

meteorological
service

annual
report
1977

FOREWORD

The year under review was marked by a substantial growth in demand for service from the general public. The number of direct telephone enquiries to the forecast offices showed an increase of 25 per cent over the previous year with the greatest increase in enquiries from agriculture and other weather-sensitive industries.

Increased activity in off-shore exploration made it necessary to expand the marine unit to provide the specialised forecasting service required for this work. At the end of the season, industry spokesmen paid tributes to the quality of the service provided.

Work on improving the effectiveness and utilisation of the existing computer facilities, the preparation and issue of specifications for a mainframe computer and the strengthening of the research unit continued during the year. Also a new radio-sonde system for upper air observations was introduced at Valentia Observatory during the year. These developments were necessary to enable the Service to continue to meet the increasing demands on its facilities.

Work on the construction of a new headquarters building was progressing satisfactorily at the end of the year and it was confidently expected that the headquarters staff, now spread over four buildings in the centre of Dublin, will be housed in one modern building early in 1979. The erection of an observing station which will also accommodate a training school at Galway was nearing completion at the end of the year.

P. K. ROHAN
Director

Meteorological Service,
Dublin.

August, 1978.

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FUNCTIONS OF THE METEOROLOGICAL SERVICE

The functions of the Meteorological Service are summarised as follows:-

- (i) The collection, analysis and publication of meteorological, geophysical and geochemical data;
- (ii) the carrying out of research in fundamental and applied meteorology;
- (iii) the supply of forecasts, statistical information and scientific advice on the application of meteorology in various fields to agricultural, industrial and public utility undertakings, the press, radio and television, maritime interests, individual members of the public, etc.
- (iv) the supply of similar information to Government Departments and the Defence Forces;
- (v) the provision of meteorological facilities for civil airlines operating to and from airports in Ireland and/or flying over Irish territory and the supply of advice on the meteorological aspects of civil aviation problems generally;
- (vi) co-operation with other State Meteorological Services and with meteorological workers in other countries in the development of meteorological science and of the international meteorological organisation; and the representation of Ireland at international meteorological conferences.

INTRODUCTION

Our Voluntary Observers

One of the functions of the Meteorological Service is to provide climatological statistics of the various weather elements, such as rainfall, temperature, wind and sunshine for the country, in the form of averages, extreme values, frequency of occurrence of specified values of the elements, etc. There is an increasing demand for this type of information from agricultural, industrial and engineering (water supply, drainage, hydrological) interests. The economic value of the information is widely recognised.

Because weather elements in Ireland vary considerably and significantly over relatively short distances and are also affected by topography and type of surface (e.g. water, vegetation, rock, built-up areas), extensive networks of weather observing stations operating over long periods are essential. The accuracy and reliability of the analyses on which the climatological statistics are based must be directly related to the distribution, quality and longevity of the observing stations.

The Meteorological Service itself operates only about 15 observing stations. To give comprehensive profiles of the temperature, wind and sunshine over the country, a reliable network of about 100 strategically—located stations is necessary. For rainfall, the most variable element, the requirement is of the order of 1,000 stations. The enormous deficiency in the Service's own network is almost made up by the corps of voluntary observers. The extent to which these observers provide the Meteorological Service with something approaching adequate networks is illustrated by the fact that daily temperature and sunshine values are measured by them at 65 sites and daily rainfall values at 703 sites. The Meteorological Service is very glad of this opportunity to acknowledge the indispensable co-operation of these dedicated people.

The pioneer work of some Irish scientists and devoted amateurs in this area has been noted in the annual report of 1975, and on this occasion, it is proposed to mention some notable long term

contributions made by individuals and families.

Instrumental readings of weather elements have been recorded since early in the 18th century. One of the earliest continuous records was that kept by Richard Kirwan at Cavendish Row, Dublin, from 1789 to 1808. Because of lack of standardisation of instruments and their exposure at that time, such a series, though valuable, must be treated with caution. It was only in the latter half of the nineteenth century that instruments and methods of observation reached an acceptable level of standardisation.

Professional weather observing may be said to have started in Ireland in 1867 with the founding of Valentia Observatory. In the next twenty years further official stations were opened, but with the interests of synoptic meteorology and weather forecasting, rather than climatology, in mind. These stations were, with one inland exception, in almost insular situations, and their observations were representative of coastal areas. However, they formed - and with the later additional synoptic stations continue to form - the backbone of the climatological network. We are fortunate that, even before their advent, reliable records were being kept, mainly by enthusiastic amateurs but in a few cases by semi-professionals.

Of the stations currently in operation, that at Phoenix Park (Ordnance Survey Office) is regarded as the oldest in continuous service. A succession of military and civilian observers since 1830 has maintained there an uninterrupted series of readings with that same meticulous attention to detail that we find in the Survey's field and mapping work. In Dublin also, at the Botanic Gardens, observations have been made since early in the last century but it is only from 1860 that an unbroken series is available.

Perhaps the most remarkable Dublin record was that kept at Fitzwilliam Square and later at Leeson Park by Sir John Moore, doctor, public health expert and pioneer in preventative medicine. He began observations in 1865 and continued them for 71 years, until his death in 1937 at the age of ninety-two.

Outside Dublin, we are indebted for two remarkable long-term records to two families of landed proprietors with scientific leanings, the Cowpers of Markree, Co. Sligo and the Earls of Rosse at Birr. At Markree Castle, near Collooney, the Cowper Family established what was regarded in its day as the finest private observatory in these islands, with a resident astronomer who also kept weather records. The Markree telescope is now in Hong Kong and the only part of the observatory remaining is the massive stonework of the telescope supports. But the weather records, started in 1834, are still maintained; they are the only representative series from the west of over a century's duration.

The observatory at Birr Castle is better remembered than that at Markree because of the fame of the great telescope designed and built there in 1845, and at that time the most powerful in the world. Weather records were also kept at the Castle and eventually it became the only inland synoptic station in Ireland, reporting its observations several times daily by telegraph. The great Birr telescope is now dismantled, its lens a museum piece in London, but the weather records continue. The station has twice been re-sited, but it has been possible to correlate the three series of observations, covering more than a century, to form the longest representative series for the midlands.

While records were kept at several other great houses, notably at Castleforbes, Co. Longford and Kilkenny Castle, it is to improving landlords, progressive farmers, and enthusiastic gardeners that we are principally indebted for long-term records. At Seskin near Carrick-on-Suir, the Grubbs recorded rainfall, temperature and sunshine for over a century until 1951. At Mountmellick, the Robinsons and Pims maintained weather records for almost half a century. Incidentally the Pims also made phenological observations, recording the dates of development, growth, progress of certain key plants and trees, and the first and last appearances of insects and migrant birds, a study which in recent years has been revived internationally after years of neglect.

Growing interest in agricultural research around the turn of the century was responsible for the establishment of several climatological stations. One of the most notable was that at Ballinacurra, Co. Cork, where, in 1908, the maltster, John Bennett, with the Board of Agriculture and Messrs. Guinness, set up a barley research station which included a weather observing station. Here, to quote the reviewer of his work "The Barley Crop", the great expert, Dr. Herbert Hunter, "spent forty years watching barley". When he discontinued his watch the weather observations were continued by the Bennett family until the maltings eventually closed. Weather observations are, however, still made at Ballinacurra by the Department of Agriculture.

One of the few weather records begun for purely commercial reasons was at Mallaranny, Co. Mayo where, in 1894, the Great Western Railway established an hotel near the terminus of its Achill branch. The hotel was publicised as a health resort, and in evidence of the claims regarding its beneficial climate, the records of rainfall, temperature and sunshine as kept by the station-master were quoted. He continued to keep the records until his death in 1956, long after the last train had left Mallaranny and the Great Western Railway itself had ceased to exist as a company. Another set of weather observations started for commercial reasons was at Quilty, Co. Clare where an anemometer was installed by the West Clare Railway in January, 1911. This followed a severe gale during which a train was blown off the tracks. Subsequently, when the wind speed recorded on the anemometer reached a certain limit, train movements were halted. The records at Quilty were maintained until January, 1961 i.e. they covered just over 50 years.

Mr. William McCarthy of Tralee is, perhaps, the most remarkable figure among our present observers. He has kept records officially since 1937, but began observing many years earlier. The observational data he has supplied, together with his notes and interpretations, form a solid foundation for a study of the climatology of West Munster, a most interesting region from this point of view.

So far we have dealt with long-term records in general, mainly of temperature and sunshine but also including rainfall. Temperature and sunshine do not normally vary dramatically over short distances, but rainfall is a much more variable element in time and space and, as its variation was of great importance for water supply and arterial drainage planning, special networks of rainfall observing stations were organised at an early stage. Rainfall measurement was first put on an organised basis in 1860 when G.J. Symons founded the British Rainfall Organisation with the object of standardising rain-gauges and their exposures, and of bringing together for publication all available rainfall data. He received remarkable co-operation from Ireland, and by 1870 was publishing returns from 73 Irish stations. At Mayfield, Portlaoise the Malcolms family commenced rainfall records in 1841 and this record has been continued up to the present day despite changes in ownership and use of the property. At Fenagh, Co. Carlow the Pack-Beresford family have kept records since 1866. Other stations which now have records for over a century are at Foulkesmills, Co. Wexford (1873), Ahascragh, Co. Galway (1874), Blandsford, Co. Laois (1874) and Belvedere House, Mullingar (1875). Mr. J.P. Hodson was personally responsible for the rainfall record at Twyford, Athlone from 1875 to 1953.

In many cases these observers did not content themselves with furnishing daily rainfall figures only, but on their record sheets gave details of crop conditions, reports on storms, floods, droughts and their effects, and descriptions of remarkable phenomena. In 1895, for instance, Mr. Burton of Carrigaholt, Co. Clare, records the fall of a shower of small fish - and Mr. Burton was also a Justice of the Peace! Dublin in 1867 had a shower of nuts, and the observer notes that they fell in great quantity in places as far apart as Capel Street, Dame Street and Bishop Street, and with such force that "even the police, though protected by unusually strong head-covering, were obliged to seek shelter from the fusillade". A shower of sulphur was reported in Dublin in 1879 but Dr. John Moore was quick to prove that the yellow dust was actually pollen.

These phenomena were probably due to minor whirlwinds commonly known in rural Ireland as "sidhe-gaoithe".

We are fortunate that the tradition of voluntary co-operation still persists. Not only are historic records being continued but new observers and new stations still appear although sadly in much fewer numbers. Many are discontinued after a short period but we have acquired from voluntary observers almost 50 observational series extending over 30 years or more since the 1920's. Outstanding among the rainfall observers of this century was Mr. E.W.M. Murphy of Ballinamona, Cashel who formed the Munster Rainfall Association in 1918. In 1920 this was extended to cover the whole country and renamed the "Irish Rainfall Organisation" of which Mr. Murphy was Hon. Secretary. An annual pamphlet was published giving rainfall values for a number of stations. Mr. Murphy expended a good deal of his time travelling the country inspecting raingauge sites and seeking further recruits to his organisation. The number of stations in the organisation apparently reached its maximum in 1932 when values for 269 stations were published. After that time the number of stations gradually decreased.

Over the years these voluntary observers have received little recognition beyond a brief mention in the published climatological records or occasional newspaper quotation in time of flood or drought. To the layman they may appear as harmless eccentrics always quoting "wettest since", or the "warmest ever" ... To the drainage and water supply engineer, the agricultural researcher, the environmentalist, long-term reliable climatic data are essential. The Meteorological Service can supply details of current and past weather parameters including statistical summaries and analyses; it can advise on the average and extreme weather conditions to be expected in most parts of the country, but only because it has available as source material the records built up over the years by this intensely interested body of farmers, gardeners, fishermen, foresters, clergymen, gardai and school teachers - people from all walks of life who comprise our Voluntary Observers.

THE WEATHER OF 1977

Generally, it was the coldest January since 1963.

February was the wettest on record at several places, including Dublin (Phoenix Park) where the records go back to 1837. Overall, February's rainfall was about 100 per cent above normal (126 per cent above at the Phoenix Park). March also was very wet with rainfall generally about 45 per cent above normal. On the other hand, May was dry with 65 per cent below normal over the country as a whole. At the Phoenix Park, with 76 per cent below, it was the driest May since 1896.

June was also drier than normal and, in the northern half of the country, sunshine was above average; nevertheless temperatures were well below normal.

July and August were fairly good holiday months with temperatures and sunshine near or above normal. July was also drier than normal but many places had thundery rain on a few days in August, Belmullet recording its greatest rainfall in one day (57.3 mm on the 25th) since records began there in 1956.

A feature of the three-month period May to July was the low rainfall. Generally it was as much as 40 per cent below normal (at Roche's Point, with 51 per cent below, this period was the driest since 1923). As a result, crop growth was reduced during the late summer.

October was wet generally, the south having about double the normal rainfall and Cahirciveen, with 125 per cent above normal, having the highest October rainfall since records began in the area in 1866.

STAFFING

The number of staff serving in the different grades on 31st December 1977 were:-

Director	1
Assistant Director	1
Senior Meteorologist	8
Meteorologist	47
Meteorological Systems Analyst	6
Senior Meteorological Officer*	35
Meteorological Officer*	147
Assistant Meteorological Officer*	30
Other grades	<u>40</u>
TOTAL	315

This total represents a decrease of five on the previous year.

Mr. D. Noel Reidy, Meteorological Officer, died on 14th December, aged 38 years. Mr. Reidy joined the Service in January 1958. Following his training course, he was posted to Valentia Observatory where he served until his untimely death. Mr. Reidy left a wife, Noreen, and three young children to whom sincere sympathy is extended.

Mr. F.E. Dixon, Senior Meteorologist, retired in April, Mr. M. O'Shea (Miko), Meteorological Officer, retired in May, Mr. Michael Roche, Assistant Meteorological Officer retired in July and Mrs. E. Hennessy, Cleaner, retired in September.

*The titles of these grades were changed during the year; Senior Meteorological Officer was formerly known as Senior Meteorological Assistant, Meteorological Officer was formerly known as Meteorological Assistant and Assistant Meteorological Officer was formerly known as Station Assistant.

Mr. Dixon was one of the first batch of seven meteorologist cadets recruited to the newly formed Meteorological Service early in 1939. He is an honours graduate of Cambridge University and, before joining the Meteorological Service, he worked for three years in the British Meteorological Office. Mr. Dixon served as meteorologist at Foynes, headquarters, Dublin Airport and Shannon Airport. In 1956, he was promoted and took over the newly-established Training School at Rosslare. He was transferred to Dublin Airport as officer in charge in 1963 and later served for over 10 years as officer in charge of the Central Analysis and Forecasting Office (CAFO). For the last two years of his career in the Meteorological Service, Mr. Dixon was in charge of the Climatological Division which must have been his most congenial appointment, for Mr. Dixon is probably the greatest living authority on historical Irish weather records. Mr. Dixon was closely associated with the Meteorological Service's library for many years and his personal interest in the history of meteorology and in early meteorological research is reflected in the library's excellent holdings of early works in meteorology, which it owes largely to his efforts and generosity. They include many volumes donated from Mr. Dixon's own library, and copies of the very valuable transcriptions he has made from Irish printed books and MSS of the 18th and 19th centuries.

Mr. O'Shea was serving at Valentia Observatory when it was taken over by the Meteorological Service in 1937. By the time of his retirement, his total service amounted to over 50 years.

Mr. Roche's association with meteorology was also of long standing. For many years he assisted his aunt who was already the observer at the Roches Point "Telegraphic Reporting Station" when the newly-formed Irish Meteorological Service took it over in 1936. When the official synoptic station replaced the telegraphic station in 1962, Mr. Roche joined the staff.

Mrs. Hennessy looked after the outhoused Climatological Division in 55/56 Upper O'Connell Street for several years before she retired due to illhealth.

All four carry with them the best wishes of the staff in their retirement.

Mr. P. O'Sullivan, Meteorological Systems Analyst, obtained a B.Sc. degree in computer science in July, gaining distinction in all three parts of his final examination. Mr. R.G. Kavanagh was appointed to an acting post of Meteorological Systems Analyst following completion of the second year of his B.Sc. course in computer science at T.C.D.

Messrs. L.N. Fitzpatrick and M. Murphy, Meteorological Officers, commenced a four year course in computer science at T.C.D. Mr. O. Veale, Meteorological Officer, successfully completed the second year of a four-year course leading to a diploma in administrative science from the I.P.A.

Mr. David Blair, Meteorological Assistant, continued his honours degree course at University College, Dublin. Mr. P. Lynch, Meteorologist, registered for a Ph.D. degree in the School of Mathematics, T.C.D.

Dr. J.R. Bates resumed duty in the Meteorological Service on 4th January, following a year's leave of absence during which he acted as expert adviser on tropical meteorology to the Government of Egypt under the United Nations Development Programme. Dr. Bates also resumed his active participation in the work of the joint British universities panel which is developing a global model of the atmosphere. In July, the Council of the University of Reading conferred on him the title of Visiting Research Fellow in the University's Department of Meteorology for a period of three years.

Mr. M.J. Connaughton, Meteorologist, continued on leave of absence during the year acting as Chief of the Agricultural Meteorology Branch of the World Meteorological Organisation. Mr. John Hennessy, Meteorological Systems Analyst continued on leave of absence with the European Centre for Medium-range Weather Forecasts (ECMWF).

PRINCIPAL OFFICERS OF THE METEOROLOGICAL SERVICE ON 31st DECEMBER 1977

DIRECTOR - P.M. Austin Bourke, Ph.D., D.Sc. (hon. causa)

ASSISTANT DIRECTOR - P.K. Rohan, M.A.

SENIOR METEOROLOGISTS - S. McWilliams, B.Sc.

M.G. Granville, B.Sc.

C.J. Gillman, M.Sc.

L.S. Leech, B.Sc.

D.L. Linehan, B.Sc., B.E.

C. O'Connor, B.Sc.

W.H. Wann, B.A., M.Sc.

P.A. Lyons, B.Sc.

ACCOMMODATION(i) Headquarters

The Climatological Division was transferred to new accommodation at 101-104, Marlboro Street on 21st January. The research and long-range forecast unit remained at 55/56 Upper O'Connell Street and the transfer of the Climatological Division made it possible to transfer the library and the agricultural meteorology unit to this address also. The Civil Service Commissioners have been good enough to continue to allow the computer staff and the marine meteorology unit to remain at No. 45 until the new building at Glasnevin is ready.

(ii) New headquarters building

Work on the new headquarters building at Glasnevin re-commenced early in the year. The building was topped out before the end of the year and it is still expected that the building will be ready for occupation early in 1979.

(iii) New training school

Construction of the new training school and synoptic reporting station at Murrrough, Galway was practically completed by the end of the year and staff were being selected for assignment there so that synoptic observations could commence early in 1978.

(iv) New synoptic and agricultural meteorological station at Johnstown Castle

The legal problems regarding acquisition of the site remained unresolved during the year.

(v) New building at Claremorris synoptic station

Erection of the new building started in May. It was hoped to have it ready for occupation in December but bad autumn weather and a shortage of steel delayed completion by a few months.

OBSERVING PROGRAMMESurface Observations

The following 14 surface synoptic observing stations operated continuously on a 24-hour basis throughout the year:

Malin Head	Birr
Clones	Shannon Airport
Belmullet	Kilkenny
Claremorris	Rosslare
Mullingar	Valentia Observatory
Dublin Airport	Cork Airport
Casement Aerodrome	Roches Point

The positions and dates of establishment of these stations are shown in Figure 1.

The network of surface synoptic stations was supplemented by the following networks which sent regular returns to the Climatological Division during the year:

65 climatological stations;
 44 rain recorder stations; and
 638 rain-gauge stations

Upper Air Observations

At Valentia Observatory, upper air observations of pressure, temperature and humidity by radio-sonde and upper wind observations by radar were continued during the year.

Other Observations

The aurora, solar radiation, satellite, atmospheric nuclei, geomagnetic, seismological, weather surveillance radar, tidal and other special observations outlined in previous annual reports were continued during the year.

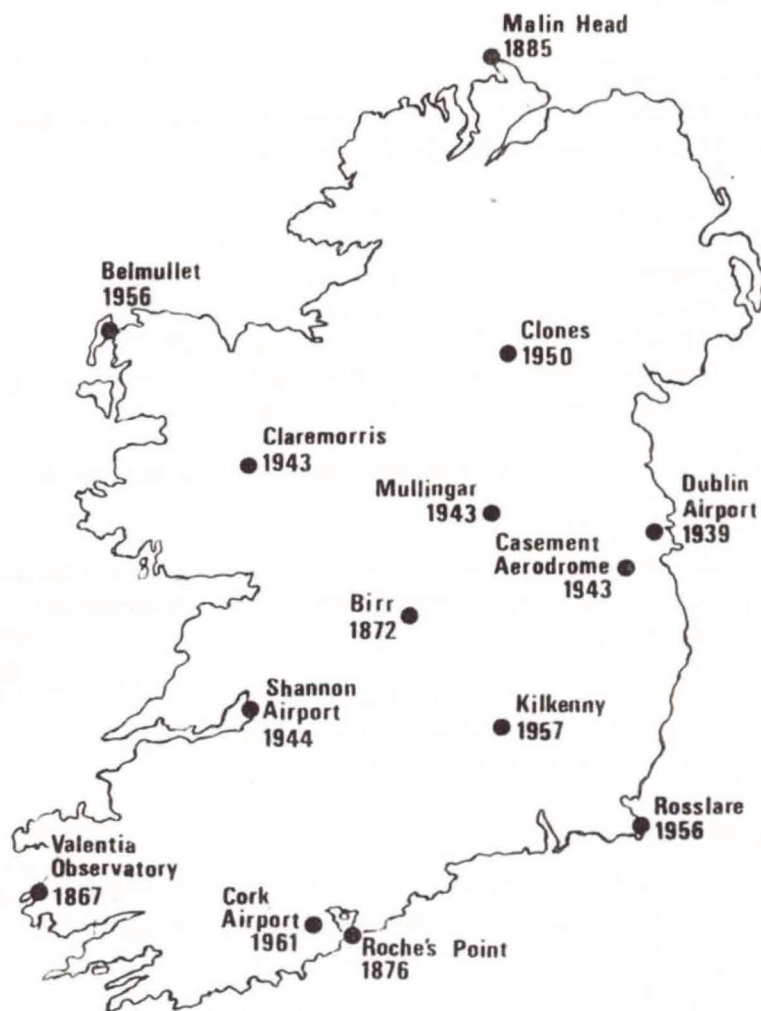


Fig. 1. The synoptic observing stations and dates of their establishment

FORECASTING SERVICES

The analysis and forecasting work of the Service was continued at the Central Analysis and Forecasting Office (CAFO) during the year. The forecasting offices at the airports continued their assistance to the CAFO by dealing with enquiries from local agricultural, industrial, commercial and other non-aviation interests as well as the general public. A number of the synoptic stations also continued their assistance by relaying the CAFO forecasts to local enquirers.

Over 520,000 calls for forecasts for the Dublin area were made during the year to the Post Office automatic telephone weather service (Dublin 1199). The number of direct telephone calls made to the forecasting offices during the year by various interested parties were as follows:-

Interests originating Enquiries	Telephone calls made to				Totals
	CAFO	Shannon	Cork	Dublin	
Agricultural	9,670	5,208	1,885	17	16,780
Industrial & Commercial	2,885	1,274	1,871	48	6,078
Marine	6,034	1,091	451	48	7,624
Defence Forces	14	24	18	4	60
Other Government Departments	1,075	164	126	40	1,405
Press	274	85	31	1	391
Sporting	493	381	659	95	1,628
Private	8,648	4,908	2,679	415	16,650
Totals	29,093	13,135	7,720	668	50,616

In addition, over 600 requests for forecasts were dealt with by the synoptic stations.

A round the clock forecast service was provided during the year to the Air Corps by the Meteorological Office at Dublin Airport, either direct or through the Meteorological Office at Casement Aerodrome. In addition, a full 24-hour forecast service was provided for civil aviation operations by the meteorological offices at the Dublin, Shannon and Cork international airports. The numbers of flights serviced were 18,420 at Dublin, 6,430 at Shannon and 2,280 at Cork - total 27,130. In addition 290 briefings were given to air-line training crews. Light aircraft, attached to flying clubs or privately owned were provided with briefings on 10,500 occasions. 200 warnings of hazardous conditions in the Shannon Flight Information Region were issued.

During the summer months, the Dublin, Shannon and Cork forecast offices provided briefings and forecasts for helicopters servicing 6 oil-exploration installations operating in Irish coastal waters.

Forecasting for offshore oil exploration operations was undertaken by the Meteorological Service for the first time on 21st March and, during the drilling season, wind, weather and wave forecasts were provided to some half a dozen rigs drilling in the seas around the Irish coast. The provision of this service involved a major co-operative effort between staff of the marine unit and of the CAF0.

CLIMATOLOGICAL ACTIVITIES

Analysis of Data

Monthly and Annual Rainfall Averages for 1941-70 were prepared and published and the 1941-70 annual average map was prepared. This work is of special interest since, in the period 1941-70, rainfall records for 10 to 30 years were available for some 900 stations.

Card Punching and Storage of data on magnetic tape

The punching on cards of the current data from synoptic, climatological and rainfall stations, and of upper air data for Valentia, was kept up to date and, after quality control, the data were stored on magnetic tape.

Over 11 station years of hourly data prior to 1950 were transferred to magnetic tape and over 10 station years of these were quality controlled. Eight books of ships' reports from the Marine Unit were punched and verified. Upper air data for Valentia back to March 1965 have been punched, quality controlled and put on tape.

Work continued on the transfer of ships' observations to magnetic tape in a format suitable for FORTRAN programming.

Computer work

Total effective work on the Revenue Commissioners' computer was 836 hours for the year - an average of 16 hours per week.

Tables for the aeronautical climatological summaries for Cork Airport were prepared. Monthly tables up to November 1977 of all elements for all synoptic stations were printed, and tables for about 10 station years prior to 1957 were also printed. Daily values of rainfall for all stations from 1941 up to June, 1977 were printed for the use of the Enquiries section.

Fortran programmes were written for the extraction of hourly values of sunshine over five year periods, for the computation of 5-day means of soil and earth temperatures and for processing values

of solar radiation. A pilot project for the processing of current daily rainfall data on the Service's own computer was undertaken. A number of programmes were written or amended to meet specific enquiries.

Help from outstations

In addition to doing regular climatological tabulations and processing of current data for their own station, the staff of most outstations continued to help in processing back data. 142 station months of hourly wind data were tabulated and 128 station months of synoptic data in the pre-1949 code were prepared for punching in the current form by the outstations.

Routine Publication of Data

Monthly Weather Reports (MWR) for September 1976 to July, 1977 inclusive and the Annual Summary for 1976 were issued. Monthly weather summaries and an annual summary were issued to the newspapers.

Inspection of Stations

Routine inspections of climatological and rainfall stations were carried out during the year; 500 stations were inspected in 1977. Three new raingauge stations and two climatological stations were opened. Two rain recorder stations and five raingauge stations were closed.

Climatological enquiries

3,680 climatological enquiries were dealt with during the year.

AGRICULTURAL METEOROLOGY

Routine Activities

Publication of the monthly Agrometeorological Bulletin was continued.

Three warnings of weather suitable for the spread of potato blight were broadcast on RTE during the growing season; three bulletins detailing the progress of the disease were issued.

Ollernshaw's Index which indicates the likely level of liver fluke disease was calculated. It indicated a low level of infection during the winter of 1977-78 and this was taken into account in the dosing recommendations issued by the Department of Agriculture.

Data from the four Irish phenological gardens were processed and the results forwarded to the international directorate of the programme.

The notification of fair spells during the harvesting season was continued. Six forecasts of fair spells were issued by the CAFO.

Over 140 requests for specialist information were dealt with. More than 16,000 of the requests for forecasts received by the forecasting offices came from agricultural interests.

Investigational Work

Agrometeorological Memorandum No. 7, entitled 'Earth Temperature in Ireland', was published giving means, standard deviations and extreme values of the temperatures at depths of 30 cm, 60 cm and 120 cm for the period 1956-75.

Averages of effective blight hours for twelve synoptic stations were updated as were the averages for degree days above 10⁰ C.

Data from stations in the east and south-east were analysed and the results supplied to the orchard study-group of An Foras Taluntais.

MARINE METEOROLOGY

The following ships co-operated with the Service by performing weather observations at sea during the year

<u>Irish Shipping (8)</u>	- Irish Cedar, Irish Elm, Irish Larch, Irish Maple, Irish Oak, Irish Pine, Irish Rowan and Irish Star
<u>B. and I. (4)</u>	- Munster, Leinster, Innisfallen, Kilkenny
<u>Irish Continental Line (1)</u>	- St. Patrick

In addition, a few reports were received from the National Science Council's research vessel Lough Beltra during the year.

Port meteorological officers visited ships in port to check and, where necessary, to replace equipment during the year as follows -

Dublin	- 12 visits
Rosslare	- 4 visits
Cork	- 3 visits

The main development during the year was the setting up of a special Off-shore Forecasts Section, attached to the CAF0, to provide a forecast service for the petroleum companies operating in Irish waters. Many different divisions in the Service gave valuable assistance in the launching of this section, which went into operation in mid-March. Three meteorologists were employed full-time on this work until mid-December, and during this period a regular forecast service was provided to some half-dozen operating companies.

Previous research work on a manual method of forecasting waves was put into operational use in the Off-shore Forecasts Section in the CAF0. A numerical wave-model obtained from the Norwegian Meteorological Institute was adapted by the Computer Unit and the Long Range Forecast Unit to be run on the Meteorological Service's computer.

Further work on this model is continuing, to devise a method of computing swell as well as waves.

The Officer in Charge of the Marine Unit attended routine meetings of inter-departmental working groups on the Kinsale Head Gas Field Platforms and Off-shore Pollution. He also attended meetings of the National Science Council's Marine Science Advisory Committee.

The Service was represented at a series of meetings of West European countries, which eventually led to an International Agreement on the setting up of an experimental European Network of Ocean Stations (ENOS). This Agreement was signed in December by Ireland, as well as Denmark, France, Norway, Portugal, Sweden, and the United Kingdom. Other European states are expected to accede later. For the present, Ireland's responsibility is confined to a financial contribution towards administrative costs, and assistance in deploying and recovering buoys launched by other states.

The Service took an active part in international meetings concerned with the provision of weather forecasts etc. for offshore operations. A seminar in London in March on weather and offshore operations was attended, as was a meeting of the North Sea Meteorological Panel in de Bilt in September. This panel was formed to co-ordinate forecasting services to petroleum companies in the area and, because of Ireland's interest, the scope of the panel was enlarged to encompass adjoining waters, including the Irish off-shore areas.

Over 7,500 of the enquiries received at the forecast offices came from maritime interests.

LABORATORY WORK

The programmes of sampling and measurement of

- (a) artificial radioactivity in air and precipitation, etc. and
- (b) atmospheric chemistry (measurement of certain chemical elements in air and precipitation)

were continued throughout the year.

(a) Radioactivity Measurements

- (i) Daily measurements:- Routine daily measurements of total beta-radioactivity of air samples and of precipitation and/or settled dust samples were continued at headquarters and Valentia Observatory.
- (ii) Weekly measurements:- Routine weekly measurements of total beta-radioactivity of tapwater and of total-fallout were also continued at headquarters and Valentia.
- (iii) Monthly measurements:- At both headquarters and Valentia Observatory, the monthly collections of precipitation and settled dust were continued; those at Valentia were measured for total beta-radioactivity and the Dublin samples were assayed for strontium 90 content.

In addition, the monthly collections of precipitation and settled dust were continued at the synoptic stations at Belmullet, Dublin Airport, Mullingar, Rosslare and Roches Point; their total beta-radioactivity was measured at headquarters.

- (iv) Publication:- The results of the measurements listed above were collated and processed at headquarters for publication in the quarterly bulletin "Measurements of Radioactivity of Precipitation, Settled Dust and Airborne Particles in Ireland".

A nuclear test carried out in China in mid-November 1976 did not produce any marked effect in radioactivity over Ireland but did give rise to a small general increase in the low levels prevailing during January to September 1977. Another Chinese nuclear test, on 17th September 1977, was responsible for a marked increase in artificial radioactivity over Ireland in October but, as in 1976, the level fell off quite quickly during November and December.

At the headquarters laboratory, the daily measurement of sulphur dioxide was continued as a routine. The decline in the average concentration of sulphur dioxide at this station, referred to in the 1975 and 1976 reports, continued in 1977; the level is now less than half of that which prevailed in 1970 and 1971.

(b) Atmospheric chemistry - measurements of certain chemical elements in air and precipitation

The network comprised the nine stations listed in the 1975 report and the sampling procedures, the elements determined and the analysis procedures remained unchanged.

Co-operation by the Valentia and headquarters laboratories in international atmospheric chemistry and turbidity programmes continued in 1977 as outlined in the 1975 report.

The results of the chemical analyses on the Irish samples are published as Table 9 in Part I of the Monthly Weather Report. They are also included in publications of data by the International Meteorological Institute (IMI), Stockholm. The WMO publish Valentia data in the series "Atmospheric Turbidity and Precipitation Chemistry Data for the World" of which four volumes, for 1972, 1973, 1974 and 1975 have issued to date. A paper reviewing the precipitation chemistry measurements over the 10 years 1966-75 was issued as Technical Note No. 42.

There were very few enquiries during 1977 relating to radioactivity or the chemistry of air and precipitation.

Sampling and analysis procedures were studied, to ascertain the need for new instrumentation, to improve techniques and to consider the feasibility of some expansion of activity in the field of atmospheric chemistry.

INSTRUMENTS AND EQUIPMENT

Anemometers

A contract was placed in April for the supply of anemometer systems for Shannon and Cork Airports which will meet the requirements of the new ICAO Annex 3. These will be similar to the new system ordered for Dublin Airport and will be supplied by the same manufacturer.

Assistance was given to the ESB in the erection and adjustment of an anemometer at their climatological station at Carne, Co. Wexford.

Barometers

All barometers at the synoptic stations and the headquarters standard barometer were checked against the national standard at Valentia.

It was decided to phase out Kew-pattern barometers. The objective to be aimed at is one mercurial barometer (Tonnelot) and one precision aneroid barometer at every station. The question of the most suitable type of precision aneroid barometer for the replacement programme was under examination during the year. Without prejudice to this examination, it was decided to meet the more urgent requirement of selected lightships and of oil exploration rigs by purchasing a number of readily available precision aneroids.

During the year the ordinary aneroid barometers were recalled from synoptic stations and some were re-calibrated and prepared for installation on lightships and fishing trawlers.

The annual check of Aer Lingus pressure-measuring instruments was carried out at Dublin Airport in February.

Solarimeters

Additional solar radiation equipment (Solarimeter, Integrator etc.) was delivered in October for the extension of the radiation network.

Upper air equipment

A new (Vaisala) radio-sonde system for upper air observations of pressure, temperature and humidity at Valentia Observatory was introduced in July.

Rain sampler

Experimental work to find a more satisfactory sensor for the automatic rain sampler continued at Valentia Observatory. The problem of a lid for better sealing of the precipitation chamber is also being investigated.

Automatic nucleus counter

The automatic version of the Pollak/Nolan nucleus counter was used during the year at Valentia Observatory to record half-hourly measurements of the condensation nuclei count.

Weather Surveillance Radar

The major part of the civil works for the installation of the Decca 41 weather radar at Cork Airport was completed by October. An engineer from Plessey Radar arrived early in November and commenced the installations and reconditioning of the equipment but his work was interrupted by an industrial dispute at the airport. He had to return to England early in December leaving the work unfinished.

Reception of wireless broadcasts

A four-band radio receiver with chart recorder and FM/AM converter for automatic facsimile reception were acquired at Dublin Airport during the year.

Evaporimeter

A class A evaporimeter was installed at Kilkenny and observations commenced in May.

Runway Visual Range

A transmissometer system for the measurement of runway visual range was brought into use at Dublin Airport in September.

Visibility

A videograph was brought into use at Dublin Airport in September.

Cloud-height measurements

A new ceilograph was brought into use at Dublin Airport in May.

Routine maintenance work was carried out during the year at the headquarters and Valentia workshops and at the airport meteorological offices.

COMPUTER DEVELOPMENTS

Developments in the Computer Unit continued during the year, if rather more slowly than planned.

In January the computer took over the transmission of operational meteorological data from Irish airports to the London collecting centre. The change-over was implemented without any serious hitch.

The 1200 baud link with Bracknell for the reception of basic meteorological data from the European Meteorological Teleprinter Network (EMTN) became operational late in the year and programming for the redistribution of these data on 50 baud circuits to the CAFO and the Airports was far advanced by the end of the year and expected to be operational early in 1978.

The implementation of computer links with the telex system, and the eventual collection of Irish synoptic and climatological data via telex for retransmission on the return leg of the 1200 baud circuit to Bracknell, was held up because of delays in the delivery of the telex/computer interface hardware. This hardware is specially designed prototype equipment and the Meteorological Service will be one of the first to attempt such a computer/telex linkage with the facility of dialling in or out of the computer. However, it is not intended to implement the computer collection of synoptic data via telex operationally until after the move to the new headquarters in Glasnevin early in 1979.

Planning for moving the live computer installation from the present headquarters to new building in Glasnevin was commenced. This will be a difficult operation involving the closest co-operation between the computer company, the Post Office and the Meteorological Service.

Specifications for a mainframe computer for the Service were drawn up and cleared with the Department of the Public Service. Invitations for proposals to meet the specifications were due for issue to computer companies in January 1978.

In collaboration with the Research Unit, development work and planning continued in preparation for the mainframe computer. A meteorologist was assigned to the Computer Division in December 1977 and commenced work on an automatic data extraction (A.D.E.) system for basic synoptic data, in collaboration with the systems analysts. He also is collaborating with the Research Unit on the allied area of objective analysis. The research group is at the same time considering and formulating plans for a numerical weather prediction model to be used when the mainframe is acquired.

RESEARCH AND INVESTIGATION

In the Long-range Forecasting and Research Unit, research work on the dynamics of planetary waves forced by zonal variations in heating and topography was in active progress during the year. Important theoretical findings were made on the possible influence of changes in the earth's ozone layer on the climate at low levels. It was shown that changes in the stratospheric wind field which would result from ozone changes could strongly modify the poleward heat transfer by planetary waves, leading to a change in the pattern of climate. These findings were reported on at an international conference sponsored by the International Union for Geodesy and Geophysics (IUGG) in Seattle, USA, in August.

Several test runs of a multi-level quasi-geostrophic forecasting model developed at the Swedish Meteorological and Hydrological Institute were carried out. The model has been shown to give reasonable results for a period up to 48 hours.

In the computer unit, research was concentrated on the development of an automatic data extraction system and on the development of a numerical weather prediction model. At Valentia Observatory, the project for the measurement of surface atmospheric ozone was held up due to lack of equipment.

In the Climatological Division a research project on the annual cycle of rainfall was completed, and material for a proposed technical note on the subject was prepared. Work on the preparation of a "Test-Reference Year" reached the concluding stages, and a summary final draft report was submitted to the E.E.C. In the course of this project an updated magnetic tape containing solar radiation data for Irish stations was prepared. The Service participated in the preparation of the final report of the WMO working group on "Climatic Fluctuations and Man".

In the Agricultural Meteorology Unit, a study was continued on the effects of weather on the apple crop.

Other research included a continuing investigation of historical Irish weather records, a study of heavy rainfall at Dublin Airport and a study of winds and weather at the Kish lighthouse.

Liaison with other organisations

- (i) Officers of the Service participated during the year in the work of a number of committees concerned with research and development e.g. the National Science Council's advisory committee on marine science, the N.S.C.'s energy research and development committee, the N.S.C.'s working group on wave power, the N.S.C.'s air pollution contact group, the water resources divisions advisory committee of An Foras Forbartha, the inter-departmental working group on off-shore pollution and the E.E.C. solar radiation data acquisition group.

- (ii) The Service co-operated, by exchanging data and information during the year, with some thirty-five research institutes abroad.

TRAINING COURSES

The following courses in meteorology were conducted at the Training School at Rosslare and/or at Casement Aerodrome:

- A course for meteorologists
- An observing course for military air traffic controllers
- A course for Air Corps Cadets to Commercial Pilot Licence level
- A specialised course for helicopter pilots

Mr. R.G. Kavanagh, Meteorological Systems Analyst, undertook a macro assembly programming course with the Digital Equipment Corporation in December.

THE LIBRARY

The transfer of the headquarters library in 1976 to its present temporary quarters in 55 Upper O'Connell Street, Dublin was its second move in a short period. The main task facing the library staff during 1977 was to sort the library stocks before a third move to the new building in Glasnevin.

The position at the end of 1977 was that most of the books and journals had been sorted and shelved, binding of periodicals (more than 400 volumes) had been brought up to date, most of the loan records had been put in order and work was continuing on a stocktaking of items held at headquarters and on permanent loan at stations throughout the country.

It was decided that the old cataloguing system was inadequate. Work began on the new catalogue, which will be on small (5" x 3") cards, with a subject index arranged according to the Universal Decimal Classification (U.D.C.) - the system adopted by meteorological libraries throughout the world. To ease the task of recataloguing and to allow for adequate cross-references the library acquired a card duplicator which prints multiple copies of cards from stencils.

The present tendency is for libraries to complement each other and share their resources. The Meteorological Service library, whose primary function is to supply the needs of the Service, continues to co-operate with other Irish libraries in inter-library loans and in offering reading facilities to research workers from outside.

INTERNATIONAL CO-OPERATION

Three meetings of the Council of the European Centre for Medium-range Weather Forecasts (ECMWF) which were held during the year were attended by the Director. Dr. Bates served on the Centre's scientific advisory committee during the year and also gave a series of lectures at the Centre's annual seminar in September.

Italy ratified the ECMWF Convention and took over the responsibilities of a full member from 1st September.

Two meetings of the NAOS Board which administers the Agreement on North Atlantic Ocean Stations (NAOS) were held during the year. The Service was represented at both meetings.

The Service was represented at a number of meetings of COST (European Co-operation in Science and Technology) which led to the agreement for the setting up of a network of automatic ocean stations which is reported on under Marine Meteorology. A meeting of a COST technical committee on meteorology was also attended. A joint Assembly of two associations of the International Union for Geodesy and Geophysics (I.U.G.G.) in Seattle in August-September was attended by the Director.

Other international meetings in which the Service participated during the year included the following:

- (1) Meetings of the E.E.C. Solar Data Acquisitions Group at Brussels (February), Rome (June) and Carpentras (October)
- (2) A meeting on air standards organised by the E.E.C. Health and Safety Directorate at Luxembourg (February)
- (3) An E.E.C. meeting on remote sensing of earth resources in Milan (February)
- (4) A seminar on weather and offshore operations in London (March)

- (5) A meeting of the European Advisory Group on the use of satellite meteorological data at Lannion (March)
- (6) An informal conference of Directors of European meteorological services at Palma (April)
- (7) A meeting of the codes working group of the Commission for Basic Systems of the W.M.O. at Geneva (April)
- (8) The seventh session of the W.M.O. Commission for Instruments and Methods of Observation (CI MO) at Hamburg (July/August)
- (9) A meeting sponsored by the Royal Meteorological Society on plants and the atmosphere at Lancaster (July)
- (10) An ECMWF seminar in Reading (September)
- (11) A meeting on the long-range transmission of air pollution in Europe, organised by the E.C.E., in Geneva (September)
- (12) A meeting of the Hydrology working group of the WMO Regional Association for Europe in Brussels (September)
- (13) A meeting of the North Sea meteorological panel at de Bilt (September)
- (14) A joint FAO/WMO meeting on the economic benefits of agricultural meteorology in Rome (October)

APPENDIX APublications by members of the staff(a) Meteorological Service Publications

- (1) Climatological Note No. 5 - "Monthly and Annual Rainfall Averages, 1941-70" - H.B. Doherty and J.J. Logue
- (2) Technical Note No. 42 - "Chemical Analysis of Precipitation in Ireland, 1966-75" - R.O. Mathews and F. McCaffrey
- (3) Agrometeorological Memorandum No. 7 - "Earth Temperatures in Ireland" - D.L. Fitzgerald

(b) Other Publications

- Bates, J.R.
- Dynamics of stationary ultra-long waves in middle latitudes - Quarterly Journal of the Royal Meteorological Society, July, 1977
 - On the application of the Arakawa-Schubert convective parameterisation scheme (with A.M. Lasheen and A.F. Hanna) - Report of the eleventh Technical Conference on Hurricanes and Tropical Meteorology, American Meteorological Society
 - Stratospheric influence on heat transfer by ultra-long stationary waves in the Troposphere - Mechanism for climate change - (Abstract), EOS, Transactions of the American Geophysical Union, Vol. 58, No. 8
 - Parameterization of convective processes - Report of the 1977 Seminar of the European Centre for Medium-range Weather Forecasts

- Bourke, P.M.A. - Meteorology and hydrology in aid of food production - Scientific lectures presented at the seventh World Meteorological Congress, WMO publication No. 435
- Apologia for a dead civil servant: Part 1, Trevelyan in the service of Peel - Irish Times 5 May, 1977
Part 2, Trevelyan in the service of Russell - Irish Times 6 May, 1977
- The Irish grain trade, 1839-48 - Irish Historical Studies, XX, 78, pp. 156-69
- The atmosphere - chapter 2 of book on Irish resources and land use (In the press)
- Keane, T. - Meteorology, its role, development and study - The Geographical Viewpoint (Dublin) Vol. 6
- Murphy, E. - Review of "The Climate of the British Isles" (edited by Chandler and Gregory) - September, 1977 issue of Technology Ireland
- Shields, Mrs.A.L. - Mediaeval manuscripts in French and Provençal in 'French texts in the Library of Trinity College Dublin' - Hermathena: a Dublin University Review, Vol. 121.

APPENDIX BA selection of Lectures given by members of the staff during the yearP.M.A. Bourke

Wynn's Hotel, Dublin: Lecture on "The great famine, weather and potato blight" to Mount Sion's Past Pupils Union (Dublin)(February 2).

R.D.S. Dublin: Presidential address to the Annual General Meeting of the Society of Irish Plant Pathologists - 'A year in Chile on Technical Assistance' (March 10).

Historical seminar in T.C.D., 'The biological cause of the great Irish famine' (May 15).

J.R. Bates

UCD Mathematical Society: Lecture on "Dynamics of Planetary-scale Standing Waves in the Atmosphere" (January 28).

Irish Mechanics Group, UCD: Two lectures on Geophysical Fluid Dynamics (February 25-26).

New University of Ulster, Coleraine: Lecture on "Dynamics of Planetary Waves in the Atmosphere" (May 25).

University of Washington, Seattle: Lecture on "Stratospheric influence on heat transfer by ultra-long stationary waves in the troposphere - a mechanism for climate change" (August 29).

European Centre for Medium Range Weather Forecasts: Seven lectures on "Parameterization of Convective Processes"(September 5-16).

Royal Meteorological Society, London: Lecture on "Dynamics of Stationary Ultra-long Waves in middle latitudes" (October 19).

Venice: Lecture on "The Influence of Extensive Mountain Complexes on the Global Circulation of the Atmosphere" (October 24).

Dept. of Computer Science, T.C.D.: Lecture on "Computer Modelling in Meteorology" (December 1).

L.S. Leach

Sligo: Lecture on "The Climate of Ireland" to the northwestern Regional Science Council Sligo (November 10).

J.A. Woods

National Institute for Higher Education: Lecture on "Vertical extrapolation from surface weather observations over the North Atlantic Ocean" (October).

