S. *Lancastria*, Captain R. G. Malin, are to be congratulated on being the pioneers of this extension of service, and upon their sustained and continuous effort.

Practical Application of the Work at Sea.—The provisions of the Meteorological Office authorize the loan of sets of tested instruments to the captains of British merchant ships for the purpose of the collection of reliable observations of weather at sea. These observations are required for providing data for research, for compiling information required for navigation, for the general purposes of meteorology ashore and for central forecasting.

The provisions of the Meteorological Office do not permit the loan of instruments to ships for their own exclusive purposes, but where instruments are lent for the first of these purposes it is intended that they should be used also for the second. And so it is that there are about 150 British merchant ships, with highly efficient official instruments on board, which may be used for the general advantage of shipping on the high seas.

In 1921, in *Weather Forecasting in the Eastern North Atlantic and Home Waters for Seamen*, published when the principle of giving actual observations at British coast stations by W/T to shipping was first adopted, it was stated :—

> "The greatest assistance which shipowners can give in furthering this aid to navigation is to provide their ships with good mercurial barometers."

It would seem that many shipowners are now realising more truly the value, to those navigating their ships, of a reliable barometer; and there are now on our list just over one hundred ships with mercurial barometers in their outfits, which with the 150 ships with official instruments, make 250 ships in our total of 500 which have on board a good mercurial barometer, and are invited to make routine reports to "all ships."

The chapters on "Wireless and Weather an aid to Navigation," originally published in the 1924 numbers of the *Marine Observer* are being revised and re-published in this year's numbers.

The number of British observing ships regularly making weather reports to "all ships" along all the trade routes of the world, has more than doubled during the past twelve months, and is steadily growing, as shown by the weather reports logged as sent.

Of the many ships which are performing this very useful service the following is an example :—

S.S. *Khyber*, Captains J. B. Browning and C. Hester, principal observer, Mr. C. W. Roche, chief officer, during two voyages to the Far East, has continued regularly broadcasting reports of observations made at the correct times, daily to "all ships"; and when within range of certain stations these reports have been addressed to British colonial observatories as well as to all ships. A weather chart has been made whenever sufficient synchronised data were available.

On her earlier voyage *Khyber* brought to the notice of the authorities at Hong Kong the utility to ships in the China Seas of weather

observations at coast stations, if broadcast by wireless; and from July 1st, 1926, these observations have been so made. On her last voyage she made good use of these reports. On September 29th, 1926, the chart of these reports and those of other ships enabled her to avoid a typhoon and to avoid loss of time.

The practical application of the work at sea is steadily being organized with the voluntary co-operation of marine observers, and the support of many of the marine superintendents of the great steamship lines, with a view not only to aiding navigation, but ultimately to aid aerial navigation overseas; and therefore too much encouragement cannot be given to the captains, officers and wireless operators of regular observing ships.

In home waters evidence of the value to shipping of the British Weather Shipping Bulletin has continued to come in, and during the year the appreciation of salvors was especially evident. The Committee of the Liverpool Underwriters' Association made special mention of this in their annual report.

Marine Publications.—The publication of the *Marine Observer* has been regularly maintained, and continues to increase its usefulness and success in providing information for seamen, and encouraging and stimulating voluntary work at sea. A list of the more important contributions to the *Marine Observer* will be found on pages 70 and 71.

The *Marine Observer's Handbook* has been revised, and was published as the Fourth Edition on 1st January, 1927.

Instrumental Observation.—The portable and modified thermometer screens mentioned in last year's report are now affording a means of improved observation in a number of ships. The old screens are being gradually replaced.

DETAILS OF VOLUNTARY OBSERVING FLEET AND COAST STATIONS

	At 31st March										
	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917
Ships equipped with instruments keeping full logs ...	115	115	117	122	123	125	133	104	—	—	—
H.M. Ships keeping full logs	7	9	8	8	9	9	9	2	2	—	—
Ships contributing reports from ship's instruments...	330	325	321	322	332	341	216	117	7	—	—
Ships equipped especially for W/T Weather Reports ...	29	31	32	21	24	17	1	—	—	—	—
Coast Stations equipped with instruments for Form 914.	32	34	34	35	38	40	42	53	52	49	49
Ships equipped with instruments for Home Waters Telegraphic Reports ...	10	10	10	10	8	8	24	—	—	—	—
Ships with logs overdue...	0	0	0	0	0	0	2	19	—	—	—
No. of Barometer corrections determined ...	1426	1560	1474	1368	1355	1025	365	—	—	—	—

	Receipts for the year ended 31st March										
	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917
Meteorological Logs... ...	274	264	274	256	272	264	204	67	22	59	115
Ships' Meteorological Rpts. Forms 911 ...	2095	2091	2189	1785	1741	1717	1668	503	21	144	670
Forms 914 (Coast Observations) ...	387	406	402	404	423	460	437	381	334	324	340
Lighthouse Registers ...	10	13	14	14	13	16	16	12	16	15	14
Ocean W/T Report Registers	314	300	264	250	228	98	—	—	—	—	—
Home Waters Telegraphic Reports ...	674	767	802	820	752	1066	1808	—	—	—	—
Cadets Meteorological Log...	10	9	9	9	9	9	6	—	—	—	—
New Data Extraction. Logs extracted	174	170	142	165	204	155	169	—	—	—	—

BRITISH CLIMATOLOGY DIVISION

Organization.—The arrangements introduced last year, under which this Division prepares for publication the serial issues of the *Weekly* and *Monthly Weather Reports* and also the annual issues of *British Rainfall*, has been continued during the year under review without essential modification. The Division remains responsible also for the passage through the press of the annual volumes of the *Observatories' Year Book.*

The Division collects and indexes climatological and rainfall records from all stations in the British Isles which report to the Office. It prepares replies to inquiries for past weather in the British Isles, and detailed reports regarding the rainfall of specified areas, in connexion with questions of water supply and other purposes.

Climatology of the British Isles—Distribution of Stations.—The following table gives the distribution by districts of the stations of different types; it also shows the distribution of the stations from which autographic records are received. The classification under "autographic records" is independent of that under "stations"; further, a single station may be counted more than once in two or more columns under "autographic records." The classification takes account of the numerous stations from which records of rainfall only are received for publication in *British Rainfall.*

Districts	Stations						Autographic Records					
	Observatories	Distributive	Telegraphic	Crop Weather	Climatological	Rainfall only	Sunshine	Rainfall	Wind	Pressure	Temperature	Humidity
0. Scotland. N...	1	0	4	0	8	116	9	1	2	12	0	0
1. ,, E...	1	1	2	2	26	330	17	3	3	3	2	2
6*a*. ,, W...	1	1	1	0	21	304	13	3	1	3	1	1
2. England, N.E.	0	1	2	3	15	256	16	3	3	3	1	1
3. ,, E...	0	2	2	4	20	453	21	5	3	3	1	1
4. ,, Midlands	0	0	4	3	39	970	29	9	1	4	1	1
5. ,, S.E.	0	6	1	4	38	764	35	8	8	9	8	7
London District	2	0	0	0	10	59	8	9	1	1	3	1
8*b*. England, S.W.	0	1	2	3	28	548	24	5	4	2	1	1
7*a*. England, N W.	0	0	1	1	22	425	22	7	2	1	0	0
7*b*. N. Wales ..	0	2	0	1	5	159	6	3	2	3	2	2
8*a*. S. ,, ..	0	0	1	1	6	212	9	3	0	1	0	0
9. Ireland, N. ..	0	1	3	0	6	111	5	2	2	3	1	1
10. ,, S. ..	1	0	2	0	15	148	5	2	3	8	0	0
6*b*. Isle of Man ..	0	0	0	0	1	8	1	0	0	0	0	0
11. Scilly and Channel Isles	0	0	2	0	2	23	3	0	2	2	0	0
Total	6	15	27	22	262	4,886	223	63	37	58	21	18
Corresponding number for last year	6	15	27	20	267	4,880	218	53	34	49	19	14

The observatories and distributive stations which are classified in the table are operated by the staff of the Office. Reports on the work of the observatories will be found on pages 58–69. The distributive stations are administered by the Aviation Services Division and particulars of their work will be found on pages 32–42. The telegraphic stations are, as a rule, maintained at coastguard stations or lighthouses by arrangement with the respective authorities. The meteorological observations at these stations are made expressly for the purposes of the Daily Weather Service and form part of the regular work of the station staff, for which payment is made from the Office. Further particulars will be found on pages 28–33. The "crop-weather stations" are maintained at certain agricultural colleges and research institutions, in connexion with the study of the relations between the weather and growing crops. They report partly to the Meteorological Office and partly to the Ministry of Agriculture and Fisheries and the Board of Agriculture for Scotland, and the arrangements for the observations are under the general control of a committee on which the Office is represented.

The numerous climatological and rainfall stations are maintained by private observers, or by municipal or other local authorities without payment by the Office. The Committee wish to express their appreciation of the public spirit shown by those who maintain these stations, and forward their records and observations for incorporation in the official weather reports and for preservation in the Office, where they are available for the benefit of the community.

Only such autographic records as are regularly received at the Office are included in the above table, but the records from other municipal or private stations are usually available on loan if required. The autographic records obtained at observatories and distributive stations are preserved at the respective observatories and stations.

Changes of Stations Associated with the British Climatology Division.—Returns of daily observations are received from a new telegraphic reporting station which has been set up on the island of Tiree, West Scotland. A pressure tube anemometer is also in operation at this station. Climatological stations have been started at Ventnor Park (August, 1926), Bromley (January, 1927), Belfast (January, 1927), Kirkwall (January, 1927), Nelson (March, 1927). In addition returns from a new station at Oxford (Sandford) have been received under the "Crop-Weather" scheme of the Ministry of Agriculture and Fisheries as from November, 1926. The Londonderry & Lough-Swilly & Letterkenny Railways erected a pressure tube anemometer at Dunfanaghy Road Railway Station, Co. Donegal, and by arrangement with the Company the records from this very exposed station are regularly received and analysed.

The wind records now received from Tiree and Dunfanaghy coupled with the record which was started at Lerwick Observatory, Shetland Isles, a few years ago, are specially valuable in representing the wind conditions on the exposed northern and north-western coasts for which provision had hitherto been lacking.

The following climatological stations have ceased, for various reasons, to send in observations:—Peterborough (July, 1926), Clongowes Wood (August, 1926), Egremont (October, 1926), Dorchester (October, 1926), Carshalton (December, 1926), Isleworth (January

1927), Cirencester (January, 1927), Sevenoaks (January, 1927), Midhurst (January, 1927), Dyffryn (January, 1927), Hounslow (January, 1927), Commondale (January, 1927), Leeds (February, 1927).

The record from the anemometer station at Rosyth Dockyard ceased as from April, 1926.

As usual, numerous changes occurred in the list of more than 4,500 rainfall stations. On the average about 300 rainfall observers drop out of the list every year and are replaced by others. In many cases the sites of the gauges remain unchanged.

Inspections.—During the year inspection reports for 146 climatological stations in England, Wales and Ireland and for 188 rainfall stations were dealt with.

Courses of Training for Observers.—A course was held at Kew Observatory at the end of September. Ten observers from the agricultural-meteorological stations and six observers, principally from health resort stations, attended. Immediately afterwards meetings were held at the Meteorological Office, South Kensington, to read and discuss papers of interest to the student of agriculture and meteorology; Sir Napier Shaw took the chair at these meetings. A report of the meetings has been issued by the Ministry of Agriculture and Fisheries.

Publications.—The *Weekly* and *Monthly Weather Reports* have been published regularly throughout the year, and the issues are up-to-date. No change of form has been made in either of these publications.

British Rainfall, 1925, was published on 10th November, 1926. The volume was arranged on the same lines as its predecessors.

The second volume of the *Observatories' Year Book*, viz., that for 1923, was issued. The volume for 1924 was passed for press and that for 1925 is now in the press.

A short supplement to the *Meteorological Observer's Handbook* was prepared containing instructions to observers at auxiliary climatological stations in the method of completing their weekly and monthly returns of observations for transmission to the Office.

Returns for Registrars-General.—A weekly summary of the weather at certain large towns is prepared for the Registrar-General for England and Wales. Quarterly and annual summaries are also supplied. Similar information is supplied quarterly to the Governments of Northern Ireland and the Irish Free State. The report for Scotland, published by the Registrar-General for Scotland, is prepared at the Edinburgh Office.

Inquiries.—During the year 625 general or scientific inquiries, including 64 legal inquiries, were dealt with. Among these the following may be mentioned:—

Reports on the rainfall of the Thames and Lea Valleys for each month and for the year ending March 31st, 1926, were supplied to the Metropolitan Water Board. Rainfall data were also forwarded monthly to the Thames Conservancy.

A report was supplied to the Ministry of Agriculture and Fisheries on the average annual rainfall over a portion of the valley of the South Teign River, in connexion with a parliamentary water bill promoted by the Corporation of Torquay.

Reports on the rainfall of the valleys of the rivers Thames and Lea, and on the rainfall over a portion of Inverness-shire, were prepared for firms of engineers in connexion with questions of water supply.

Weekly values of rainfall for one year at rainfall stations in the valley of the Tyne were supplied to the local inspector of the Ministry of Agriculture and Fisheries.

Maps of average rainfall distribution over the Huddersfield district for each of the four quarters of the year were supplied to the Tolson Memorial Museum, Huddersfield.

An analysis of the records of wind obtained from anemograph stations in Great Britain, and a statement of the rainfall were supplied to the Forestry Commissioners for the occasion of the severe gale of January 27–29th, 1927.

Tables showing monthly and annual values of temperature, rainfall and sunshine for the British Isles were supplied to the Board of Trade for publication in the "Statistical Abstract of the United Kingdom."

Information regarding humidity in different parts of the country was forwarded to the Board of Trade in connexion with the selection of sites of factories for wool-spinning.

During the summer and autumn of last year a cablegram was despatched each Monday to the United States Weather Bureau, Washington, describing briefly the weather in this country during the preceding week, for publication in a weekly crop bulletin issued by the Bureau. The service is to be resumed this year.

Information regarding extreme wind velocities in this country was supplied on several occasions for various economic purposes.

Information regarding the state of the weather in the early morning in previous months of June in N. Wales, Lancashire and Yorkshire was supplied to the Joint Permanent Eclipse Committee of the Royal Society and Royal Astronomical Society in connexion with the forthcoming total eclipse of the sun on June 29th, 1927.

Investigations, etc.—*Weekly climatological values for the British Isles.*—The preparation of a homogeneous series of weekly values by districts, of temperature, rainfall and sunshine for the British Isles, from 1878 to the present time, which was referred to last year, has proceeded, but the results are not yet ready for publication.

Rainfall Survey of the British Isles.—Some progress was made with the preparation of maps showing, on a scale 2 miles to 1 inch, the isohyetal lines of average annual rainfall. The map of Norfolk was completed and additional averages were computed for stations in Somerset and Hereford. Extraction of data for Wiltshire and Dorset was commenced.

Average annual values of the number of days with rain have been computed for the period 1881–1915 for 52 stations in England, 21 in Wales, 45 in Scotland and 37 in Ireland, and a map showing the average distribution of rain-days has been prepared. The map will be published, together with a discussion, in the forthcoming issue of *British Rainfall*, 1926.

The question of the best method of shielding rain-gauges in windy localities so as to avoid the effects of "over-exposure" which result in the recorded amounts being too low, is being investigated by the Office at Lympne Aerodrome and at Holyhead, and by Mr. F. Hudleston, M.Inst.C.E., at Hutton John, Penrith. Mr. Hudleston has devoted much time and thought to this matter and has communicated full details of his observations to the Office. The measurements of rainfall in certain hilly or mountainous regions, where the rainfall

is of special economic importance, such as Dartmoor, Wales, the Pennines, the Lake District and many parts of Scotland, are unfortunately subject in some cases to considerable doubt, because of the difficulty of obtaining satisfactory exposures for the gauges. The experiments now in progress are intended to supply data which will indicate the way to a satisfactory solution of this problem.

GENERAL CLIMATOLOGY DIVISION

The work of the General Climatology Division was continued on the lines laid down in the preceding year. Especial attention was directed to the organization of the Library, and it is satisfactory to record that many of the arrears of cataloguing, some of which had been outstanding for many years, were cleared off.

Climatology of the Globe.—Manuscript returns from seven foreign and 102 colonial stations have been received. In addition, manuscript returns have been regularly received from nine meteorological stations in the Middle East Area, Iraq and Palestine, and from a tenth station, Kirkuk, until 30th September.

Under an arrangement made with the Colonial Office in 1910, reprints of the summaries of meteorological observations published in the annual reports of the colonial governments are circulated to institutions on the Exchange Lists of the Office. An introduction entitled "Notes on Meteorological Observations made in British Colonies and Protectorates," has been issued with the reprints of the summaries for 1923. This introduction gives particulars of the equipment and exposure of the contributing stations which have been received in response to a questionnaire circulated through the Colonial Office. Supplementary notes were issued with the reprints for 1924. In addition, manuscript "recommendations" were prepared for each station in which the observers were advised as to their site, equipment and methods of observation, and the recommendations were issued through the Colonial Office.

The work on the preparation of the *Réseau Mondial* has progressed steadily. The volume for 1919 has been issued, that for 1920 is in the press, and the preparation of the tables for 1921 is well advanced.

Library.—*General.*—The preparation of the monthly "List of Meteorological Papers" has been continued. Since July the list has been classified according to subjects.

A list of papers bearing on agricultural meteorology received in the library has been forwarded monthly to the Ministry of Agriculture and Fisheries for incorporation in that Ministry's monthly report ("Crop-weather" Scheme).

Abstracts of the more important meteorological papers received in the Library have been prepared by members of the professional staff. These abstracts have been manifolded and circulated in sets to the branches and establishments of the Office.

The collection of *lantern slides* has been overhauled and re-arranged and a revised catalogue has been prepared.

Exchange of Publications.—New exchanges of publications have been arranged with :—

Meteorological Observatory, Krietern, near Breslau.
Solar Observatory, Mount Stromlo, Canberra, Australia.
Ukrainian Meteorological Service, Kiev.
Institut Scientifique Chérifien, Rabat, Morocco.

Additions.—The additions to the Library during the past year include 758 new books and pamphlets and 12,763 daily weather reports. The number of periodicals received was about 3,800.

Loan of books.—5,830 books were issued on loan during the year.

Catalogues.—The author and subject card catalogues have been kept up to date and considerable progress has been made in overtaking arrears.

The bibliographies of climatological publications and of upper air data have been kept up to date.

Binding.—380 volumes have been bound during the year.

Lantern slides.—149 new slides were received into the collection. Sets of slides were borrowed on 36 occasions.

Long-series Climatological Data.—The collection of serial monthly mean values of pressure, temperature and rainfall for a long period of time for a number of stations distributed all over the globe, referred to in the last *Annual Report*, has now been completed. The Smithsonian Institution has taken charge of the publication of the data, and the volume, which bears the title " World Weather Records," is now in the press.

Meteorology of Air Routes.—Numerous inquiries have been received as to the flying conditions in various regions. In order to provide the material for ready answers to such inquiries, systematic descriptions, accompanied by tables, dealing with the meteorology of the air routes in all parts of the world, are being prepared on a uniform basis. The following sections have been completed :—England, Southern North Sea, English Channel, Belgium and Northern France, Southern France, Spain and Portugal, Western Mediterranean, Italy and Malta, Eastern Mediterranean.

Publications.—The General Climatology Division has prepared for the press the publications enumerated on page 69 as issued during the year, with the exception of those specifically allocated to other divisions.

The *Meteorological Magazine* has been published regularly.

Admiralty Pilots.—These handbooks, issued by the Admiralty for the use of navigators, contain notes on weather and climatological tables prepared in the Meteorological Office. The text of the meteorological portion of four pilots was revised during the year. The revision of tables for five pilots was carried out, involving the preparation in the Division of data for 22 stations. In addition meteorological services abroad were good enough to contribute revised tables for eight stations.

Special Investigations.—The investigation into the causes of the variations of pressure distribution over the North Atlantic and Western Europe has been continued. In this connexion a paper on " The Variation of Pressure from Month to Month in the Region of the

British Isles" has been published in the *Quarterly Journal* of the Royal Meteorological Society, and papers on "Classification of Monthly Charts of Pressure Anomaly over the Northern Hemisphere" and "The effect of Fluctuations of the Gulf Stream on the Distribution of Pressure over the Eastern North Atlantic and Western Europe" have been published as *Geophysical Memoirs.* An investigation into the effect of variations of ice conditions in the Arctic Ocean and in the North Atlantic is well advanced, and preliminary work has been carried out on the effect of variations of solar activity and on various other factors.

The remarkable secular variations of the meteorological elements at St. Helena and Sierra Leone since 1891 were investigated statistically; the results have been published as a *Geophysical Memoir.*

In connexion with the eclipse of 29th June, 1927, a study of "The Meteorology of Solar Eclipses," with an exhaustive bibliography, was compiled by Mr. E. W. Barlow.

Inquiries.—During the year 172 general or scientific inquiries and 264 personal inquiries were dealt with.

Among the inquiries may be mentioned:—A request from the Hydrographer of the Navy for charts of the distribution of mean pressure and temperature over the globe during January, April, July and October.

A request from the British Association for Woollen Industries for data of temperature and humidity at a large number of places in different parts of the world.

A request from the Office National Météorologique, Paris, for tables of wind frequency from different directions at 38 places on the British coasts.

FORECAST DIVISION

General.—The outstanding feature of the early part of the year, the General Strike in May, caused some apprehension as to the efficient performance of the forecast work owing to the necessity for the punctual arrival of many members of the staff at an early hour in the morning for the issue of the morning forecasts. Such apprehension proved, however, to be groundless, the necessary personnel being always on duty owing to a general determination to overcome any difficulties and disregard any inconveniences met with on the journey. It was necessary at this period to cancel certain deliveries by hand of the *Daily Weather Report* but with this exception all the normal work of the Division was continued without interruption.

It has been felt for some time that the forecast districts in use for Scotland have not been entirely satisfactory, regions having very different climatic features being included in some cases within the same district. After consultation with the Meteorological Office, Edinburgh, a specification of new districts was prepared and these were brought into use from January 1st, 1927.

An important addition to the network of stations contributing daily telegraphic reports to the Forecast Service was made with the opening of a station at Cornaigmore in the Island of Tiree off the west coast of Scotland in September. The work is in charge of Mr. D. O. MacLean, M.A., M.C., Headmaster of the Cornaigmore Secondary School. An anemograph forms part of the equipment. The observations from Tiree were substituted for those from Castlebay in the *Daily Weather Report* on January 1st, 1927, in view of the decision to close the latter station during the coming year.

A new and completely revised edition of the old "Telegraphic Instructions" was prepared as Supplement No. 1 to the *Meteorological Observer's Handbook* for the use of observers at telegraphic reporting stations. No printed instructions had been issued to observers since the introduction of the present international code shortly after the war, and the need for such to replace the several typed instructions which had been prepared from time to time was very great.

Nine Supplements to the 4th edition of M.O. 252, *Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain and the countries of Europe and North Africa*, have been issued and the MS. for a fifth edition of this publication has been prepared for press.

Close attention has been given throughout the year to the new methods of forecasting as developed in Norway. In this connexion and in all the forecast work the reports of upper air temperature and humidity received from the station flight at Duxford have proved of the greatest service.

Various special charts and diagrams have been prepared for use at exhibitions and for reproduction as lantern slides and illustrations.

Members of foreign and colonial meteorological services have been shown the work of the Division, and officers of the Royal Navy and Royal Air Force have been attached for instruction at various periods.

Observations received. (*a*) *British reports.*—A number of minor changes have taken place during the year at reporting stations; some of these have been made with a view to improving the exposure of the instruments and others have been due to causes outside the control of the Meteorological Office.

The station at Scilly was moved on the 27th November to another position in the Island of St. Mary's, distant about $1\frac{1}{2}$ miles to the north-east of the old site. The coastguards are still responsible for the observations and the exposure is similar to that of the old station. Synchronous observations will be taken at the two sites for a period of one year.

A new raingauge site was secured at Portland Bill, it having proved difficult at the old site to protect the instrument from accidental damage.

Owing to the closing of the Post Office at Roche's Point, the observer, Mr. M. Fitzmahony who was also Postmaster, was transferred to another town on 21st August after rendering excellent service to the Meteorological Office since 1903. Temporary arrangements for continuing the work have been made, but the future of the station is still under consideration.

A new instrument enclosure at Tynemouth, affording a better exposure than the old site, was brought into use on June 1st.

The reception and issue to the Press of reports from health resorts has continued throughout the year, one new station, Ventnor, being added to the list.

The service of weather reports from ships of the British Mercantile Marine has been well maintained and a considerable number of reports from foreign ships have also been received.

Reports of upper air temperature and humidity have been received regularly throughout the year from the Station Flight at Duxford except for an interval of about three weeks in October and November when the aeroplanes allotted for the work were being overhauled. Numerous reports have also been received from the Royal Aircraft Establishment at South Farnborough.

The use of a trial group, giving state of the sky according to a special code, which has been incorporated in the reports from Valentia, Aberdeen, Cranwell and Cattewater since February 1925, in accordance with the request of the International Commission for Synoptic Weather Information, was discontinued in October. A revised form of the group has been recommended for trial by the Commission.

There having in the past sometimes been difficulty in distinguishing between simultaneous weather and sequence of weather in reports of past weather by telegraph, a test has been made of a method of indicating sequence of past weather by the use of a hyphen where a comma would be used in a written return.

The spheres of the sunshine recorders at all telegraphic reporting stations were tested during the summer of 1926.

(*b*) *Foreign reports.*—The network of stations organized by the Danish Meteorological Service from which weather reports are received from Greenland was increased from one station to four in May. Observations are now obtained with fair regularity from Godthaab, Godhavn, and Angmagsalik as well as from Julianehaab.

The exchange of information by wireless telegraphy between all the principal European countries has been maintained and some minor changes only have been made. An important step was, however, the adoption of the millibar as pressure unit in French reports from January 1st.

Cabled reports to supplement the wireless service continue to be exchanged with Norway, Holland, Portugal and Italy, but exchange with Switzerland ceased at the end of November, and the exchange with Italy was reduced by 50 per cent. on February 1st.

From September the American observations received *via* the Eiffel Tower have been given in a revised code which allows for the inclusion of temperature readings. These readings are of great value and have been included in the British Northern Hemisphere Chart since March 1st.

Distribution of Information.—The regular British synoptic reports have been broadcast by wireless telegraphy at the normal hours. (Full particulars of these issues are given in Publication, M.O. 252). Observations from Tiree have been included in the 7h., 13h., and 18h., synoptic reports since the 28th of December.

In connexion with the Gordon Bennett Balloon Race, special upper air observations were taken and added to the wireless synoptic messages, and surface reports from a number of stations not ordinarily issued by wireless were added to certain wireless synoptic issues on Sunday, 30th May.

Synoptic data were telephoned to the Royal Agricultural Show at Reading in July for the preparation of the charts and forecasts which formed part of the work of the Meteorological Office exhibit there.

A mid-day forecast has been prepared since January for issue by the Irish Free State Broadcasting Station at Dublin each week-day. This is additional to the evening forecast.

The Harvest Forecast Service which has been a feature of the work of the Division for many years has now practically ceased. Only a very few applications for forecasts were received during the summer; the normal service of forecasts issued by radio-telephony has superseded the service of forecasts sent by telegram.

In addition to the regular services, numerous forecasts have been supplied in response to special inquiries, and there have been a number of applications for weather reports and forecasts from ships at sea.

Lithographic and Duplicated Reports.—The *Daily Weather Report*, in three sections, together with correction and addition sheets has been published throughout the year.

A summary of the weather for the past month has been issued on the first day of each month, and a short summary of the weather of the year 1926 was issued to the Press on the evening of the 31st December.

The normal distribution of the daily duplicated reports and charts has been maintained together with the usual reports and forecasts for the press. A morning "Health Resort Report" giving data for 9 a.m. at a number of health resorts was prepared during the summer months.

Gale Warnings.—By arrangement with the British Broadcasting Corporation gale warnings have been issued since 1st October, from Daventry, when necessary, after the 1 p.m. and 4 p.m. time signals and after the 6.30 p.m. weather forecast. In conjunction with the Board of Trade, fourteen new gale warning stations have been opened during the year. Three of these, on the coast of the Solway Firth, serve a long stretch of coastline which has not been provided with gale warnings since the year 1914.

The results of the checking* of the gale warnings issued during 1926 are given in the table on page 32.

*The method of checking gale warnings is under consideration with a view to revision. The table for the year 1926 is given in the same form as in previous years.

DISTRICTS	Summary of occasions of gales		Summary of warnings issued			
	Total number of occasions upon which warnings were necessary	Percentage of occasions of gales effectively warned	Total number issued	Issues justified by gales (force 8 or above)	Issues justified by strong winds (force 6 and 7)	Percentage justified by gales and strong winds
I. Scotland N.E. A	13	85	34	11	15	76
I. Scotland N.E. B	4	100	26	4	11	58
II. Scotland E.	5	100	21	5	7	57
III. Scotland N.W.	12	100	36	12	12	67
IV. Scotland W. and North Channel.	14	93	39	13	14	69
V. Ireland N.	13	100	41	13	16	71
VI. Ireland S.	12	92	37	11	19	81
VII. Irish Sea.	11	100	32	11	17	88
VIII. St. George's Channel.	13	85	31	11	13	78
IX. Bristol Channel.	20	80	36	16	10	72
X. England S.W.	18	78	37	14	14	76
XI. England S.	9	100	37	9	22	84
XII. England S.E.	19	95	36	18	12	83
XIII. England N.E.	5	60	28	3	17	71
XIV. England E.	19	84	35	16	14	91
Totals	187	89	506	167	213	75

Inquiries.—The work of the Division in answering inquiries from the Press and public has continued. The number of inquiries received during the past five years is given in the subjoined table.

Month	1926–7	1925–6	1924–5	1923–4	1922–3
April	226	190	265	182	126
May	209	313	329	271	190
June	232	455	329	340	200
July	390	415	356	306	375
August	271	352	265	280	158
September ..	247	298	214	205	143
October ..	244	283	229	282	138
November ..	273	358	207	285	177
December ..	223	346	341	203	178
January	300	322	330	271	244
February	323	247	283	182	206
March	229	266	206	177	202
Total ..	3,167	3,845	3,354	2,984	2,337

AVIATION SERVICES DIVISION

General.—The activities of the Division have been maintained on the lines described in the last *Annual Report*, but there has been a considerable expansion in practically all branches of the work. In particular, increased advantage has been taken by both service and civil pilots of the facility by which a weather report or forecast for any route or area in the British Isles or along the main Continental routes can be obtained on request, at any time during the day or night, from the Aviation Forecast Service at the Air Ministry. During one month, September, 226 such requests were received. There has also been a marked increase in the number of inquiries for forecasts received at distributive stations on aerodromes. Mention should also be made of the increased demand for data at Headquarters regarding the meteorological conditions affecting flying in various parts of the world.

The main work of the Division is concerned with the organization and supply of meteorological information for the Royal Air Force and for civil aviation services, for which the Director of Civil Aviation is responsible. Inquiries in connexion with aviation are also received, however, from other sources. Thus, in September, meteorological data relating to British West Africa, were supplied to the Spanish Meteorological Service in connexion with a projected flight from Madrid to Spanish Guinea, and in December arrangements were made through the Colonial Office for reports to be issued from Accra and Lagos during the flight. Data were also supplied to the Yugo-Slavian Air Service in regard to a projected flight from Belgrade to India.

During the period of the General Strike, special information was supplied from Headquarters, and from several out-stations in connexion with the delivery of mails and newspapers by air.

Arrangements have been in force since January by which warnings of the approach of "fronts" are sent to the Meteorological Office, Cardington. These messages are used in connexion with experiments on wind structure now in progress at that station.

Numerous representatives of Dominion, Colonial and foreign services were shown the work of the Division during the year.

Services for Civil Aviation.—(*a*) *Organization on regular air routes.*—The general arrangements for the supply of meteorological information for flying on the London-Continental air routes have continued on the lines of the preceding year. At one period during the summer the hourly observations at stations in south-east England extended from 0200 to 1800 G.M.T. During the period under review 3,842 requests for reports or forecasts were received at the terminal aerodrome at Croydon while 2,743 reports were passed by radio-telephony from Croydon and Lympne to the pilots of aircraft in flight.

Owing to the closing of the coast-watching station at Hythe, the hourly reports of visibility over the Channel made at that station, were discontinued as from 1st September, when they were replaced by similar reports from Dymchurch.

The wireless station at Cologne was taken over by the German authorities from the Air Ministry during August. Since that time the hourly reports from stations at the eastern end of the Croydon-Cologne route have been received *via* Lindenberg at 50 minutes past the hour whereas they were formerly received direct from Cologne at 14 minutes past the hour.

Three important modifications, based on recommendations of the International Commission for Air Navigation, were introduced during the year, agreement having been reached at Civil Aviation Conferences held at Brussels and Paris in November 1925 and November 1926 respectively.

(1) A new system of ground signals was brought into operation at Lympne aerodrome in July to indicate to pilots flying on the regular air route the height of the lowest cloud, the visibility and the weather at Croydon, Biggin Hill and St. Inglevert. The signals consist of diamonds, any number of which can be exposed at will, arranged on panels similar to the diamonds on a playing card, a given number of diamonds corresponding with a definite cloud height or distance of visibility. The weather, alone, is denoted by means of symbols and not by diamonds.

(2) A new method of exhibiting the hourly route reports from stations on the air routes for the information of pilots was introduced at Croydon in December. The method consists of two large outline maps of North-West Europe on which the state of the weather, the extent and height of the lowest cloud and the visibility at the different stations at two consecutive hours of observation are shown by means of pictorial signs. A similar map has been erected in a window at the entrance to the Air Ministry, and observations from

stations on the London-Continental routes are exhibited twice daily for the information of the public.

(3) A revised system of warnings of important changes in the meteorological conditions along the air routes, supplementary to the regular hourly reports, was brought into operation on 1st January.

In addition to the changes already detailed, certain recommendations which had been made at a meeting of the Commission for Synoptic Weather Information in September were adopted, as from 1st January, in the hourly reports issued by wireless telegraphy between London and the Continent. The adoption of the recommendations which was agreed upon at the Civil Aviation Conference at Paris in November 1926 involved (*a*) a modification in the reports of the height of the base of the lowest cloud in cases where small amounts of cloud exist at a level below that of the lowest predominating form and (*b*) a modification in the heights to which the reports of upper winds refer, all heights being measured from mean sea level.

Since October, altimeter correction charts have been issued, as an experiment, to pilots flying from Croydon, the issue being limited to days on which the correction at any point along the route, due to horizontal variations in atmospheric pressure, is likely to exceed 200 feet, and on which fog or low cloud exist, or are likely to develop.

The arrangements for the supply of meteorological information on the Southampton-Guernsey air route have continued on the lines of the preceding year without any important modification.

(*b*) *Supply of weather reports and forecasts for cross-country or special cross-Channel flights.*—During the year 515 requests for information for civil aviation have been dealt with by the Aviation Forecast Service at Headquarters. Among the flights for which special advice was given the following may be mentioned :—

(1) Special flights during the general strike in May, in connexion with the distribution of newspapers by air to various centres in Great Britain.
(2) A flight from Croydon to Milan on May 4th.
(3) A flight from Southampton to Dinard on July 30th.
(4) A flight from Biarritz to Berne on August 25th.
(5) A light aeroplane flight from Land's End to John O' Groats on September 29th.
(6) A flight from Croydon to Vienna on February 23rd.

(*c*) *Investigation of meteorological conditions along projected air routes.*—During the year investigations have been carried out in respect of the following routes :—

(1) Khartoum—Kisumu.
(2) Calcutta—Rangoon.
(3) The West Indies and the northern coast of South America.
(4) Cairo—Karachi (special data).
(5) Bristol—Berehaven.

(*d*) *Meteorological organization on projected air routes.*—Considerable time has been devoted to the organization of the meteorological arrangements along the Cairo-Karachi air route, the first section of which—from Cairo to Basra—was opened in January. Memoranda setting out the detailed organization were prepared and forwarded

to the Director-General of Observatories, India Meteorological Department with whom correspondence has taken place regarding the arrangements for the supply of reports and forecasts at Karachi. The arrangements were also discussed personally, during a visit to England, with Dr. C. W. B. Normand, of the India Meteorological Department. Personnel of the operating company who are to act as meteorological observers at auxiliary reporting stations in Palestine and along the Persian Gulf have been trained at Croydon, and arrangements have been made for the supply of the necessary instrumental equipment for these stations.

Memoranda have been prepared for the Director of Civil Aviation on the meteorological organization necessary for the safeguarding of projected air routes in the West Indies, between Calcutta and Rangoon, and between Bristol and Berehaven. Arrangements were also made for the loan of instruments and equipment for the measurement of upper winds on the Khartoum-Kisumu air route.

(*e*) *Meteorological arrangements for long distance flights.*—During the year special meteorological arrangements were made in connexion with two noteworthy flights. In connexion with the return flight from England to Australia organized by Sir Alan Cobham, considerable time was spent in discussing in detail with the pilot, prior to the flight, the prevailing weather conditions along different sections of the route during the period selected. Arrangements were made subsequently with the India Meteorological Department for special reports and forecasts to be issued to Sir Alan Cobham for each stage of his flight through India which was to be traversed during the monsoon.

For the second flight, in which the Secretary of State for Air flew as a passenger from England to India and back to Cairo in December and January in one of the D.H. "Hercules" machines designed for the Cairo-Karachi air service, a detailed organization of weather reports and forecasts was arranged, involving the co-operation of the Air Ministry meteorological services at Malta, in Middle East Area and Iraq in addition to the meteorological services of India, France and Italy. Special reports and forecasts were issued by this Division in connexion with the first stage of the flight from Croydon to Marseilles. Prior to the flight information was supplied to the Secretary of State on the prevailing weather conditions during the period selected along two alternative routes from England to Baghdad and thence along the route to India.

A similar organization was arranged in connexion with the flights of four D.H. "Hercules" aircraft from England to Cairo or Basra which took place in December (two flights) January and February.

Arrangements of a rather more general character were made in connexion with the flight from England to India, in December and January, of Messrs. Stack and Leete in two D.H. "Moth" light aeroplanes. In this case, also, the prevailing weather conditions along the route were discussed with the pilots prior to the flight.

Special forecasts were supplied in June for a flight from Croydon to Cairo.

(*f*) *Air races and competitions.*—In connexion with the Gordon-Bennett balloon race in May, special reports of the direction and speed of the wind at different heights at various stations in Great Britain

were transmitted to Brussels prior to the commencement of the race. Arrangements were also made for reports and forecasts relating to upper winds, squalls and thunderstorms to be broadcast from the Air Ministry four times daily, during the first 48 hours of the race, for the benefit of competitors carrying wireless reception apparatus.

Special arrangements were made for the supply of weather reports and forecasts in connexion with the King's Cup Race in July and the Light Aeroplane Competition held at Lympne in September.

(*g*) *Imperial Conference* 1926.—A memorandum on the organization of meteorological services for civil aviation prefaced by an historical summary was prepared for inclusion as an appendix to the memorandum by the Secretary of State for Air laid before the Imperial Conference and entitled "The Approach towards a System of Imperial Air Communications."

An exhibit illustrating the meteorological organization on the London-Continental air route was staged at Croydon on the occasion of the visit of the Dominion Premiers to the aerodrome in October.

(*h*) *Navigator's and pilot's licences.*—Examinations in meteorology were conducted in September for candidates for first and second class navigator's licences, and again in December and February for second class licences. An examination paper was set in March for an examination for second class licences to be held in Heliopolis. These papers were set and marked in conjunction with the Airship Meteorology Division. A course of nine lectures was given to pilots of Imperial Airways Limited by the Meteorological Officer at Croydon in preparation for the December examination.

Examinations in meteorology were conducted as in previous years for pilots taking "Class B" licences. Forty-five pilots were examined during the year.

(*j*) *Miscellaneous.*—Forecasts were supplied from Headquarters *via* Lympne in June and July, in September, and from January to March in connexion with the work of the Acoustical Section, R.E. Special observations of upper wind, cloud and visibility were made during the operations, and upper air temperatures from an aeroplane were taken by a member of the Meteorological Office Staff.

The Superintendent of the Division broadcast one of the Air Ministry monthly talks from the London Station of the British Broadcasting Company in October, the subject being "The Airman and the Weather."

Special information for a flight of one of the instructors of the Lancashire Aero Club from Woodford Aerodrome, Manchester, to the top of Snowdon was supplied by the Meteorologist-in-Charge at Sealand.

Services for the Royal Air Force.—(*a*) *Supply of meteorological information for Service aviation.*—The arrangements for the supply of weather reports, forecasts and warnings of line squalls and thunderstorms to Royal Air Force Units have continued in accordance with the organization outlined in the last *Annual Report*. From September, however, the forecasts sent to night-flying squadrons about an hour before sunset have been issued in a collective message including forecasts for the areas concerned, which is broadcast from the Air Ministry. From December all routine forecasts have been sent as

"important" messages with a view to minimizing the delay in transmission.

Forecasts have been supplied daily to the Superintendent of the Royal Air Force Reserve for flying in different parts of the country. In addition to the issue of routine forecasts, 672 requests for information have been received from Royal Air Force units in connexion with special flights. Among the purposes for which such information was issued may be mentioned the following :—

June	..	Night flying forecasts for the exhibition of flying at the Aldershot Command Tattoo.
July 3rd	..	A special service of reports and forecasts, including upper wind data, for the long distance reliability trials which formed part of the Royal Air Force Display at Hendon.
September	..	A series of forecasts supplied to the School of Photography for the purpose of taking photographs from the air of the Thames bridges.

(*b*) *Supply of information from Distributive Stations.*—The work of the different meteorological stations attached to Royal Air Force units has continued on the lines of preceding years. A new station was opened at Aldergrove, near Belfast, in July for the purpose of supplying meteorological information to No. 602 (Ulster) Bombing Squadron. The station at Andover was transferred to Worthy Down, near Winchester, on 1st November.

A temporary meteorological station was in operation at Western Zoyland, Somerset, from June to October in connexion with night flying operations. The meteorologist-in-charge also supplied meteorological information to the anti-aircraft practice camp at Watchet.

(*c*) *Supply of special data for Service aviation.*—Statement of weather conditions in different parts of the country were prepared as required for the Inspector of Accidents.

Data regarding air densities over various parts of the world were supplied to the Directorate of Technical Development. A memorandum on the average meteorological conditions at different times of the year at certain aerodromes was supplied to the Superintendent of the Royal Air Force Reserve in November. Memoranda were also prepared in connexion with the second Royal Air Force Cairo to Cape Flight and the forthcoming Flying Boat Cruise in the Far East. In addition over 30 statements regarding the weather conditions in various parts of the world from the point of view of aviation were prepared as required for other branches in the Air Ministry. Special problems in connexion with the application of meteorology to air navigation were also dealt with.

(*d*) *Meteorological arrangements for long-distance flights.*—A special organization of weather reports and forecasts was brought into operation for the last stage of the Royal Air Force Cape Flight on the return journey to England in May. The arrangements for the necessary reports between Egypt and England were made with the Meteorological Section Royal Air Force, Middle East Area, the Meteorological Office, Malta, and the Directors of the French and Italian Meteorological Services.

A similar organization was arranged in connexion with a flight of two Royal Air Force flying boats from Plymouth to Alexandria and back in June and July. The organization included in each case (a) the supply of reports and forecasts at each port of call for the next stage of the flight and (b) the issue by wireless telegraphy to the aircraft during flight of warnings of the occurrence of adverse weather conditions along each section of the route. Forecasts for the first stage of flight from Plymouth to Bordeaux were supplied from Headquarters. A forecast for the last stage of the return flight was also issued by wireless to the aircraft after they had left Bordeaux.

A form of meteorological log for use on long-distance flights was prepared at the request of another branch of the Air Ministry.

(*e*) *Meteorological instruction to Royal Air Force officers.*—Regular courses of instruction have been given during the year to officers under training at the Flying Training Schools at Netheravon, Digby and Sealand, the lectures having been given by the meteorological officers at Worthy Down, Cranwell and Sealand respectively. The Meteorological Officer at Cranwell has been responsible as in previous years for instruction in meteorology at the Royal Air Force Cadet College.

Two lectures in meteorology were given in August by the Meteorological Officer at Andover in connexion with a course at the Central Flying School. Instruction in connexion with special courses in air pilotage at Calshot and courses for naval observers at Lee-on-Solent have been given by the Meteorological Officer at Calshot, who has also given special instruction to naval officers destined for meteorological duty on aircraft carriers.

Since September lectures in Meteorology have been given by the Meteorological Officer at Leuchars to naval pilots in training at that station.

The Superintendent of the Division gave a lecture at a number of Royal Air Force stations during February and March on the organization of the meteorological service for aviation, the lecture forming part of the annual ground training.

Notes on meteorology for service pilots were prepared at the request of Headquarters, Air Defences of Great Britain, for the use of pilots attached to Home Defence Squadrons.

(*f*) *Training of Royal Air Force personnel for meteorological duty overseas.*—One officer completed his course of training in meteorology in the Division prior to proceeding overseas as Meteorological Officer in Iraq. A second officer received a preliminary course of training in meteorology at Calshot before proceeding to the school of Meteorology, Imperial College of Science and Technology.

Two airmen received a six months' course of training in meteorology at Calshot and Cranwell respectively. At the end of the course examination papers for "trade-testing" the airmen were prepared and the examinations conducted at the training stations.

Distributive Stations.—(*a*) *Observations and reports.*—Warnings of the occurrence of line squalls and thunderstorms were issued from Sealand and Cranwell to Pulham in connexion with the flight of the airship "Norge" in April, and again in October and November in connexion with airship operations.

Meteorological reports for artillery practice have been supplied at various times from Aldergrove, Calshot, Cattewater, Felixstowe, Lympne and Renfrew.

Special observations of the movement of high cloud were made at Renfrew during August and September in connexion with the University of Michigan Greenland Expedition.

Until November, the observations made at Cranwell and Cattewater at 0700, 1300 and 1800 G.M.T., and sent by wireless telegraphy to Headquarters, included a special group reporting the state of the sky in accordance with a recommendation of the International Commission for Synoptic Weather Information in September 1924.

Observations of short period oscillations in the free atmosphere by observing the movement of pilot balloons in the intervals between the normal readings of azimuth and altitude have been made at all stations.

Observations of the occurrence of rain falling through drizzle were made by all stations during December and January.

(*b*) *Distribution of information.*—The main work of the out-stations apart from observational routine, is concerned with the supply of weather reports, forecasts and data for aviation. Most stations, however, have to deal with inquiries from other sources, sometimes from a wide area. This applies particularly to the station at Renfrew which not only issues over 40 copies of the *Local Daily Weather Report* prepared at the station but also receives numerous inquiries for meteorological information particularly in connexion with shipping. At Cattewater a daily weather report has been supplied since March to the King's Harbour Master at Plymouth.

In June and July special forecasts were supplied from Cranwell to the General Officer Commanding, Northern Command.

(*c*) *Special work.*—Summaries of current upper wind observations according to the scheme recommended by the International Commission for Air Navigation have been prepared for each month of the year at Croydon, Cranwell and Leuchars.

Observations of the blueness of the sky, estimated according to a scale devised at the Frankfurt Observatory, have been made at Croydon, Cranwell and Cattewater since June.

At the experimental anemometric station at Holyhead, further comparisons of temperature readings at the old and new sites were made in July and the results examined. Tables of the duration of sunshine, the declination of the sun and the equation of time for each day in the year 1910 for latitudes 30° to 50° were constructed at this station.

Work on the checking of rainfall returns was carried out by the clerical staff at certain stations during January on behalf of the British Climatology Division.

The meteorologist-in-charge at Sealand arranged an exhibit and demonstration of weather forecasting at the Annual Conversazione of the Chester Scientific Society in October.

Upper Air Observations.—The total number of pilot balloon ascents made at out-stations during the year, either by the single theodolite method or by the tail method was 10,749. In addition 4,139 nephoscope observations of the movements of upper clouds have been made.

Registering balloon ascents have been made at Sealand in connexion with the Upper Air Section at Kew Observatory.

Two hundred and thirty-one observations of upper air temperatures taken from aeroplanes have been received from South Farnborough, Lympne and Andover.

Tests have been carried out at South Farnborough on a new method of obtaining upper air temperatures from aeroplanes, in which the thermometers are exposed in an air duct designed to secure efficient ventilation while at the same time the thermometers are near enough to the observer to be read direct without any auxiliary apparatus.

Investigations.—A report was prepared on the occurrence of dichroic fog at Wealdstone, based on an examination of data supplied by Messrs Kodak, following a visit of Dr. J. S. Owens and the Superintendent of the Division to their works. Following on this report the system of reporting the occurrence of fog at Kew and Croydon to Messrs Kodak was replaced in October by a system of special forecasts which are issued by the Forecast Division.

In addition to the papers published by members of the staff (*see* p. 71) the following investigations were completed during the year :—

"Sea disturbance observations during one year" by C. W. Lamb.

"The observations of vertical currents during sea breezes at Calshot and Felixstowe" by J. Durward and C. W. Lamb.

"The relation between the wind velocities at 43 feet and at 2,000 feet about noon during winter and summer at Cranwell" by W. H. Pick and C. Smith.

"Mammato Cumulus Cloud at Cranwell" by W. H. Pick and G. A. Wright.

"The Sea Breeze and Diurnal Changes of Wind Direction" by W. J. Grassick.

An investigation on comparison of the relative humidity recorded by a Lambrecht polymeter with the results obtained from dry and wet bulb thermometer and Assmann psychrometer readings was carried out at Felixstowe.

An investigation was carried out on the diurnal and seasonal variation of humidity at different stations and a chart of isopleths of humidity was constructed for each station.

Experiments have been conducted at Lympne throughout the year for the purpose of investigating the catch of rain-gauges having different exposures. The investigation is still in progress.

Inquiries.—The total number of inquiries received at out-stations during the year was 15,641, an increase of 1,887 on the previous year.

At Headquarters, 1,188 inquiries were received for forecasts and 101 inquiries for data regarding weather conditions affecting flying. The total number of inquiries was thus 16,930 as compared with 14,579 during the previous year, and 12,442 during the year 1924/25.

Works and Buildings.—The new building at Cranwell was completed and occupied in September. Existing buildings have been converted to accommodate the staffs at the new stations at Aldergrove and Worthy Down.

Owing to alterations in the layout of the Royal Air Force aerodrome at Sealand, it has become necessary to evacuate the existing office. Work has commenced on a new building which is similar in design to the building erected at Cranwell.

Minor alterations and re-decorations were carried out at Cattewater, Felixstowe and Renfrew.

New theodolite pillars were erected at Biggin Hill and Cattewater, and screens have been erected round the pillars at all stations.

A new glass enclosure has been fitted to the top of the Pyestock Chimney, South Farnborough, where a thermograph and hygrograph are exposed.

AIRSHIP METEOROLOGY DIVISION

The *Annual Report* for the year ended March 31st, 1925, contained a brief outline of the programme of work of the Airship Meteorology Division, which was formed early in the year 1925, with a small staff to deal with meteorological questions arising out of the proposal of the Government to carry out flights with the two new 5,000,000 cu. ft. airships to India *via* Egypt. The *Annual Report* for the year ended March 31st, 1926, gave details of the progress made during that year, but at the same time indicated the magnitude of the work in hand. During the year now under review this work has been pursued, but progress has been retarded owing to the Imperial Conference held in London in the autumn of 1926. The preparation of material prior to the Conference occupied much time, and, as a result of the deliberations of the Conference, it has been necessary for the staff of the Division to devote the greater part of their time since then to the consideration of questions concerning the probable future main airship routes to the various Dominions. This work was urgent in view of the decision to send in May 1927 representatives of the Air Ministry, including the Superintendent of the Airship Meteorology Division, to the Dominions to advise the Dominion Governments as to the selection of airship bases and the arrangements for demonstration flights from this country.

Excepting that in connexion with the Imperial Conference, there has been no material change in the programme of work of the Division from that originally laid down. Fairly complete details of the investigational work were given in the last *Annual Report* and accordingly they will not be repeated here. Mention may, however, be made of the fact that the investigational work on wind structure at Cardington with a special network of electrically synchronised anemometers is making satisfactory progress. Very close liaison is being maintained with the Airship Staff in all meteorological matters affecting airships, and interim reports are being made as the investigational work progresses, to enable the earliest possible use to be made of the results.

The year has seen considerable advance in the plans for the provision of the necessary ground meteorological organization for the home trial flights of the new airships and for their trial flights to India. At this stage an organization on a temporary basis alone can be

visualized and it will accordingly be less complete than one founded on a permanent basis would be.

The work in connexion with the Imperial Conference involved, amongst other things, the preparation of articles on various aspects of meteorological work in relation to airship operation. These appeared in the memorandum by the Secretary of State for Air entitled "The Approach towards a System of Imperial Air Communications." One of these memoranda aimed at delimiting areas within which Main Imperial Airship Routes could probably best be developed, as far as weather is concerned. Since the Conference comprehensive reports have been prepared on meteorological conditions in the vicinity of 27 places within these areas, to assist in the choice of airship bases and to form the basis of discussion with the Dominion authorities when the Air Ministry representatives visit the various parts of the Empire. The places reported on are :—

Bathurst (Gambia, W. Africa).
Freetown (Sierra Leone, W. Africa).
Mombasa (Kenya, E. Africa).
Dar-es-Salaam (Tanganyika, E. Africa).
Zanzibar (E. Africa).
Durban (Natal, Union of S. Africa).
Cape Town (Cape of Good Hope, Union of S. Africa).
St. Helena (South Atlantic Ocean).
Mauritius (Indian Ocean).
Perth (Western Australia).
Adelaide (South Australia).
Victoria (Australia).
Sydney (New South Wales, Australia).
Auckland (New Zealand).
Wellington (New Zealand).
Christchurch (New Zealand).
Dunedin (New Zealand).
Cocos (Keeling) Island (Indian Ocean).
Christmas Island (Indian Ocean).
Colombo (Ceylon).
Galle (Ceylon).
Diego Garcia (Indian Ocean).
Toronto (Canada).
Quebec (Canada).
Ottawa (Canada).
Montreal (Canada).
Aden.

During the year a meteorological reporting and forecasting organization was provided for airship operations on two occasions. The first was in April when the Italian Polar Airship "Norge I." visited Pulham aerodrome on the way to the North Polar regions. Special weather reports were provided by the Division from before the airship left Rome until she landed at Oslo. In October and November a temporary organization was established in connexion with flights of H.M. Airship R. 33 at both Pulham and Cardington. This organization was in operation on the occasion of the visit of the Dominion Premiers to Cardington on November 17th when they witnessed a flight of R. 33.

NAVY SERVICES DIVISION

General.—The progress in the work of the Division has been very encouraging during the past year and the work continues to expand. Close liaison with the Admiralty has been maintained and frequent discussions on meteorological matters concerning the Fleet have taken place with the Hydrographer of the Navy and other naval authorities. All matters connected with meteorology are now referred by the Admiralty to the Division.

Observations.—The four Home Surveying Ships have discontinued keeping meteorological logs, as observations in the area in which they are located are no longer required. Seven of H.M. Ships on foreign stations now keep these logs for the Meteorological Office and this number will be increased to ten as occasion arises.

The number of ships sending in reports of meteorological interest steadily increases.

Aircraft Carriers.—Special attention has been paid to the meteorological work carried out in aircraft carriers which is now recognised as being of essential importance. A number of naval observers have undergone a special course in meteorology at Calshot, on completion of which they have been appointed to H.M. Aircraft Carriers for meteorological duties. These officers are responsible not only for issuing forecasts to the aircraft carried in the ship but for general forecasts to the Fleet twice a day. These forecasts have proved to be of great value during operations, and their accuracy has been noted by both the C.-in-C.'s Mediterranean and Atlantic Fleets.

Lieut.-Commander Langley, a naval observer from H.M.S. *Eagle*, has recently completed a three months' course in meteorology at Headquarters. It is anticipated that opportunities will be given to other naval observers to undergo this course which it is considered will be beneficial to them in carrying out the meteorological work in the Fleet.

Instruments.—In view of the progress being made in synoptic meteorology in the Fleet consideration has been given to the supply of certain meteorological instruments to H.M. Ships, especially to Aircraft Carriers. As a result the Admiralty have approved of certain special instruments being added to the establishment of Aircraft Carriers, and also of the supply of Gold slides to all ships carrying mercurial barometers.

The question of adopting the millibar as the unit of pressure for general use in H.M. Naval Service is now being considered by the Admiralty.

Forecasts.—The arrangements for the supply of special forecasts to H.M. Ships are frequently taken advantage of and reports show that they are of great benefit to those concerned and their accuracy has from time to time been commented on.

The supply of daily weather charts to certain Dockyard Ports on the same day of issue has proved of value to the naval authorities at these ports and has recently been extended to Devonport; arrangements are in progress with regard to Chatham.

Visits.—The Naval Establishments at Devonport and Portsmouth have been visited and also a number of H.M. Ships including the Aircraft Carriers. Many naval officers have also visited the Division, including the Hydrographer of the Navy and other officers of senior rank.

Navigation School.—A close liaison has been developed with the Navigation School, Portsmouth, and the Superintendent attended a Conference at the School on the question of instruction in meteorology. The importance of the study of meteorology by the navigating officers of the Fleet is fully recognised by the Captain of the establishment, and instruction in the subject on modern lines is contemplated. Lectures on upper air work have been arranged.

Weather Reports.—Arrangements have been made with the Admiralty for the transmission of W/T reports from H.M. Ships proceeding to and from Gibraltar and the West Indies, and detailed instructions are being drafted and will be issued shortly.

Mediterranean.—Reports from the Mediterranean show that the meteorological arrangements made at the conference held on board H.M.S. Queen Elizabeth during the Superintendent's visit to Malta last year have proved of much value, both to the Fleet and the Meteorological Office, Malta. The liaison then established between the Fleet and the Office has been maintained and a large number of officers now visit the Office when the Fleet is in port. The importance of establishing a liaison at other naval stations where there is a meteorological office is emphasised.

The question of issuing an evening synoptic message to the Mediterranean Fleet is under consideration. Trial issues have been undertaken by the Meteorological Office, Malta, on two occasions, during the combined exercises of the Fleets, and a report is now awaited from the C.-in-C.'s.

Pilot Balloons at Sea.—The further development of the scheme of obtaining observations of Pilot Balloons over the sea, anticipated in last year's report, has now materialised, and the Admiralty have approved of H.M. Ships in all parts of the world obtaining observations of upper winds, and 40 ships are gradually being equipped with pilot balloon apparatus. These observations are aimed at the eventual preparation of a series of charts showing the normal direction and velocity of the wind at varying heights for use of the Fleet Air Arm airships and for gunnery purposes. Records of observations have already been received from H.M. Ships *Daffodil* (W. Africa), *Eagle* (Mediterranean), *Enterprise* (E. Indies), *Furious* (Home), *Hermes* (China) and *Ormonde* (W. Indies). H.M.S. *Renown*, during her world cruise, was also equipped with pilot balloon apparatus. Records of upper air temperatures have been received from H.M.S.'s *Furious* and *Hermes*, those from the latter on "International Days." Preliminary arrangements for carrying out further experiments with the mirror theodolite in H.M.S. *Fitzroy* were approved by the Hydrographer, but had to be abandoned owing to the coal strike.

Marine Sub-Committee.—The Marine Sub-Committee, of which the Superintendent is Secretary, has met on two occasions during the year and some important questions have been discussed, amongst them being the revision of the "Wind Atlas of the Atlantic, Pacific

and Indian Oceans." The Atlas is now being revised by the Meteorological Office and will be published by the Admiralty.

Gale Warning Service.—The Gale Warning Board, of which the Superintendent is Secretary, met once during the year. Gale warning stations have been established at Broughness, Gourdon, North Goodwins Light Vessel, Kentish Knock Light Vessel, Maryport, Point Law (Aberdeen), Port Patrick, Whitehaven, Kildonan, Aberystwyth, Montrose, Rudh Re' Lighthouse, Little Ross Lighthouse, Fairlight, New Brighton. Fourteen stations were visited during the year and the positions of those not already shown on the Admiralty charts fixed for insertion thereon. The new organization of the distribution of gale warning telegrams etc., has now been in force a year and although the number of stations shows an increase of 34 there has been a considerable reduction of cost without impairing the efficiency of the Service.

Fishery Barometer Stations.—The position with regard to the Fishery Barometer Service is now under review and the re-organization of the distribution of fishery barometers and barographs is contemplated, and a questionnaire has been issued to all stations through the Ministry of Agriculture and Fisheries and the Scottish Fishery Board. When replies have been received from all stations a new scheme will be drawn up which, it is considered, will add to the efficiency of the Service.

ARMY SERVICES DIVISION

The work of the Division has continued on the lines of preceding years. Meteorological stations have been maintained at Shoeburyness and Larkhill, for supplying meteorological information, as required, to Artillery units.

The Meteorological Station at the Chemical Warfare Station, Porton, has been maintained as before, the professional staff required being seconded from the Meteorological Office, and the clerical staff being lent.

At Shoeburyness the two theodolite method of observing pilot balloons remains the standard method of measuring upper winds, but on occasions when two theodolites are not used a tail is usually attached to the balloon.

During this year, the duty of issuing statements of the probable effects, on civilian property at Southend and elsewhere, of the concussion due to firing large guns, has been taken over by the meteorologist-in-charge at Shoeburyness.

Lectures on the application of meteorology to gunnery have been delivered from time to time by the meteorologists-in-charge at Shoeburyness and Larkhill to classes of officers and non-commissioned officers.

During the summer of 1926, one observer (Grade III clerk) was posted to each of four artillery practice camps at Buddon Ness, Okehampton, Trawsfynydd, and Redesdale, for the purpose of supplying upper air data to the artillery units posted at these camps.

Arrangements were also made for the supply of meteorological information to the Anti-Aircraft Artillery Practice Camp at Weston Zoyland, during July and August. In the case of the last-named, it was decided, after discussion with the War Office, to adopt equal weighting factors for winds and temperatures in the preparation of meteor messages to anti-aircraft artillery units.

The computation of a number of trajectories, and of weighting factors for wind and temperature appropriate to special trajectories, has been carried out at Shoeburyness.

The Superintendent has attended a number of meetings of the Chemical Warfare Committee and certain of its sub-committees, and has continued to act as Chairman of the Meteorological Sub-Committee.

A number of inquiries for data of weather and climatology have been received from the War Office, and have been answered with the assistance of other divisions of the office.

INSTRUMENTS DIVISION

Supply of Equipment to Official stations.—The equipment at official stations at home and abroad, including meteorological stations in the Middle East and Iraq Commands, has been maintained in serviceable condition. Special mention may be made of the following :—

Issue of equipment for the research at Cardington on wind structure. This installation has entailed a considerable amount of special work. It will consist eventually of four pressure tube anemometers and Dines-Baxendell direction recorders, all fitted with quick run clocks controlled electrically.

Supply of apparatus for recording temperature gradient at Ismailia.

Issue of W/T receivers to Kew, Valentia, Eskdalemuir and Aberdeen Observatories for the reception of time signals.

Repair of a Schulze Dip Inductor at Eskdalemuir by the maker in Germany.

Overhaul of the W/T apparatus at Edinburgh by the makers, and of the Benndorf electrograph at Lerwick. Installation of drying apparatus for the magnetograph room at Lerwick.

Supply of equipment to stations on the Cairo-Karachi Air Route.

The mechanical assistant visited the following stations in connexion with the installation of new anemometers or the adjustment of existing instruments :—Tiree, Kew, Eskdalemuir, Cardington, Scilly, Worthy Down, Cranwell, Pendennis Castle, Wisley and East Malling. Some progress was made with the erection of the anemometer mast on the roof of the new Science Museum at South Kensington.

Supply action was taken for equipping 35 of H.M. Ships with instruments for upper air observations.

Supply of Instruments on Repayment.—No change was made in the conditions under which stores are issued on repayment. The total value of stores issued in this way was £3,420 17*s.* 9*d.*

The following issues may be noted :—

(*a*) Baro-thermographs of the new R.A.E. pattern to the Meteorological Services of India and New Zealand.

(*b*) Two pilot balloon slide rules to the Meteorological Service of Latvia.

(*c*) Two distance thermographs, 60 modified screens and 120 thermometer protectors to the Admiralty.

Instruments and equipment of various types were also issued to the Dominion Governments and to the Crown Agents for the Colonies.

Store-Keeping and Accounting.—A few alterations were made to relieve the pressure of work in this section, but the procedure has, on the whole, been continued as in previous years.

As storage space at Headquarters is limited, arrangements were made for the storage at No. 1 Stores Depot, Kidbrooke, of gale warning cones and anemometer masts in addition to Stevenson screens.

The number of store accounts now kept, each of which details the equipment on charge and accounted for by the Office at a single station, is 753. Each account has been checked by inspection or by correspondence with the custodian during the year. All discrepancies revealed have been investigated and cleared in consultation with the relevant branches of the Air Ministry when necessary.

Air Ministry auditors visited the division from 28th June to 2nd July, 1926, and from 4th to 7th January, 1927.

A board of survey for conditioning surplus and unserviceable stores was held on 17th December, 1926. The recommendations of the board were approved and carried into effect.

Stock was taken of the instruments and equipment held at the central stores at South Kensington as on 31st March, 1927, and compared with the ledgers.

The total number of demands dealt with during the year was 2,669, an increase of 179 on last year.

A new edition of the " Priced Vocabulary of Meteorological Stores " was prepared and put forward for printing.

An establishment of furniture and equipment for the Assistants' house at Lerwick was approved.

Special Investigations—Specifications.—Apart from special work necessitated by the supply of instruments for the investigations on wind structure and vertical temperature gradient by the Airship Meteorology Division, a good deal of attention was devoted to standard instruments and progress has been made in various directions. In several instances, collaboration with the National Physical Laboratory has produced gratifying results.

Mention may be made of the following :—

(*a*) *Barometers.*—The three experimental barometers with cisterns of stainless steel, cast iron and polished cast iron were re-issued to H.M.S. *Endeavour* for further trials.

One of the specially designed portable barometers, referred to in the report of work for 1926, was issued to Middle East for trial.

A provisional specification of a standard Kew pattern barometer was drawn up and approved. An initial supply of barometers to this specification was ordered. Arising out of the specification a conference was held on 16th March, 1927, attended by Colonel Gold and the Superintendent, Instruments Division, representing the

Meteorological Office, and Mr. Sears and Mr. Gould representing the National Physical Laboratory. As a result of this conference the following standard equivalents were adopted :—

1 mb.	=	·0295306 mercury inch
1 mercury inch	=	33·8632 mb.

Scale values for barometers with standard temperature 285a

1 barometer mb.	=	·0295975 barometer inch
1 barometer inch	=	33·7866 barometer mb.

(The above values are in accordance with the following agreed data :—

g_{45} = 980·617 cm/sec²,		1 inch	= 2·54000 cm.
Density of mercury at 0°C			= 13·5955
Coefficient of expansion of mercury			= ·0001818 per °C
Coefficient of expansion of brass			= ·0000184 per °C).

Some progress was made in the preparation of a pamphlet on the barometer, in conjunction with the National Physical Laboratory.

(*b*) *Thermometers.*—The question of the position in which right-angled thermometers are tested was taken up with the National Physical Laboratory. It was also decided that inspector's thermometers should be tested annually for the next two or three years in order to detect any change of zero that may occur.

The specifications of maximum and minimum thermometers were revised and approved.

Arrangements were made for an investigation into the influence of parallax on the readings of thermometers in a Stevenson screen to be carried out at Kew Observatory. The results obtained indicated the desirability of reducing the width of the mounts for maximum and minimum thermometers used in a Stevenson screen.

(*c*) *Radiation instruments.*—A low resistance type of thermopile was lent by Dr. Gorczynski and daily radiation records are being obtained with this instrument in conjunction with a thread recording millivoltmeter. A portable Gorczynski solarimeter was compared with this instrument and it is hoped that a comparison of Callendar sunshine receivers will be carried out during the coming summer.

(*d*) *Sunshine recorders.*—The investigation on sunshine spheres was continued. Experiments were carried out by the British Scientific Instruments Research Association and it is thought that a specification of a glass which will not change colour will be found for these spheres.

A device for adjusting sunshine recorders for level and azimuth after the base has been permanently fixed was designed. A recorder was also fitted with clamping screws for keeping the cards in position. A new pattern of centering gauge for purposes of adjustment was designed. Proposals for reducing the number of different patterns of sunshine cards were formulated.

(*e*) *Anemometers.*—The research on pressure tube anemometers was continued at the National Physical Laboratory. It was found that calibrations of Dines head carried out without the vane being in position gave erroneous values for the ratio of suction to pressure. The ratio was also found to be affected by the projecting pressure and suction outlets, by the arrangement of the suction holes and by the diameter of the inner tube. A modified head with shielded outlets and staggered holes was designed in the Division for the installation at Cardington. A flexible coupling for the direction rod was also adopted after trial of three different patterns. Further investigations are being carried out at the National Physical Laboratory on the

effects of leakage and of the relative dimensions of the outer tube and rain shield.

Considerable time was spent in desigming and supplying equipment for the wind structure research at Cardington. An electrical starter and time marking device for giving distant control of any number of quick run clocks from a central station were devised and installed. A diaphragm velocity recorder was also supplied with cocks for changing over from the Dines to the diaphragm anemograph. Supply action was taken to complete the anemometer equipment for this research.

Consideration was given to the question of improving twin pen direction recorders and of improving the sensitivity of diaphragm recorders in light winds. A piece of apparatus for testing the helix of direction recorders was also devised and made in the workshop. A portable anemometer on the lines of the Savonius Wing Rotor was made at Kew for trial purposes. Recording pens made at Shoeburyness were tested.

Specifications for anemometer masts, 40-feet and 50-feet high, were drawn up and approved provisionally. In conjunction with the Works and Buildings branch, special masts were designed for Scilly, Cardington and Croydon.

(*f*) *Thermometer screens.*—The thermometer screen with zinc louvres made last year was tried at Kew Observatory, but the results were not favourable. Arrangements were made for the construction and trial of a new pattern.

(*g*) *Thermographs.*—The "non-corrosive" thermograph was tested for a year at a coast station. It was found that the exposed parts showed signs of corrosion. The question is being taken up again with the makers.

(*h*) *Gold slides for marine barometers.*—The question of testing Gold slides was taken up with the National Physical Laboratory, and 50 slides were tested at the Laboratory with satisfactory results.

The design of these slides was modified to permit of easier adjustment, in view of a decision by the Admiralty to adopt them on all mercurial barometers issued to H.M. Ships. A pamphlet on the adjustment, use and care of the slides was prepared.

(*i*) *Inspection equipment.*—Further investigations were made with a view to the standardisation of apparatus for use by inspectors for testing rain measures.

(*j*) *Pilot balloon slide rules.*—After trial of alternative patterns, Mr. Whipple's modification to facilitate computation when the "tail method" is employed was adopted. Detailed specifications and drawings were prepared and action taken to secure a supply of the new rules.

(*k*) *Rain-gauges and rain measures.*—Attention was given to the elimination of sources of leaks in rain-gauges. Two gauges with seamless funnels were issued for trial purposes.

A specification of requirements for self-recording rain-gauges was drawn up and approved.

Consideration was given to the question of improving the apparatus used for testing rain measures. A paper on the comparison of volumetric methods, by Mr. Belasco and the Superintendent, was read at the Staff discussion in March.

(*l*) *Measurement of temperature and humidity at sea.*—Arrangements were made for the loan of Assmann psychrometers and modified marine screens to four of H.M. Surveying Ships in connexion with an investigation of the influence of relative wind force on the readings in screens of that pattern.

(*m*) *Apparatus for recording temperature gradient at Ismailia.*—Screens for the resistance thermometers to be installed at Ismailia were designed and specifications and drawings prepared. Supply action was also taken for the recorder and other portions of this apparatus.

(*n*) *Paper for autographic charts.*—A laboratory test for porosity was devised.

(*o*) *Atmospheric pollution gauges.*—Much trouble was experienced owing to deterioration under atmospheric influence of gauges supplied by the present maker. There is reason to hope that gauges of a slightly different type, ordered in March, will prove more durable.

(*p*) *Specifications* for Hills mirrors, strut psychrometers, 150-inch balloons and fillers for 150-inch balloons were also prepared.

Testing and Inspection of Instruments.—The usual test work was carried on during the year. The work of testing sunshine spheres was continued. The majority of observers have sent in their spheres for test. The number of spheres tested during the year was 167, including 13 tested for makers. 16 of these spheres were not certified.

New fees for testing instruments for measuring rainfall were introduced towards the end of the year. The total number of rain-gauges tested on behalf of makers was 14, while 83 measures were certified.

A Dines pressure tube anemometer was tested on behalf of the Union of South Africa.

Improved methods of test on chart papers and wind direction recorders were introduced.

Drawing and Photographic work.—Arrangements were made for demands for routine photographic work and blue prints to be carried out by the appropriate departments of the Air Ministry.

In spite of this, the following figures show an increase over those for last year, except in the case of contact prints.

Drawings	137
Blue Prints	298
Negatives	265
Contact Prints	268
Lantern Slides	268

Workshop.—Mention may be made of the following items made in the workshop at South Kensington :—

(*a*) Whirling psychrometer.
(*b*) Strut psychrometers.
(*c*) Electrical device for starting and making time marks on diaphragm anemographs.
(*d*) Flexible couplings for anemometer direction rod.
(*e*) Boxes for storing fittings for boards for display of meteorological information.
(*f*) Model of ground signals at Lympne.
(*g*) Centering gauge for sunshine recorders.
(*h*) Testing apparatus for wind direction recorders.

(*i*) Special recording rain-gauge for Forecast Division.
(*j*) Modified barograph.
(*k*) Adjusting base for sunshine recorder.

Exhibitions.—Instruments were exhibited at the Royal Agricultural Show, Reading, and at the British Association meeting at Oxford. The exhibit of meteorological instruments in the Science Museum was brought up to date.

Inquiries.—An increased number of inquiries from Foreign and Colonial Governments, firms of instrument makers and private individuals with regard to the design and supply of instruments was dealt with. A noticeable feature during the year was the large number of inquiries relating to anemometers.

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION

The investigation into atmospheric pollution has been continued during the year ending March 31st, 1927. The office of Chairman was filled by the Director of the Meteorological Office; Dr. J. S. Owens acted as Honorary Secretary. A list of members of the Committee during the year referred to is given on p. 5.

The work of collecting and examining the monthly deposits of rain and impurity from 68 gauges has been continued. The number of stations operating deposit gauges during the current year was 31. Of these three commenced work during 1926, while one station which was already making observations set up 10 additional gauges.

The *Twelfth Report* of the Committee has been issued.

The special researches in hand during the current year have been as follows:—

(1) The examination of dust particles found in furnace ash.
(2) Investigation into the obstruction of ultra violet radiation by smoke.
(3) The relation of tar deposit to total deposit.
(4) The relation of sulphur deposit to total deposit.

METEOROLOGICAL OFFICE, EDINBURGH

General.—The organization of the work of this Office has been described in earlier reports. It was continued unaltered during the year now under review.

Reduction of data from Observatories.—The reduction of the Eskdalemuir magnetic data has been carried on as usual, whilst the Lerwick data for the years 1924, 1925 and part of 1926 have been dealt with. The sections of the three Scottish Observatories for the 1924 *Observatories' Year Book* were completed, including proof reading. The year closes with the corresponding sections of the 1925 *Observatories' Year Book* just going to the press. As noted below, and particularly this year in respect of the Lerwick Sections of the *Year Book*, the position in regard to arrears is being slowly retrieved.

Climatological, Telegraphic and Rainfall stations.—The number of climatological stations in Scotland is now 59. A new station has been started at Kirkwall under the control of the Town Council, the instruments having been provided by the Office. The total number of rainfall stations is now about 800. Work in these sections has been kept well forward. The number of observing stations in Scotland (other than rainfall stations) at work during the year is shown below.

	Observatories.	Telegraphic Reporting Stations.	Climatological Stations.
Number at beginning of year.	3	8	58
„ closed during year	0	0	0
„ opened during year.	0	1	1
„ at end of year ..	3	9	59

The new telegraphic reporting station at Cornaigmore on the Island of Tiree was opened in September.

Inquiries.—The number of inquiries dealt with by correspondence was 48, by interview or by telephone 34.

Forecasts, etc.—In general, inquiries for forecasts have been dealt with by reference to the information received by W/T and by telegram from London or by referring the inquirers to the Forecast Division.

In connexion with the possible usefulness of special warnings of snowstorms, it was mentioned in this report last year that an examination had been made of the losses of sheep and lambs in Scotland arising from snowstorms. Statistics provided by the Board of Agriculture suggested that the losses which could be related to snowstorms in spring were of considerable magnitude. With regard to lambs alone the deficiency in the numbers living at 4th June ranged up to 280,000 in an extremely bad year, whereas the excess (above the normal expectation) in good years might reach 140,000. Even accepting part of the losses as due to other causes and a considerable proportion as absolutely unavoidable, it appeared that early warning of storms or renewals of wintry conditions could still enable much loss to be averted.

The purely meteorological aspects of the problem were examined last year in conjunction with the Forecast Division and it was decided that the latter should regard the first winter (1925-6) as one for study of the problem and for experiment. The results unfortunately did not justify the inauguration of a warning service for the winter 1926–7. It is hoped that with further experience the position may be improved to a useful degree.

Advisory Committee.—This Committee met on 7th December, 1926, and on 25th January, 1927, the Director being present at the former meeting as Chairman.

Research.—During the year 1926, the Superintendent was authorized to employ a temporary clerical assistant in connexion with an approved programme of research. By the end of the year now under review the results of this work had been partially summarized.

Miscellaneous.—Dr. C. W. B. Normand, of the Indian Meteorological Service and Dr. W. A. Harwood visited the Office on several occasions. Professor V. F. K. Bjerknes, University of Oslo, spent a few days at the Office at the end of October. Other visitors, in addition to the Director and members of the Advisory Committee, included Sir William Haldane, W.S., Professor J. H. Ashworth, Major Maclean of Ardgour, Commander L. A. Brooke-Smith, Mr. R. A. Watson Watt.

On 15th November the Superintendent attended a meeting at the Royal Society Rooms of a Regional Survey Committee, appointed to consider certain scientific questions connected with the town-planning of the greater Edinburgh district.

Library.—354 volumes, mostly of serials and in the main arrears for the war period or earlier years, were bound or put in hand for binding during the year, this virtually disposing of these arrears. Increased shelving was also provided.

Inspections, etc.—In the course of the year 19 climatological or telegraphic and 6 rainfall stations in Scotland were inspected.

METEOROLOGICAL OFFICE, MALTA

No large changes occurred at Malta during the year, but progress was made in most branches of the work of the office. The Navy continued to demand a considerable and increasing amount of meteorological information and much work was done also for the Army and the Air Force. Perhaps the most important event of the year was the commencement of civil aviation through the central Mediterranean to Africa and the East. This involved temporary amplification of the organization existing for reports to the Services.

The amount of meteorological information available in the Mediterranean area continued to increase slowly and the difficulties of forecasting correspondingly diminished. Observations over the sea area were available at times from ships, and fairly regular observations of upper air temperatures were obtained at Malta itself.

The University Observatory, under the supervision of the Rector, Professor Agius, was mainly responsible for surface observations and for climatological work.

Navy Services.—A daily synoptic message continued to be issued for use by ships at sea and also for the information of the R.A.F. Meteorological Service in Egypt. The weather forecasts which this message enabled ships' officers to make for themselves, were found to be useful and the officers concerned raised the question of issuing synoptic messages for 1800 G.M.T. as well as for 0700 G.M.T., and of making the issue on Saturdays, Sundays and holidays as well as on week-days. Many personal inquiries and requests for information were made in this connexion, and trials took place from September 6th to October 1st and February 25th to March 14th. Requests

for details of the synoptic messages were also received from the Italian Navy and from the Greek Meteorological Office during the year.

A regular system of gale warnings for ships at Malta was in operation and many warnings of strong winds were issued. From time to time also requests were received for reports regarding the risk of strong winds in other parts of the Mediterranean.

In addition to these special reports, the shore offices of the Navy were in regular receipt of the routine local reports, and from time to time also addressed to the office inquiries relating to meteorological and associated subjects. Relations with the Fleet were not confined only to the issue of reports. Certain ships, when at sea, transmitted observations to the office. These observations provided information for the large sea areas which are normally quite blank on the daily charts, and were of great use.

R.A.F. Services.—The number of extended flights made during the year by the Royal Air Force based on Malta was relatively small. Special night forecasts and early morning observations of upper winds were supplied to them on each occasion. Similar reports were supplied to the machines taking part in the Flying Boat cruise in the Mediterranean and to those of the Cape Flight. French flying boats from Bizerta, cruising in the Mediterranean, also called on the office for information.

Routine reports were issued daily to the R.A.F. Base, and a few special inquiries were dealt with.

In the course of the year machines of the R.A.F. made many observations of temperature in the upper air over Malta, and it is hoped that these may go some way towards elucidating the differences between the nature of "fronts" in the central Mediterranean, and that found for the "fronts" associated with depressions further north in Europe.

Civil Aviation.—Reports for civil aviation included those supplied to "Moth" aeroplanes proceeding east, and, later, to the Imperial Airways craft intended for the Cairo-Karachi service. For the latter, special arrangements were made with the Italian authorities to ensure the receipt of reports from Tripoli and Bengasi, and also with the Cairo Meteorological Office for the issue of information in the evening as well as in the morning. The weather was disturbed during the passage of some of the machines and the scantiness of the data on which some of the forecasts had to be made was much felt.

Monthly returns of data regarding upper winds, upper air temperatures and W/T reception were sent to Headquarters for analysis by the Airship Division.

Army Services.—The Army made considerable calls on the office for "meteor messages" in connexion with Artillery practice. Meteor messages were issued once a day on 146 days during the year, twice on 27 days and three times on four days. Special pilot balloon ascents were made on the days of two or three "meteor messages" and on some of the days of single messages. Routine reports were also sent to Artillery H.Q.

General.—Routine local reports and forecasts were issued twice daily throughout the year except when the information received was

insufficient. This occurred from time to time owing to various difficulties associated with W/T reception. Ordinarily, new issues by Mediterranean countries and increased contributions from ships of the Fleet, together with generally improved W/T arrangements, rendered forecasting more satisfactory. Information from parts of North Africa however still left much to be desired, and there was no sort of international organization of reports from merchant ships plying within the Mediterranean.

Preliminary examinations of the observations of upper air temperatures made by the Air Force at Malta indicated the importance of a knowledge of these temperatures for forecasting; but Malta remained, during the year, the only station in the Mediterranean issuing such observations for general use. In spite of the scanty information available, polar front methods of forecasting were applied as far as possible, and on several occasions, when the movement of well-marked depressions departed largely from the normal movement, rather striking successes were achieved. A detailed study of the structure and behaviour of fronts in the Mediterranean is much required.

During the year the office continued to function in the temporary quarters rented at Pieta, but by arrangement with the Army authorities, a suitable site for permanent quarters was made available in Valletta, and it is hoped that the office may be transferred to this more central position. The transfer will reduce the many difficulties which have been experienced with the telephone system, and should increase considerably the general efficiency of the meteorological service in Malta. Towards the end of the year many of the difficulties due to the telephones were avoided by installing a second W/T receiving set at the office. This was however only possible as a temporary arrangement.

The local observations continued to be made at the University Observatory and passed to the office for issue locally and through the international broadcasts. The Observatory also rendered monthly climatological returns to London. Professor Agius was appointed Rector of the University in the course of the year, but maintained his interest in the meteorological work which continued to be under his supervision.

METEOROLOGICAL SECTION—MIDDLE EAST

On 27th January, 1927, the Superintendent (Mr. J. Durward) and Grade I Clerk (Mr. R. Pyser) arrived at Heliopolis and commenced duties at the Meteorological Office on 28th January. Mr. J. Wadsworth, Senior Professional Assistant, arrived on 12th March, 1927. The transfer of the responsibility for the Meteorological work in Middle East Area took place immediately. The actual transfer of instruments and stores took place on 11th March, 1927, after personal inspection, as far as this was possible.

Organization.—The following Meteorological stations are established in Middle East Area, and are administered, as far as meteorological work is concerned, by the Superintendent, Meteorological Section :—

Heliopolis.....Headquarters and fully equipped climatological station. Meteorological observatory.

Aboukir, Abu-Sueir, Ramleh, Amman .....Fully equipped meteorological stations.

Khartoum (Sudan) .....Sub-station (temporary).

Gaza, Rutbah (Iraq) .....Auxiliary reporting stations.

Heliopolis is the headquarters of the Meteorological Section and in co-operation with the Meteorological Office, London, and the Air Officer Commanding, Middle East Area, deals with all questions of administration, staff, stores, etc.

Meteorological Reports broadcast by the countries of Europe, N. Africa and Iraq are collected at Headquarters, and synoptic charts are prepared from which a forecast is made daily for Egypt and Palestine and broadcast to all stations Middle East. Copies of the synoptic charts and forecasts are distributed to Headquarters Middle East, to local R.A.F. units and to Imperial Airways Ltd. A collective message giving a selection of the reports is broadcast by Heliopolis to all meteorological stations, Middle East, from which a synoptic chart is prepared for the information of the local Royal Air Force units.

Heliopolis, Aboukir, Abu-Sueir, Ramleh and Amman as fully equipped meteorological stations make pilot balloon ascents and take complete surface observations four times daily at dawn, 0600, 1400 and 1800 G.M.T. Each set of observations is broadcast to all meteorological stations, Middle East. Autographic instruments are maintained ; monthly returns and summaries are prepared for the Meteorological Office, London, and the general routine followed at these stations is similar to that at meteorological outstations at home. Additional reports are made on flying days for the information of the pilots of the Imperial Airways machines on the Cairo-Baghdad air route and warnings of dangerous phenomena and improvements of weather are issued in accordance with the recommendation of the International Commission for Air Navigation.

Khartoum has been established on a temporary basis for the purpose of supplying upper wind data to the local Royal Air Force units and general weather conditions for the Cairo-Kisumu Air Route.

Gaza and Rutbah have been established as auxiliary meteorological stations for the purpose of supplying reports for the Civil Aviation Air Route Cairo-Baghdad. Warnings of dangerous phenomena and improvements of weather are also issued in the same way as the fully equipped stations. The erection of the instruments has not yet been completed at these stations : when this has been done endeavours will be made for regular observations to be taken three times daily and for monthly returns and summaries to be completed.

There are no recording instruments (apart from a barograph) and no pilot balloon apparatus at these stations.

Stores.—The Royal Air Force Depot at Aboukir acts as a clearing house and distributing agent for all meteorological stores for stations in Middle East, Rutbah, Khartoum and Aden to and from the Meteorological Office, London. Instruments and stores at stations shown in the second paragraph as well as those at the Stores Depot, Aboukir and Aden are held on charge by the Superintendent, Meteorological Section, and an acceptance is given as required by the Meteorological Office, London. On authority of the Superintendent, stations demand on Stores Depot, Aboukir, and Stores Depot on Meteorological Office, London, for consumable and non-consumable stores within approved establishment.

OBSERVATORIES

KEW

Buildings, etc.—The Observatory and out-buildings were painted externally during August and September. The felt on the roof of the Experimental House was replaced by tiles.

The three pillars, which were erected as meridian marks about the time the Observatory was built in 1769 and had got into very bad condition, have been repaired by His Majesty's Office of Works.

When the electric light was brought into the Observatory building in 1924, to serve the seismographs, connexions were made to the meter provided for the lighting circuits. It was found that an economy could be effected by bringing the instruments on to the power-meter, so as to reduce the charge for each unit of electric energy consumed. A considerable amount of new wiring was required. The work was carried out by the Richmond Electric Light & Power Co. At the same time, proper connexions were made for lighting the photo-thermograph electrically.

Equipment.—A wireless set has been installed for the reception of time signals. The reception of the signals from Greenwich over the Post Office lines will be discontinued.

Telephonic communication between the Observatory and the old cloud-camera enclosure, half-a-mile to the south-east has been re-established. Apparatus for determining cloud-height has been under trial.

A nephoscope hut has been erected for trial. There is a lens in the roof of this hut. An image of the sky is focussed on a table and under favourable circumstances the apparent velocity of the clouds can be determined with precision.

A special camera, designed by Professor Vernon Boys for photographing lightning flashes, has been lent by him to the Observatory. No opportunity for using the camera has yet occurred.

The photo-heliograph was removed to the Science Museum, South Kensington on February 8th. This instrument, which was the first camera specially designed for photographing the sun, was made by

Ross in 1855, the cost being defrayed from a fund placed at the disposal of the Royal Society by Mr. Benjamin Oliveira. The instrument was in use at Kew Observatory for sun photography up to 1876. For many years, up to 1897, drawings of sunspots were made. The results obtained with the apparatus were the subject of numerous important papers by De la Rue, Balfour Stewart and Benjamin Loewy. The history of the instrument is set out in "Memorandum on the Kew Heliograph" by Dr. Chree.*

Seismology.—The Galitzin seismographs have been in action throughout the year. Information with regard to important earthquakes has been sent to the Air Ministry for communication to the newspapers. Arrangements have been made for the publication monthly of a seismological bulletin, which is being reproduced by photo-lithography.

In May, 1926, the recording apparatus of the seismographs was altered, so that each photographic sheet now serves for 24 hours instead of 12. Some minor improvements, such as the fitting of ball bearings to the driving wheels of the drums carrying the photographic sheets, have been introduced.

In windy weather the seismographs are considerably affected by slow oscillations, which are attributed to the tilting of the ground, the movement being conveyed through the foundations of the Observatory. Fortunately, no important earthquake has occurred at a time when these wind disturbances have been prominent.

Before the seismographs were installed, there was some doubt as to whether there would be any ill effects from underground water. In March, 1927, this question was happily answered. The Thames overflowed on March 5th, 6th, and 7th, and the flooded area reached to the Observatory grounds. The highest level of the underground water was about 20 cm. below the floor of the seismograph room. The water rose to about this level in the pit round the pillar on which the seismographs stand. On the same day, there was a great earthquake in Japan; the records obtained were quite satisfactory. The pillar was slightly tilted, however, so that the pendulums had to be re-adjusted. If the tilt was due to one side of the pillar settling down, the relative movement was about 0.1 mm.

The principal earthquakes recorded during the year occurred in the following regions :—

1926.	April 12.	Solomon Islands.	1926.	Sept. 19.	Crete.
	June 26.	Crete.		Oct. 26.	New Guinea.
	June 29.	Sumatra.	1927.	Feb. 14.	Dalmatia.
	Aug 30.	Crete.		16.	Kamtchatka.
	Aug. 31.	Azores.		Mar. 7.	Mineyama, Japan.

Interesting records were also obtained for four minor earthquakes which were felt in the British Isles, the epicentres of two of these earthquakes which occurred on July 30th and February 17th respectively, were near Jersey, another on August 15th was near Hereford, and the other on January 24th under the North Sea.

**London Proc. R. Soc.*, 92, (1915), p. 199.

Atmospheric Electricity.—An insulated test-plate has been installed in the garden at ground level, for obtaining direct measurements of air-earth current. The recording apparatus experimented with, which includes improved mercury micro-voltameters, a Wilson electrometer and a Lindemann electrometer, is housed in one of the old magnetic huts. Electrical connexion between the plate and the recorder is by means of a wire stretched along a shallow trench in the ground.

A specially prepared pit has been used for experiments on the electrical conductivity of the air and on the potential gradient at ground level, to obviate interference from the observer and apparatus. To standardise the Wilson electrometer for the potential gradient observations an artificial electric field was set up in the laboratory.

The variations of absolute potential gradient over three separate sites in the garden have been compared with those at the Kelvin water-dropper jet.

Atmospheric Pollution.—Experiments have been made with an Owens automatic air filter to which an auxiliary cistern has been fitted to enable double the volume of air to be aspirated. The object is to obtain records which are darker and therefore easier to judge. Consistent results have been obtained. A report has been prepared for communication to the Advisory Committee on Atmospheric Pollution.

Rainfall.—A rainfall chronograph (or drop-counter) has been under trial. The instrument is designed to give more precision in recording the times of occurrence of rain, especially light rain, than is obtained with autographic rain-gauges.

Thermometer Exposure.—The series of comparisons of thermometer screens which was initiated in 1923 and terminated in March, 1926, has been under discussion, and a report has been prepared.

Comparisons have been made between Stevenson screens of the standard pattern and similar screens provided with metal louvres. The effect of substituting a metal stand for a wooden one has also been investigated.

Earth Temperatures.—A comparison of earth thermometers of different types was brought to a conclusion in June, 1926. From that date three direct reading earth thermometers have remained in use in addition to the autographic thermometers and the old Symons thermometers at 1ft. and 4ft. For reading the earth thermometers, which have horizontal parts of their stems on the turf, a telescope with a swinging arm has been installed.

Local Climate.—For the cultivation of plants which cannot be grown successfully in the Royal Gardens, Kew, an experimental plot has been prepared in Richmond Park. At the request of the Director of the Gardens, meteorological instruments have been lent by the Meteorological Office, and installed near the plot. Arrangements have been made for the supervision of the observations, and the relations between the temperatures, etc., in the Park and at the Observatory are being studied. The difference between the temperatures recorded in the Stevenson screens at the two stations is generally small but during the night October 26–7th it exceeded 6°F., the Observatory having the lower reading. The site in the Park is near to the highest part of Richmond Hill, whereas the Observatory is on level ground in the Thames Valley.

Sunshine Recorders.—A series of trials of sunshine recorders terminated at the end of July. The records have been discussed by the Instruments Division at South Kensington.

Gravitation.—The results of the pendulum observations made by Sir G. Lenox-Conyngham and Mr. G. Manley at Kew Observatory and at Cambridge in 1925, have been published in the "Report of the Committee for Geodesy in the University of Cambridge."

The difference between the values of g at Cambridge and Kew, is found to be ·066 in C.G.S. units. A recent determination by Dr. Meinesz of the difference between the values at Potsdam and Cambridge is quoted as ·009. The combination of these two researches gives for the difference between the values of g at Potsdam and Kew ·075. This is in exact agreement with the observations made by Mr. G. Putnam at these two stations in 1900.*

The value of g at Potsdam has been determined with great precision by Kühnen and Furtwängler, viz. $g = 981.274$.** The corresponding value for Kew is therefore $g = 981.199$.

It may be noted that as early as 1874 the length of the seconds pendulum at Kew was determined by Captain Heaviside, the comparison with the standard of length of the Ordnance Survey being made at Southampton by Col. A. R. Clarke. Heaviside found 39.14008 inches for the length of the seconds pendulum.† The corresponding value of g in C.G.S. units is 981.193.

Detonating Meteors.—With a view to using the observations in discussing the condition of the atmosphere at great heights, information as to the audibility of three "detonating" meteors has been collected.‡ These meteors occurred on Sept. 6th, October 2nd, and February 25th respectively. The second one passed over the west of London under favourable conditions, and about 700 communications with regard to it were received in response to a notice in the newspapers.

Audibility of Explosions.—It is recognised that the audibility of explosions at very long ranges provides a means of investigating the upper atmosphere. The practicability of timing the passage of the sound of gunfire was demonstrated by the Superintendent on June 28th, when he heard at Grantham the firing at Shoeburyness. Seven rounds were fired, and the times of passage of the sound over this range, 115 miles, varied between $10\frac{3}{4}$ and $11\frac{1}{4}$ minutes. The test was facilitated by the courtesy of the military authorities and the co-operation of the Meteorological Office, Shoeburyness. It is intended to follow up this line of investigation.§

Routine Work.—The normal routine of the observatory has been maintained.

Intimations of the occurrence of fog, which had been sent by telephone to Messrs Kodak, Ltd. since December, 1921, were discontinued at the end of September, arrangements for an equivalent service having been made by the Forecast Division.

---

* Washington. *Report of the Superintendent, Coast and Geodetic Survey*, 1900–1, App. No. 5, p. 345.

** Berlin. *Veröff. K. Preuss. Geodät Inst.*, Neue Folge (1906).

† Calcutta. *Account of the Operations of the Trigonometrical Survey of India*, Vol. V, 1879, p. [293.]

‡ *Meteor. Mag.* Vol. 61, 1926, pp. 253, 285; Vol. 62, 1927, p. 57.

§ *Meteor. Mag.* Vol. 61, 1926, p. 164.

The supply to the Medical Research Council of monthly tables shewing the duration of sunshine for 24-hour intervals (16h.-16h.) ceased as from the end of August.

Instructional Class.—A class for observers at climatological Stations was held by Captain Spence of the Meteorological Office from September 27th to October 2nd. The Experimental House was used as the lecture room on this occasion.

General.—In April, 1926, Mr. R. S. Whipple read before the Optical Convention a paper* on the instruments which were in the royal collection at this Observatory at the end of the eighteenth century. The subsequent history of the more important instruments is traced. The instruments have been deposited in the Science Museum.

In preparing his paper, Mr. Whipple learned of the existence of some old manuscript books which have been preserved at King's College, London, and which contain details of the astronomical and meteorological observations made at this Observatory. From one of these books he has reproduced the account of observations on the transit of Venus on June 3rd, 1769, the observations for which the Observatory was built and in which King George III took part. The meteorological note-books which have been found include the observations for the years 1773–83 and 1804–40. Unfortunately the observations were not made with sufficient regularity to give them any high scientific value.

Kew—Upper Air Section

The work of the Upper Air Section and Workshop at Kew Observatory has been continued on lines similar to those followed in previous years.

The mechanical staff have been engaged on design, maintenance and experimental work connected with the upper air observations; a good deal of experimental work has been executed for the Observatory as well as repairs and maintenance of the ordinary equipment. A considerable amount of work has been undertaken for other departments of the Meteorological Office.

The total number of sounding balloons sent up during the year was 44, and the total number of records obtained 35. Heights up to 21.1 kilometers were reached, with a mean of 16·7 km. Of the successful soundings 25 were made from Sealand Aerodrome, one from Oxford and nine from Kew Observatory. About half the soundings were concentrated into the month of May, and a very complete series of records were obtained distributed through that month.

Steady efforts have been made through the year to fit a simple form of hair hygrometer to the Dines baro-thermograph. The problem proved to be one of some difficulty and involved among other things, investigations into the response of hairs to changes of relative humidity. After various trials a detachable fitting was designed and made, and a number of records have been obtained from meteorographs fitted with them during the latter half of the

* *Proceedings of the Optical Convention*, 1926. Part II, pp. 1—27.

year. Fairly good results have been achieved, and when more experience has been obtained in their use, there is good ground to hope that they will prove as satisfactory as hair hygrometers can reasonably be expected to be.

Experiments have been directed towards making the Dines meteorograph less susceptable to small shifts of zero due to shock. A minor trouble, believed to be due to ice freezing on the record plate, and involving occasional loss of record in wet weather has been dealt with. Occasional opportunity has been taken to test such improvements as have suggested themselves towards the attainment of greater accuracy in the measurement of upper air temperatures. The launching device, which is intended to facilitate the starting of the balloon and meteorograph in windy weather, was re-designed owing to several failures, and has since been quite satisfactory.

Various methods of checking the upper air data and many points of detail in dealing with instruments, which have been evolved from time to time, have been continued as regular practice. Though they increase the time consumed in preparing the apparatus and in dealing with the results of a sounding they tend to increase the confidence which can be felt in the final figures.

Observations were made through the winter with the small captive balloon on the temperature gradient in fogs, and the information obtained was supplied at once to the Aviation Services Division.

The tables and Introduction for the upper air section of the *Observatories' Year Book* for 1926 have been completed and advance copies of the data have been supplied to select foreign upper air stations.

Current information as to upper air conditions was supplied to Dr. G. M. B. Dobson, in connexion with his investigations into the ozone content of the atmosphere.

Valentia

Meteorological Routine.—The Observatory has been maintained as a first order meteorological station. The standard self-recording instruments have been kept in continuous operation without loss of record during the twelve months and the tabulation and reduction of records have been kept well up to date. Eye observations of the various instruments have been made at the usual hours without intermission throughout the year, and in addition to the usual telegraphic reports to the Air Ministry the special reports at 10h., and 16h., have been continued.

The raingauge at the Cahirciveen reservoir continued in action until May, when the receiver was stolen and the gauge damaged. An improvised receiver was substituted and the gauge was repaired but in September the whole gauge was stolen. As the individuals concerned were never traced the records from this station have been discontinued.

Rainfall data have been supplied monthly to Mr. E. W. M. Murphy of the Irish Rainfall Association.

Magnetic Observations.—Absolute observations of magnetic declination, horizontal force and inclination were made weekly throughout the year.

Miscellaneous.—The evaporation tank and the Piché evaporimeter continue to be read twice daily. The readings of thermometers near to the surface in the water of the evaporation tank were continued until twelve months observations had been obtained. The analysis of the results has not yet been completed.

The Eder photometer supplied by the National Institute for Medical Research was returned in July, the observations being then discontinued.

Regular observations are made with the ozone spectrograph designed by Dr. G. M. B. Dobson on all days with sunshine.

The time signals received at the Observatory by land line having been unreliable for some time past, a wireless receiver has now been installed for receiving signals.

Eskdalemuir

Terrestrial magnetism.—Continuous photographic registration of the three geographical components of terrestrial magnetic force was maintained, the curves being standardized by means of the results of absolute observations, made twice weekly, of horizontal force, declination and inclination. The tabulation, from the curves, of hourly values, hourly ranges, daily maxima and minima, and the assigning of the curve base line and scale values were done at the Observatory, while most of the ensuing work of computation and reduction was performed at the Edinburgh Office. Estimates of the daily magnetic character figures, according to the international scheme, and the values of the squares of the daily range were forwarded quarterly to the Royal Netherlands Meteorological Institute at De Bilt.

The Schulze dip inductor was sent away in April 1926 for reconditioning of the vertical circle and for general overhaul. Owing to various delays, both in London and Potsdam, this instrument was not available again until March, 1927. During the absence of the inductor observations of inclination were made with the Dover dip circle, No. 74. Numerous comparison observations with the inductor and dip circle were made prior to the despatch of the former instrument, and a further series is in progress at the time of writing.

Registration, by means of the coil and galvanometer method, of the finer details of the changes in vertical magnetic force was practically continuous throughout eleven months of the year. Sufficient time has not been available for close study of the several interesting features which are shown on these records, and attention was confined to the study of the changes constituting "sudden commencements." Some of the more interesting records of the rate of change in vertical force were selected for exhibition to the Gassiot Committee. Dr. A. Crichton Mitchell, Edinburgh, has had a number of records for the purpose of a study of the occurrence and nature of sinusoidal changes in force.

The condition of the west room of the magnetograph house has not warranted the complete installation of the declination, horizontal force, and vertical force magnetographs which were formerly at Kew Observatory. However, a number of declination records were obtained in the last three months of the year.

Professor F. G. Baily, of Edinburgh, visited the Observatory for a week in August-September and obtained a number of simultaneous open time-scale records of changes in horizontal magnetic force and of changes in electrical potential difference between pairs of earth plates situated in, and perpendicular to, the magnetic meridian. A number of these records were simultaneous with similar records obtained by a collaborator in Oxfordshire.

Throughout the year particulars of the larger magnetic disturbances have been communicated to Dr. Rayner at the National Physical Laboratory for information of radio-research workers. On October 15th, 1926, intimation of a magnetic storm in progress was sent by telegram, and it is understood that useful results were obtained from radio transmission experiments which were carried out during the storm, with which was associated a brilliant auroral display during the night of October 15th–16th.

Meteorology.—The routine work of a first order station was maintained and in addition observations were made daily at 7h, 13h, and 18h, G.M.T. for the purpose of telegraphic reports to Headquarters. Pilot balloon ascents were made on "International Days," when weather permitted, and on other days as opportunity offered; the "tail method" was employed in the majority of ascents.

Solar radiation observations with the Ångström pyrheliometer were made on a few days. Eder photometer records, which give a measure of ultra-violet radiation, were obtained and forwarded to the National Institute of Medical Research until July 19th, 1926. Special monthly returns of sunshine in connexion with the Eder records were continued.

The mast of the pressure tube anemometer was adjusted in June, and in December a special direction rod coupling was introduced with satisfactory results.

The Hellman-Fuess recording snow-gauge was subjected to various tests in December and January. In order to reduce the broadening of the trace which is due to wind disturbance, the gauge has now been set up in a pit about 2 feet 6 inches in depth and 8 feet in diameter.

Towards the end of the year a fair amount of time was devoted to determination of the scale value of the Short & Mason bimetallic spiral pen psychrograph, and in this connexion the instrument was exposed to artificially varied temperature.

The tabulation of these autographic records (controlled and standardized by eye observations where necessary) and the work of computation and reduction were carried out at the Observatory. The usual data were supplied for publication in the *Weekly* and *Monthly Weather Reports*. During the year the preparation of the greater part of the current tables in meteorology for the *Observatories' Year Book* was kept practically up to date.

A brief discussion of Eskdalemuir temperature, 1911-23, and more particularly the diurnal variation of temperature, was completed.

Atmospheric electricity.—The photographic records from a Dolezalek quadrant electrometer connected to a water dropper were maintained; and the behaviour of the installation was generally satisfactory. Combined leakage and scale value determinations were carried out almost daily, and in nearly all months at least six absolute observations of potential gradient in the open were made for the purpose of obtaining

values of the factor for converting the indications of the photographic records into potential gradient in volts per metre above ground level in the open. Since May, 1925, the scale value of the photographic records has been about one half of that of previous years. Calibrations of the Wulf electrometer, used in the potential gradient work, were carried out by means of a battery of dry cells and a potentiometer.

A large number of the units of the battery of dry cells having deteriorated, the battery was renovated and re-arranged after September.

Determinations were made of the time constant and of the electrical capacity of the electrograph.

Values of the potential gradient at 3h., 9h., 15h., 21h., G.M.T. on each day and at each hour on certain selected electrically quiet days were tabulated.

Publication of results.—The meteorological, electrical and seismological tabular matter for the *Observatories' Year Book* for 1925, and the text for the 1924 and 1925 Year Books were prepared.

Miscellaneous.—A small radio receiving set was bought into use in January, 1927, for the purpose of receiving time-signals.

The summarizing, with a view to discussion, of various portions of Eskdalemuir data in terrestrial magnetism, meteorology and atmospheric electricity has been in progress intermittently.

Records of atmospheric pollution from Dr. Owen's automatic air filter were obtained throughout the year and the results are being summarized.

Visitors to the Observatory included :—Dr. G. C. Simpson, Lt.-Col. E. Gold, Prof. F. G. Baily, Prof. E. M. Wedderburn, Dr. A. Crichton-Mitchell, and Mr. R. A. Watson Watt.

Buildings, etc.—The modification of the ventilation system of the magnetograph house, which was referred to in the last report, has not been followed by any decided improvement in the condition of that building. The use of paraffin lamps under the ventilation shafts having been discontinued, the air in the building is certainly less unpleasant than formerly, but the seasonal fluctuations in the degree of dampness of the walls remain much as before. The walls of the west room were tolerably free from serious dampness during the winter months only.

Some advance was made in the matter of provision of additional accommodation for married members of the staff.

Aberdeen

Routine.—In the course of the year only minor alterations occurred in the ordinary routine. The employment of the "trial group" for reporting the character of the weather (S.C.N.I. of the International Commission for Synoptic Weather Information) was continued in the 13h. and 18h. telegrams.

Reduction of data.—The stage reached in the preparation of data for the *Observatories' Year Books* is that the work for the 1925 volume

has been completed and copy has already gone to press, thus representing considerable progress as compared with the situation at the end of the preceding year.

Instruments.—The pressure tube anemograph mast and hut were repainted and re-conditioned, the hut being also lined with matchboarding and stonyflex felt.

During the autumn a Burroughs adding and listing machine and a wireless set for receiving time signals were added to the equipment.

Throughout the year the autographic instruments worked very satisfactorily, only one or two minor repairs being necessary.

Buildings.—At the end of December, by arrangement on the part of the University authorities, the rooms were cleaned and re-painted. Opportunity was taken at the same time to have a number of cupboards and shelves built in for the storage of records and tabulations. The binding of some 40 volumes of loose serials was put in hand and a considerable bulk of useless material was eliminated. In these ways working conditions have been very materially improved.

Miscellaneous.—During the month of July, Mr. S. G. G. Kelliher, of the Meteorological Service of the Federated Malay States, attended at the Observatory for a period of training in observational methods.

Some pilot balloon filling equipment was lent to Mr. G. Manley for use on the " Heimland " Expedition to East Greenland.

Inquiries.—Several inquiries were dealt with either locally or after reference to Edinburgh. On occasions information as to wind and weather was supplied to the Royal Artillery at Torry in connexion with calibration of the guns.

Lerwick

Terrestrial magnetism.—An apparatus for drying the magnetograph house by a method suggested by the Director was brought into use in October. The interior of the building is gradually becoming drier and about four pints of water are extracted from the magnet chamber each month.

The Falmouth magnetographs have been in operation throughout the year and adjustments were made on several occasions with a view to eliminating the persistent instrumental defects mentioned in earlier reports ; such alterations and adjustments included :—

(1) An increase in the damping of the declination and horizontal force magnets.

(2) Fitting a lighter bifilar suspension to the horizontal force variometer, whereby the drift on the traces has been reduced to less than 1γ per day.

(3) Adjustments to the sensitivity of the vertical force balance and renewal of the drier contained in the case of that instrument. The vertical force balance was thoroughly cleaned on 2nd December, and the magnet was thinly coated with a hard insulating varnish.

No further adjustments were made to the magnetographs during the earlier months of 1927.

The Krogness portable magnetographs were removed from the magnetograph house in July, cleaned, and put into store.

Absolute observations of declination, dip, and horizontal force have been taken twice weekly and determinations of the scale values of the horizontal and vertical force magnetographs were made on at least two occasions during each month.

Estimates of the daily magnetic character figures according to the international scheme, have been assigned and forwarded to Edinburgh quarterly, together with absolute daily ranges of declination and horizontal force.

Aurora.—The regular auroral watch from 19h. to 23h. has been maintained except during the four summer months, and the details of displays have been forwarded to Edinburgh monthly. Although the regular logging of meteorological conditions ceases at 23h., the members of the staff show a very active interest in the work and have taken numerous voluntary observations after that time.

Since October, 1926, a regular watch from 19h. to 23h. has been kept by Mr. Anthony Johnson at Haroldswick, Unst, and his reports have been communicated to the observatory monthly.

Observations of the luminosity of the night sky have been continued, though Lord Rayleigh's spectroscope, formerly in use, has been returned to him.

Meteorology.—The work in this section has proceeded along the lines set out in previous reports.

The orientation of the anemometer has been checked on several occasions.

Observations of the motion of cirrus cloud were made during the summer and autumn of 1926 in co-operation with the University of Michigan Expedition to Greenland.

An annual summary of the weather at Lerwick has again been supplied to the County Medical Officer of Health for inclusion in his report to the County Committee and the Board of Health.

Atmospheric electricity.—The Benndorf electrograph was forwarded to London for cleaning and overhaul in July, but before removing the instrument from the electrograph hut a series of determinations was obtained for the factor of reduction from potential at the collector to the potential in the open at one metre above level ground. The instrument was returned to the Observatory late in December and was then installed in the north-west corner room of the Office buildings. The subsequent behaviour of the installation has been highly satisfactory considering the climatic difficulties encountered during the Shetland winter. The only adjustment to the instrument in early 1927, was carried out on 28th March, when the scale value of the record was increased to about 22 volts per millimetre; with this scale value the limits of registration correspond with potentials of +1700 volts and −1150 volts per metre in the open.

Wulf electrometer, No. 5225, which was issued to the Observatory in June is employed for making daily tests of scale value and rate of leak, and for determinations of the reduction factor.

The tabulation of electrograms, assignation of electrical character figures, and computation of quiet day inequalities has been kept up to date.

Radio research and W/T station.—The atmospheric recorder, belonging to the Radio Research Board, has been maintained throughout the year by the W/T charge hand. During his absence on leave,

this work, together with the management of the Pelapone charging set, was undertaken by the Meteorological Office staff.

Buildings, etc.—The Works and Buildings Section Officer from Leuchars visited the station in July 1926, and prepared specifications for maintenance work which was carried out later in the summer.

Samples of the domestic water supplies were tested at the Royal Air Force Pathological Laboratory in June 1926, and again in March 1927, and were passed as potable.

Official furniture has been provided for the assistants' quarters and, in case it should be required, a suitable establishment of furniture has been approved for the residence of the Officer-in-Charge.

Miscellaneous.—A spectrograph, designed by Dr. G. M. B. Dobson, for measurement of the ozone absorption in the upper atmosphere, was received in June ; exposures have been made thrice daily during the months when the sun is high enough in the heavens (March-September) and conditions are otherwise favourable.

Various magnetic equipment and parts of instruments were received from Kew Observatory in June.

PUBLICATIONS

The official publications issued or signed for press during the year are as follows :—

PERIODICAL.—

The Daily Weather Report issued in three sections (to date) :—

1. The British Section.
1. The International Section.
3. The Upper Air Section.

The Weekly Weather Report (to date).

The Monthly Weather Report with a summary for the year (to January, 1927).

The Marine Observer (to date).

The Meteorological Magazine (to date).

The British Meteorological and Magnetic Year Book :—

Part V. **Réseau Mondial.** Monthly and annual summaries of pressure, temperature and precipitation at land stations, generally two for each 10 degree square of latitude and longitude. Volume for 1919.

The Observatories' Year Book, 1923. Comprising the results obtained from autographic records and observations at Meteorological Office Observatories. (In continuation of Parts III (2) and IV of the British Meteorological and Magnetic Year Book.)

British Rainfall, 1925. A report on the distribution of rain in space and time over the British Isles as recorded by more than 5,000 observers.

Report of the Committee for the Investigation of Atmospheric Pollution. Report on observations for the year ending 31st March, 1926.

Southport Auxiliary Observatory. Annual Report and results of meteorological observations. By J. Baxendell. Report for the year 1925.

OCCASIONAL.—

Marine Observer's Handbook, with separate Cloud Plate. 4th edition, 1927.

Meteorological Observer's Handbook, 1926.
Supplement No. 1. Instructions for Meteorological Telegraphy.

Meteorological Reports issued by Wireless Telegraphy in Great Britain and by the countries of Europe and North Africa. 4th edition, 1926.

A Short Course in Elementary Meteorology. By W. H. Pick, B.Sc. 2nd edition, 1926.

Notes on Meteorological Observations made in British Colonies and Protectorates in 1923 and summarized in the Annual Reports of Colonial Governments.

Geophysical Memoirs :—
Vol. IV :—
31. Classification of Monthly Charts of Pressure Anomaly over the Northern Hemisphere. By C. E. P. Brooks, M.Sc., and Winifred A. Quennell.
32. Hourly Character Figures of Magnetic Disturbance at Kew Observatory, Richmond, 1913–23. By J. M. Stagg, M.A., B.Sc.
33. Variation of Meteorological Elements at St. Helena and at some other places in the Atlantic Region. By C. E. P. Brooks, D.Sc.
34. Effect of Fluctuations of the Gulf Stream on the Distribution of Pressure over the Eastern North Atlantic and Western Europe. By C. E. P. Brooks, D.Sc.

Professional Notes :—
Vol. IV :—
44. Velocity Equivalents of the Beaufort Scale. By G. C. Simpson, C.B.E., D.Sc., F.R.S.
45. Comparison of Sunshine Recorders of the Campbell-Stokes Type. A report prepared in the Meteorological Office, London, at the request of the International Meteorological Committee.
46. A note on Bumpiness at Cranwell, Lincolnshire, during the period 1st December, 1925, to 30th April, 1926. By W. H. Pick, B.Sc., and G. A. Bull, B.Sc.

The Committee desire to express their appreciation of the following articles by contributors not on the staff of the Meteorological Office :—

In the *Marine Observer*

Commander C. I. Speerschneider, R.D.N.R., Chief of Nautical Department, Danish State Meteorological Institute.
Arctic ice.

Commander E. C. Shankland, R.N.R., River Superintendent and Chief Harbour Master of the Port of London.
The tidal and hydrographical functions of the Port of London.

Mr. Cecil Ashwin, Wireless Operator, S.S. *Port Pirie*, Capt. W. S. Higgs.
Atmospherics : origin, range and directional properties.

Captain T. Golding, C.B.E., Elder Brother of Trinity House.
Captain Sir H. Acton Blake, K.C.M.G., K.C.V.O., R.N.R., Deputy Master of Trinity House, 1910–26.

Commander J. A. Slee, C.B.E., R.N.
The practical application of wireless to meteorology.

Captain N. G. Roskruge, Deputy Director of Navigation, Queensland.
Queensland coast, notes on weather, winds and tides.

Captain J. M. Isaacson, S.S. *Cristales*
Currents in the Caribbean.

Commander S. Robinson, C.B.E., R.D., R.N.R., S.S. *Empress of Australia.*
The Japanese earthquake of September 1st, 1923.

In the *Meteorological Magazine*

Sir Napier Shaw, Sc.D., F.R.S.—
An episode in the history of Kew Observatory.

H. Jeffreys, D.Sc., F.R.S.—
Climatic variations.

J. Fairgrieve, M.A.—
London fog, January 20th, 1927.

E. W. Bliss, M.A., B.Sc., A.Inst.P.—
Two memoirs on world weather: the Nile flood and British winters.

Among the articles contributed to the publications of the Office by members of the staff may be mentioned :—

In the *Marine Observer*

Capt. L. A. Brooke Smith, R.D., R.N.R.—
Work of the year.
Commander A. J. Coad, R.N.R.
Wireless and weather in South African waters.
A very important observation. Temperature.
Wireless telegraphy and tropical revolving storms.
Wireless and weather. An aid to navigation.
Observation and seamen's terms.
Ocean currents on the route to the West Indies and Panama.

Commander L. G. Garbett, R.N.—
The Beaufort scales.
Upper air observations over the sea.

C. S. Durst, B.A.—
Currents on the trans-North Atlantic tracks.
Thermometer screens for use at sea.
The use of humidity observations at sea.
The pycnosonde.

Commander J. Hennessy, R.D., R.N.R.—
Ice in the Western North Atlantic.
Cyclones of the Bay of Bengal.
Ice of the Southern Ocean.
The " Antinoe " and " Laristan " gale.

Lt. Commander M. Cresswell, R.N.R.—
Tides and currents and the effect of the wind on the water level near the shore with set and drift associated.

H. Keeton.—
Tropical cyclones of the Eastern North Pacific.
Mean sea surface temperatures. North Atlantic.

H. T. Smith.—
Phosphorescence of the sea.

W. G. Williams.—
Submarine earthquake phenomena.

J. L. Thomas.—
Northern and southern lights.

In *British Rainfall*, 1925.

J. Glasspoole, M.Sc., Ph.D.—
The relation between annual rainfall over Europe and that at Oxford and Glenquoich.

In the *Meteorological Magazine*

E. Gold, D.S.O., F.R.S.—
The travel of depressions.

F. J. W. Whipple, M.A., F.Inst.P.—
Detonating meteor of October 2nd, 1926.
Abnormal audibility of gunfire. The time of passage of the sound.

E. G. Bilham, B.Sc., A.R.C.S., D.I.C.—
The problem of atmospherics.

C. E. P. Brooks, D.Sc.—
Extremes of temperature.
Abnormal rainfalls.

C. K. M. Douglas, B.A.—
On some summer depressions.

M. T. Spence, B.Sc.—
Old fashioned winters.

E. H. Geake, M.Sc.—
The cold nights at Garforth.

S. P. Peters, B.Sc., A.Inst.P.—
The polar flight of the airship Norge I.

G. A. Clarke.—
Remarkable stereoscopic effect produced by motion at right angles to the direction of view.

The publication of the following books or papers by members of the staff may also be mentioned :—

By G. C. Simpson, C.B., D.Sc., F.R.S.—
Scott's polar journey and the weather, being the Halley lecture delivered on 17th May, 1923. Oxford 1926. pp. 31.
On lightning. *Proc. R. Soc.*, IIIa, 1926, pp. 56–67.

E. Gold, D.S.O., F.R.S.—
A numerical index of meteorological conditions on an aerodrome or air route for comparison with flying statistics. (Paper read at the III^{e} Congrès International de Navigation Aérienne).

By F. J. W. Whipple, M.A., F.Inst.P.—
(Note on) Rime in Arundel Park and neighbourhood on February 12th, 1927. *Nature*, 119 pp. 328–329.
Audibility of explosions and the constitution of the upper atmosphere. *Nature*, 118, pp. 309-313.
A remarkable halo complex. *Q. J. R. Meteor. Soc.*, 53, pp. 80-82.

By F. Entwistle, B.Sc.—
Meteorology in relation to the selection of aerodrome sites. (Paper read at the III^{e} Congrès International de Navigation Aérienne).
Wind structure in relation to air navigation. (A paper read before the Institution of Aeronautical Engineers, December, 1926). *J. Inst. Aeron. Engin.*, March, 1927.

By J. S. Dines, M.A.—
Upper air temperatures and thunderstorms. *Nature*, 117, pp. 822-823.

By D. Brunt, M.A., B.Sc.—
The period of simple vertical oscillations in the atmosphere. *Q. J. R. Meteor. Soc.*, 53, pp. 30-31.
An investigation of periodicities in rainfall, pressure and temperature at certain European stations. *Q. J. R. Meteor. Soc.*, 53, pp. 1-25.

By E. G. Bilham, B.Sc., A.R.C.S., D.I.C.—
The third optical convention (Meteorological Instruments). *J. of Sc. Instruments*, III, No. 8, pp. 281-285.

By C. E. P. Brooks, D.Sc.—
Climate through the ages. London, Benn Bros. 1926.
The troposphere and stratosphere in relation to cyclones and anticyclones. Aberystwyth, Geogr. Ass., *Geogr. Teacher* 13, pp. 383-386.
The variation of pressure from month to month in the region of the British Isles. *Q. J. R. Meteor. Soc.*, 52, pp. 263-276.
The meteorological conditions during the glaciation of the present tropics, being some remarks on the climatological basis of Wegener's theory of continental drift. *Q. J. R. Meteor. Soc.*, 52, pp. 251-262.
Pressure distributions associated with wet seasons in the British Isles. *Q. J. R. Meteor. Soc.*, 52, pp. 387-401.
Non-linear relations with sunspots. *Q. J. R. Meteor. Soc.*, 53, pp. 68-71.

By H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.—
The times of commencement of recent "sudden commencements" of magnetic storms at Eskdalemuir. *Terr. Mag.*, March, 1927.

By L. H. G. Dines, M.A., A.M.I.C.E.—
Plotting isopleths of relative humidity. *Q. J. R. Meteor. Soc.*, 53, pp. 43-44.

By E. V. Newnham, B.Sc.—
The tropical cyclone. *Nature*, 118, pp. 524-526.
Tropical cyclones of the Pacific. *Nature*, 119, pp. 218-219.

By W. H. Pick, B.Sc.—
Wind direction and velocity and day horizontal visibility at Cranwell, Lincolnshire, during the period 1st April, 1920 to 30th September, 1925. *Q. J. R. Meteor. Soc.*, 52, pp. 117-118.

By R. S. Read, M.A., B.Sc., A.R.C.S.—
The depression of February 5th–7th, 1926. *Q. J. R. Meteor. Soc.*, 52, pp. 342-344.

By N. K. Johnson, M.Sc., A.R.C.S.—
Some meteorological observations at sea. *Q. J. R. Meteor. Soc.* 53, pp. 59-63.

By N. K. Johnson, M.Sc., A.R.C.S. and E. L. Davies, M.Sc.—
Some measurements of temperature near the surface in various kinds of soils. *Q. J. R. Meteor. Soc.*, 53, pp. 45-57.

By J. Glasspoole, M.Sc., Ph.D.—
The driest and wettest years at individual stations in the British Isles, 1868-1924. *Q. J. R. Meteor. Soc.*, 52, pp. 237-249.
The daily fall of rain over the British Isles. *Q. J. R. Meteor. Soc.*, pp. 65-67.
The wet summer of 1924, and other wet seasons in the British Isles. *Q. J. R. Meteor. Soc.*, 52, pp. 363-385.

By Spencer Russell, LL.B.—
Note on halo frequency and the succeeding occurrence of precipitation in London, 1918-1924. *Q. J. R. Meteor. Soc.*, 52, pp. 118-121.

By C. W. Lamb, B.Sc.—
A comparison of minimum temperatures as recorded by grass minimum thermometers, set over shingle and grass at Felixstowe. *Q. J. R. Meteor. Soc.*, 52, pp. 427-8.

By Lt. Commander M. Cresswell, R.N.R.—
Meteorology. *Salt Spray*, 1926, April, pp. 163-167.

By R. A. Watson, B.A.—
Hourly ranges of the north component of magnetic force at Eskdalemuir. *Terr. Mag.*, March, 1927.
The variability of air temperature over the North Atlantic in January. *Q. J. R. Meteor. Soc.*, 52, pp. 143-4.

ADDITIONS TO THE LIBRARY

Books presented.—The following important works have been presented to the library during the year :—

Carpenter, A and D. Wilson Barker. Nature notes for ocean voyagers. 2nd Ed.
Danilow, L. Wetterwellen zur Kenntnis der langwährenden Witterungsperioden.
Davos, Schweizerischen Institut für Hochgebirgsphysiologie und Tuberkuloseforschung. Verhandlungen der klimatologischen Tagung in Davos, 1925. (Presented by Prof. C. Dorno.)
Dobson, G. M. B. The uppermost regions of the earth's atmosphere.
Dorno, C. Das physikalisch-meteorologische Observatorium in Davos.
Gregg, W. R. Aeronautical meteorology. (Presented by the Air Attaché, British Embassy, Washington).
Hamburg, Deutsche Seewarte. Köppen Heft. Beilage zum Annalen der Hydrographie und maritimen Meteorologie, September, 1926.
Horn-D'Arturo, G. Le ombre volanti.
International Research Council. First report of the Commission appointed to further the study of Solar and Terrestrial Relationships.
London, Board of Education. Handlist of short titles of current periodicals in the Science Library. 4th Ed.
London, Ministry of Agriculture and Fisheries. An agricultural atlas of England and Wales.
————An agricultural atlas of Wales.
London, Royal Meteorological Society. Rainfall atlas of the British Isles.
Lwów, Institut de Géophysique et de Météorologie. Communications Nos. 1-18 des résultats des recherches de Henryk Arctowski et de ses collaborateurs.... (Presented by Dr. H. Arctowski.)
Meinardus, W. Uber den Wasserhaushalt der Antarktis.
Rothé, E. Le tremblement de terre.
Schmauss, A. Wetterkunde und Landwirtschaft.
Vienna, Zentralanstalt für Meteorologie und Geodynamik. Festschrift der.... zur Feier ihres 75 jährigen Bestandes im Jahre 1926.
Wegener, A. Ergebnisse der dynamischen Meteorologie.
Zinke, Hans. Das Klima von Erfurt.

Books purchased.—Among those acquired by purchase are :—

Alexander W. H. A climatological history of Ohio.
Auerbach, F. Modern magnetics.
Baldit, A. Etudes élémentaires de météorologie pratique. 2nd Ed.
Cave, C. J. P. Clouds and weather phenomena.

Fischli, Fritz. Aeronautische Meteorologie.
Gockel, A. Das Gewitter. 3rd Ed.
Gruner, P. Beiträge zur Kenntnis der Dämmerungserscheinungen und des Alpenglühens. I und II.
Gutenburg, B. Der Aufbau der Erde.
Hill, Leonard and A. Campbell. Health and environment.
Kessler, Paul. Das eiszeitliche Klima.
————————Das Klima der jüngsten geologischen Zeiten und die Frage einer Klimaänderung in der Jetztzeit.
Klein, P. and J. Sanson. Météorologie et physique agricole.
Kolhorster, W. Die durchdringende Strahlung in der Atmosphäre.
Lundegärdh, H. Klima und Boden in ihrer Wirkung auf das Pflanzenleben.
McAdie, A. Man and weather.
————————War weather vignettes.
Mascart, J. Notes sur la variabilité des climats. Pt. I.
————————Peut-on prédire le temps ?
Meyer, R. Haloerscheinungen.
Moreux, Th. Comment prévoir le temps. 2nd. Ed.
Neumann, H. Heinrich Wilhelm Dove. Eine Naturforscher—Bibliographie.
Paris, Bureau Central de Magnétisme Terrestre. Atlas magnétique.
Robitzsch, M. Die Beobachtungsmethoden der modernen Meteorologen.
Rouch, J. Les méthodes de prévision du temps.
Sanson, J. La prévision du temps en agriculture.
Schmidt, W. Der Massenaustausch in freier Luft und verwandte Erscheinungen.
Shaw, Sir Napier and Elaine Austin. Manual of meteorology. Vol. I.
Shaw, Sir Napier and J. S. Owens. The smoke problem of great cities.
Simpson, G. C. Scott's polar journey and the weather.
Wigand, A. Luftelektrische Untersuchungen bei Flugzeugaufstiegen.
World list of scientific periodicals published in 1900-1921. Pt. I.
Zürich, Hydrologische Abteilung der Schweiz. Meteor. Zentralanstalt. Über Niederschlag und Abfluss im Hochgebirge, von O. Lütschg.

Printed under the authority of His Majesty's Stationery Office
By Barclay & Fry, Ltd., The Grove, Southwark Street, London, S.E.1.