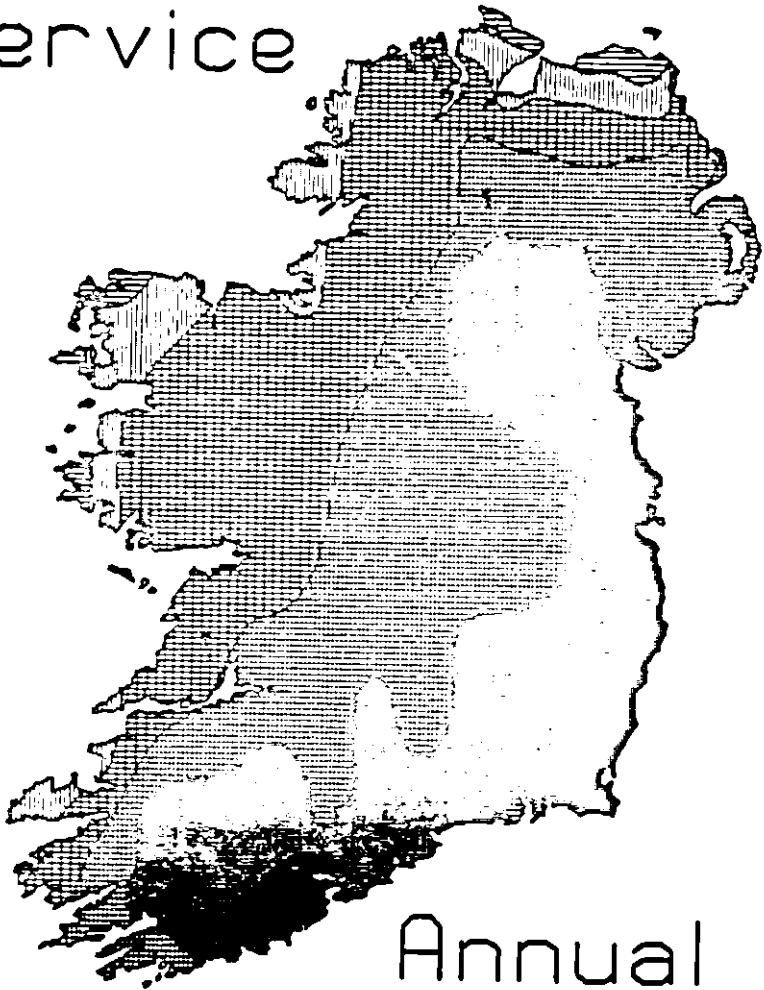


Meteorological Service



Annual
Report
1984

Department of Communications

Meteorological Service
Annual Report
1984

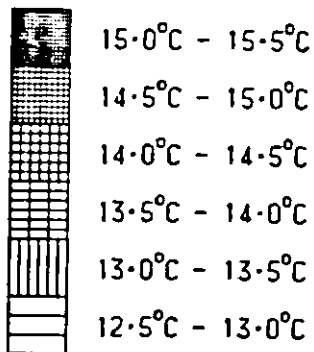
Meteorological Service
Glasnevin Hill, Dublin 9

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Front Cover : Mean air temperature - reduced to mean sea level - for the month of June 1984.

Legend



FOREWORD

It is encouraging to note, in this Report, the many examples of progress in adapting procedures and equipment to the increasing demands on our Service. It is a tribute to staff that this has been possible despite the reduction in the number of personnel. However, there have been severe difficulties in some areas, and it has not always been possible to provide as good a service as we would wish. These problems have resulted more from the loss of senior posts than actual numbers. If the Meteorological Service is to maintain its tradition of serving the public and to develop its potential in the field of general economic progress, it will be necessary to implement a structure in which staff can have job satisfaction and reasonable prospects of promotion.

The best known work of the Meteorological Service is the provision of forecasts to the public at large. The voices and faces of forecasters who are engaged in these duties are well known to many. They are stationed in the Central Analysis and Forecast Office which is our major operational centre. A short history of this Office and a description of its work is given in the article on page 1.

D.L. Linehan
Director

Meteorological Service

Dublin

April 1986

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FUNCTIONS OF THE METEOROLOGICAL SERVICE

The functions of the Meteorological Service may be summarised as follows:-

- (i) The collection, analysis and publication of meteorological, geophysical and geochemical data;
- (ii) Research in fundamental and applied meteorology;
- (iii) The supply of weather forecasts, statistical information and scientific advice on meteorological matters to agricultural, industrial and public utility undertakings, the press, radio and television, maritime interests, and the general public;
- (iv) The supply of similar information to Government Departments, Semi-State Bodies and the Defence Forces;
- (v) The provision of meteorological facilities for civil airlines and general aviation interests operating to and from airports in Ireland and/or flying over Irish territory, and the supply of general advice on the meteorological aspects of civil aviation.
- (vi) Cooperation with the Meteorological Services of other countries on matters related to meteorology and the representation of Ireland at international conferences.

THE CENTRAL ANALYSIS AND FORECAST OFFICE

1. Foundation

The Meteorological Service was established in 1936 mainly in response to the needs of civil aviation, and for the first twenty-five years of its existence all forecasting operations were centred at the airports. In the post war period, as requests for weather information from other sectors began to increase, it became clear that there was a need for a new structure. Accordingly, the Central Analysis and Forecast Office (CAFO) was established to cater for all non-aviation forecasting and to provide centralized guidance on surface weather to the airport offices.

CAFO began operations in March 1961 from an office at 44, Upper O'Connell St. in Dublin. Its original staff complement of six forecasters and eleven meteorological officers were drawn almost equally from the Shannon and Dublin Airport Meteorological Offices.

2. Evolution

The work of CAFO expanded rapidly. Within a year of opening, with the advent of television in Ireland in January 1962, the CAFO forecasters appeared before the cameras, at first only five days a week, but very soon on a daily basis. The severe winter 1962-63 led to the introduction of snow and frost warning services for many County Councils and Urban Corporations throughout the country and weather charts were provided for Irish daily newspapers for the first time in 1964. In addition, a request forecast service for international shipping in or near Irish coastal waters was initiated through Malin Head and Valentia coastal radio stations in 1966. Cross-channel ferries and Irish fishing fleets had become customers long before.

During the early years, perhaps because of increased media exposure, the number of casual telephone enquiries from the general public, especially in the Dublin Area, increased rapidly. To cope with this demand, the '1199' recorded forecast was developed in cooperation with

the Department of Posts and Telegraphs in 1967. It proved very popular and quickly achieved an annual usage of over half a million calls.

Direct Radio broadcasting of forecasts from CAFO began in 1968, providing twice daily Regional and Sea Area Forecasts. Towards the end of that year, CAFO received its first satellite pictures, the signals being relayed by land line from the Shannon Airport antenna.

The early 1970's proved to be a period of consolidation for CAFO, during which forecast services to the Defence Forces and Radio na Gaeltachta, among others, were organised on a regular basis. The second half of the decade saw the introduction of extended marine forecasts for off-shore oil exploration.

The use of computers for weather analysis and forecasting had begun in the United States in the 1950s and the new technology was gradually spreading to the smaller countries. In 1977 the Meteorological Service acquired its first computer system, which was used for communications, followed three years later by a mainframe computer which allowed the Service to begin operational numerical weather prediction. At around the same time, the European Centre for Medium Range Weather Forecasts (ECMWF) was established, with Ireland as a Member State. The Centre was equipped with the world's most powerful computer, a CRAY-1, and its goal was to forecast for up to ten days ahead using a global mathematical model. These developments greatly influenced the work of CAFO, allowing it to provide more accurate forecasts in the short range and for the first time, to give reliable guidance for several days ahead.

In 1979 the new Meteorological Service Headquarters in Glasnevin was completed and CAFO was assigned the top floor. The new location provided much needed additional space and a variety of new technological aids were introduced into CAFO. Automatic plotting machines were installed, making it possible to produce Upper Air analyses and atmospheric soundings centrally, and to relay them to the Airports, thus eliminating much of the duplication of efforts that had

been occurring. The new premises were also fitted with the necessary antennae for receiving signals directly from the weather satellites.

3. Operational Procedure

CAFO currently has a staff of twelve meteorologists, six senior meteorological officers and twenty-three meteorological officers.

The standard forecast issued covers a period of 24 hours ahead, with an additional outlook to 48 hours. Its preparation involves the regular and careful study of current atmospheric conditions over an area stretching from the Urals in Russia westwards over Europe, the Atlantic, and North America as far as the Rockies, between latitudes 80°N and 30°N. The great bulk of the necessary information is available on the Global Telecommunication System (GTS) of the World Meteorological Organisation and comes to Ireland from Bracknell in the United Kingdom, which is linked directly to the Communications Computers in CAFO. The computers process the data, which is then displayed on automatically plotted synoptic weather charts. Visual pictures and infrared images of cloud cover are obtained from the polar orbiting U.S. NOAA satellites and the geostationary METEOSAT launched by the European Space Agency. Of crucial importance in the early stages of the work are the hourly reports from the fifteen Irish observing stations, atmospheric soundings and upper level wind profiles from Valentia Observatory, echoes from Dublin and Shannon Airport weather radars, and reports from lighthouses, ships and oil rigs in Irish coastal waters.

4. Output

(a) Warning Service

In some respects perhaps the most important service supplied by CAFO is that of issuing WARNINGS to those at risk from hazardous weather conditions. Gales and storms on our coastal waters are the commonest of these. Extreme rainfall (liable to cause flooding or other damage), fire risk to forests (in times of drought and high temperatures), thunderstorms, and frost or snowfall (likely to cause hazardous driving conditions) are also notified in advance to relevant

authorities. CAFO forecasters work closely with the Agricultural Meteorology Unit to warn farmers and horticulturalists when weather related diseases or pests threaten crops. Suitable warnings are provided also, on a fee basis, to private industrial or commercial concerns vulnerable to particular weather elements.

(b) Public Forecasts

The most extensive part of CAFO's work is the provision of FORECASTS, especially through the media. The number of regular daily forecasts has increased many times over since 1961 and they are disseminated in the following ways:

(I) Radio

Four comprehensive forecasts for Irish land areas and coastal waters are broadcast daily by the duty forecaster direct from CAFO's Radio Room. These are supplemented by a series of abbreviated forecasts, issued approximately every three hours, and broadcast regularly with news bulletins on RTE Radio Channels 1 and 2. There are further issues to Radio na Gaeltachta, News at One-Thirty, An Nuacht, Cork Local Radio and occasionally to RTE local Community Radios.

(II) Television

Daily presentation of the forecast, usually in association with the main evening news bulletin, has continued since 1962, interrupted only on occasions when RTE itself was unable to broadcast. During the period of the Olympics Games in July-August an experimental morning presentation was made each day, while interview type weekend forecasts on Friday afternoons commenced in October.

(III) Newspapers

A general text of the standard forecast is available to all daily and Sunday papers. Some of these obtain and publish copies of the forecast charts on a regular basis, with specially adapted versions of the text, while many of the weekly journals are supplied with forecasts for a week ahead.

(iv) Automatic Telephone Weather Services

The '1199' Service consists of an eighteen hour forecast for the greater Dublin Area, and Dublin Bay. Recorded at six hourly intervals as a routine, it can be changed more frequently if necessary.

A service for Leinster, Cavan and Monaghan began in 1981. It includes an outlook for about five days and is aimed principally towards the agricultural community. It is becoming increasingly popular and handled over one hundred thousand calls in 1984. It, too, is normally recorded every six hours but can be amended whenever considered desirable.

(v) Videotex

CAFO has already had experience of this modern form of information transfer technology, having acted as information provider to pilot projects from time to time in recent years. Further involvement is anticipated in the near future.

(c) Specialised Services

(I) Enquiries

An appreciable amount of staff time is occupied with enquiries from journalists, discussing current and future weather with them. Forecasters are often the source of weather stories in the media. They are frequently interviewed on radio and television when unusual weather events occur, or on special occasions.

(II) Individual Requests

Direct contact with the forecasters is sought by means of personal telephone calls by many people for whom ATWS does not cater adequately. Among the important groups in this category are farmers in North Connacht and Donegal, marine transport companies, and travelling holidaymakers.

(III) Special Forecasts

Forecasts are prepared on request for a variety of different interests including engineering and construction companies, agribusiness firms, fish processing firms, film companies, hotels,

tourist offices, foreign broadcasting stations, fruit growers, sporting or competitive events, conferences and many others. Special temperature forecasts are made daily for the major utilities, ESB and Dublin Gas, to help them determine their optimum production levels. Off-shore oil exploration is aided with forecasts for 72 hours ahead, which include details of sea and swell conditions at the drilling sites. The Marine Unit works closely with CAFO in this program.

5 Communications

For maximum value, weather observations must be exchanged at the greatest possible speed, and because of the large volume of reports involved, the task can only be handled properly by computers. CAFO employs two DEC 11/40's for the purpose. These automatically interrogate the Irish observing stations every hour and quality control the reports, alerting the operators to any errors, before inserting the bulletins into the GTS for the use of other countries. Simultaneously the International data required by CAFO is received on medium speed circuits, and the computers also control the stream of half hourly reports and landing forecasts from Irish and overseas airports. Weather information in chart form is received from the Regional Meteorological Centre at Bracknell by facsimile link, while radio reception of the facsimile broadcasts from Offenbach, Paris and Bracknell is possible, as a back up, in emergencies.

Internally, within the Meteorological Service, similar arrangements apply. CAFO transmits analysed and forecast charts to the Airport Meteorological Offices on facsimile, while they in their turn can access the mainframe computer directly on dedicated lines for other non-standard meteorological information.

Telex is, of course, the basic outlet channel for forecasts and warnings, but charts are sent to some newspapers by telecopier, and oil rig forecasts are occasionally transmitted via MARISAT.

6 Future Developments

Advances in the science of meteorology and in modern technology continue to have a positive impact on the accuracy of forecasts and

demand for the Improved products which CAFO produces continues to expand. In the near future it is hoped to augment the work programme of CAFO in the following ways:

- (a) Complete the nationwide ATWS network by extending the service to North Connacht and Donegal, with the forecast message remotely input by CAFO on recording equipment suitably located in that area.
- (b) Introduce a three-hourly forecast for Irish coastal waters broadcast on VHF through the marine coastal radio stations.
- (c) Upgrade the regular daily TV weather presentation, and the Friday afternoon TV weekend weather outlook, using new electronic graphics systems.
- (d) Introduce a new weekly TV forecast presentation for the Agricultural community.
- (e) Cooperate with ACOT and AFT in a Videotex forecast and climate data service for farmers in particular areas of Leinster and Munster.
- (f) Provide suitable radio forecasts for some other special interest groups by arrangement with RTE.
- (g) Replace the ageing Communications Computers with their up-to-date counterparts.
- (h) Install a new generation satellite reception system.

If these plans are successfully implemented, we can look forward to a further improved service from CAFO to the public in the years ahead.

THE WEATHER OF 1984

The year was notable for the exceptionally dry spring and summer. At Malin Head the period March to August was the driest this century. However, heavy rainfall in January and November brought the annual total to near normal in most places.

Mean annual air temperatures ranged from normal to 0.5 degrees Celsius above normal. Record high temperatures for April were registered in the western half of the country. A value of 24.0 degrees Celsius recorded at Cahirciveen on 23rd April was the highest April temperature there since records commenced in 1892. Glenties, Co. Donegal, recorded 25.8 degrees Celsius on 26th April, which was the highest April temperature ever recorded in Ireland. It was the warmest summer in Rosslare since records began there in 1957.

Sunshine was below normal in the southwest, west and north and above normal in the south and east. May was the sunniest month with over 200 hours of sunshine at most locations. February and March were notably dull. It was the dulliest March at Birr since records began in 1881 (53% of normal).

Gales were particularly frequent in January when the highest gust of the year (90 knots) was recorded at Belmullet.

A climatological summary of conditions at the Meteorological Service's 15 Synoptic Reporting Stations during 1984 is given in Table 1.

METEOROLOGICAL SERVICE
 WEATHER SUMMARY FOR Year 1984

STATION	RAINFALL (mm)				AIR TEMPERATURE (°C)							SUNSHINE DURATION (hr)			
	Total Fall	Rain-days*	Most in a day		Means of		Annual mean	Extreme Temperature				Annual Total	Daily Mean	Most in a day	
			Amount	Date	Max.	Min.		Highest	Date	Lowest	Date			Amount	Date
Belmullet	1242.1	236	34.2	24th Oct.	13.0	6.6	9.8	26.4	20th Aug.	-2.5	17th Mar.	1241.9	3.39	14.0	12th May
Birr	807.2	185	42.2	2nd Aug.	13.7	5.6	9.7	26.6	8th July	-7.7	20th Jan.	1222.8	3.34	14.1	13th May
Cahiriveen	1514.4	230	63.5	29th Nov.	13.8	7.2	10.5	25.8	20th July	-2.8	28th Feb.	1261.8	3.45	15.0	30th June 1st July
Casement Aerodrome	690.5	168	42.9	14th Dec.	13.6	5.6	9.6	27.1	19th Aug.	-7.6	20th Jan.	1398.0	3.82	14.4	28th May 22nd July
Claremorris	1044.3	206	25.4	23rd Mar.	13.2	5.1	9.2	26.5	20th Aug.	-7.5	20th Jan.	1059.3	2.89	14.2	28th May
Clones	962.5	198	33.5	23rd Mar.	13.0	5.4	9.2	25.9	20th Aug.	-10.0	20th Jan.	1246.2	3.40	15.0	28th May
Cork Airport	1088.3	190	35.4	11th Nov.	13.1	6.5	9.8	25.5	27th July	-2.5	19th Jan.	1493.4	4.08	15.4	30th June
Dublin Airport	761.3	175	28.2	14th Dec.	13.3	6.6	10.0	26.0	6th July	-3.7	19th Jan.	1532.5	4.19	14.3	13th & 14th May
Galway	1112.5	200	42.1	3rd Sept.	13.5	6.5	10.0	26.4	20th Aug.	-4.7	20th Jan.	1364.6	3.73	15.0	22nd July
Kilkenny	811.6	197	29.9	23rd Mar.	14.2	5.6	9.9	27.8	20th Aug.	-6.1	20th Jan.	1397.5	3.82	14.2	30th June
Malin Head	1020.3	230	31.9	24th Oct.	11.9	7.0	9.5	24.0	21st Aug.	-2.9	20th Jan.	1195.0	3.27	15.1	7th June
Millingar	991.8	197	54.1	14th Dec.	13.0	5.2	9.1	25.6	20th Aug.	-7.1	20th Jan.	1353.0	3.70	14.7	22nd July
Roche's Point	874.7	165	27.1	26th Jan.	13.4	7.8	10.6	24.6	27th July	-0.1	19th Jan.	1565.7	4.28	14.9	9th June
Rosslare	783.7	159	31.9	11th Nov.	13.1	7.8	10.5	23.1	27th July	-0.4	15 Jan 26 Dec	1715.3	4.69	14.9	8th June
Shannon Airport	904.1	192	25.6	12th Jan.	14.1	7.1	10.6	26.5	24th July	-3.8	20th Jan.	1264.0	3.45	15.3	8th June

* = Days with 0.2 mm or more

TABLE 1

OBSERVING PROGRAMME

Surface Observations

The network of Synoptic Reporting Stations continued unchanged throughout 1984. 15 stations operated continuously during the year, each manned throughout the 24 hours by Meteorological Service personnel. Their locations and dates of establishment are shown in Figure 1.

These stations provide hourly reports of wind, temperature, pressure humidity and cloud, and details of the weather currently being experienced at the station. Their reports are distributed both nationally and internationally using an internationally recognised Synoptic Code, and are used for operational weather forecasting, as well as climatological purposes. Many of the stations are also involved in specialised observing programmes, details of which will be found in sections of the Annual Report dealing with particular aspects of Meteorology.

The network of Synoptic Reporting Stations was supplemented by returns of climatological data from a network of Climatological and Rainfall Stations. On 31st December 1984 753 stations were reporting rainfall data, and of these 85 were full Climatological Stations.

The locations of the more important elements of this auxiliary network are shown in Figure 4. (P.27). Weather data were also received from ships of the Irish Naval Service, from cross channel and merchant ships, and from a number of drifting buoys in the Atlantic.

The Service has not yet become involved in the use of Automatic Weather Stations for the acquisition of synoptic reports in real time, but it is hoped to acquire prototypes of such equipment in the next few years with a view to exploring ways in which the existing synoptic network might ultimately be augmented or partially replaced. In common with most other Services however, the Meteorological Service feels that the technology is not yet sufficiently developed to contemplate radical developments in the foreseeable future.

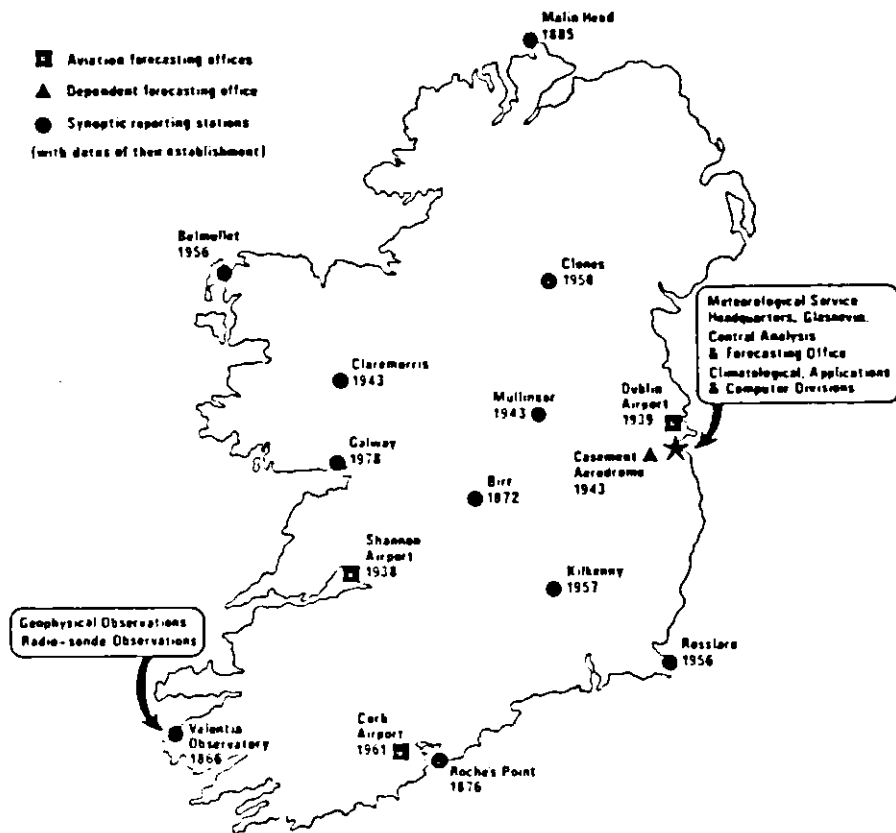


Figure 1. Synoptic Reporting Stations and Dates of their Establishment

During U.S. President Reagan's visit to Ballyporeen, Co. Tipperary and Ashford Castle, in June, an observer was located on site, and provided observations as required by the Air Traffic Control authorities, while also liaising with the Meteorological Office at Shannon Airport.

Upper Air Observations

At Valentia Observatory, upper air observations of pressure, temperature and humidity by radio-sonde were continued during the year. The routine procedure of two ascents per day at 1200 and 2400 G.M.T. was maintained. All ascents were satisfactorily completed to schedule.

Repeat ascents were necessary on 42 occasions out of a total of 732 (5.7%). In general the repeats were required because of failure to reach the minimum acceptable height (200 hPa, or 12000 m.) because of instrument failure, early balloon burst, or some such inopportune occurrence. R/S20 sondes were flown on midday ascents during January and February, and on all ascents from 21st May.

Totex TA77 800grm and CR 500grm balloons were generally used for radio-sonde ascents, while CR 500grm and CR 350 balloons were used for radar wind observations. The three types proved satisfactory.

The hydrogen generating equipment at Valentia gave satisfactory service during the year, although it continues to require a high level of routine maintenance.

Geophysical Observations at Valentia

The general organisation of the station remained the same. A full summary of the station's operations, with photographs showing the general layout, instruments enclosure, observing huts and recording huts etc. can be found in the pamphlet "Valentia Observatory" published by the Meteorological Service.

Geomagnetism

No changes were made in observing procedure during the year.

Instruments used for base-line data were:

Declination - Ruska Observatory Magnetometer
Total Force - Proton Precession Magnetometer
Horizontal Force - Proton Vector Magnetometer
Vertical Force - Proton Vector Magnetometer

The two sets of La Cour Variometers with Quick-Run and Standard recorders continued to operate satisfactorily. Microfilming of the standard magnetograms for Valentia continued at WDC CI, Copenhagen. All the normal magnetograms since the beginning of the IGY in 1957 up to the end of December 1983 have now been microfilmed.

Seismology

Continuous recordings of the components of seismic activity were maintained using the WSSN short-period and long-period instruments. Regular preventive maintenance resulted in satisfactory continuous operations, only minor electric failures in the timing system being encountered. Preliminary reports of seismic activity were sent to the U.S. Geological Survey, Denver, Colorado, while original seismograms were sent for microfilming on a monthly basis. Data in respect of each earthquake recorded were supplied on data sheets to the International Seismological Centre, Newbury, England.

Thirteen enquiries involving copies of seismograms were handled during the year.

Solar Radiation

Measurements of Global and Diffuse Radiation on a horizontal surface were continued using Kipp and Zonen pyranometers in conjunction with Lintronic Integrators and Print-out Units.

Measurements of Direct Sun Radiation at normal incidence were made using an Eppley Pyrheliometer and Solar Tracker and electronic Integrator, while Infra-red radiation was monitored using an Eppley Infra-red Radiometer and electronic Integrator. Radiation balance was

also continuously recorded using a Funk pattern CSIRO Net Radiometer driving a Honeywell Potentiometric Recorder with off-set zero to accommodate negative net radiation values.

Measurements of total radiation on a south-facing vertical surface, shielded from ground reflected radiation and measurement of ground reflected radiation were continued.

Thrice-daily observations of Direct Sun Radiation were made, when sky conditions permitted, with the Linke-Feussner Actinometer fitted with OG1, RG2 and RG8 filters for spectral band measurements. The measurements with filters facilitated the computation of Angstrom's turbidity co-efficient "B". Routine turbidity measurements were made with the Volz Sun Photometer with transmission bands in the Green, Red and Blue.

All recording equipment was calibrated against the Linke-Feussner Actinometer which in turn was calibrated against the Angstrom Pyrheliometer which is maintained as the National Standard and which is compared regularly with other National Standards at the WMO International and Regional Comparisons. A Comparison was held in Courpentras, France, from 5-19 June 1934.

Global and Diffuse Radiation measurements from Dublin Airport, Birr, Kilkenny, Clones and Malin Head and Global measurements from Belmullet continued and were supervised from Valentia.

FORECASTING SERVICES

The main analysis and forecasting work of the Service was continued at the Central Analysis and Forecast Office (CAFO) during the year, with supplementary analysis for aviation and local forecasting purposes being performed at Dublin, Shannon and Cork Airports. The surface analysis is done manually by the forecaster, while upper air analysis are processed automatically by the computer. Numerical predictions for 24 hrs. and 36 hrs. at surface and 500 mb. levels produced by the Service's own computer are available to the forecaster twice daily in real time, as an aid to the preparation of the forecasts. In addition European Centre for Medium Range Weather Forecasts (ECMWF) products, and U.S. National Weather Service numerical products are received at the forecasting offices. They cover periods up to seven days ahead, and are valuable additional aids to the forecaster. Forecast products, received in digitised form and displayed on a VDU, with hard-copy option, are also available from the U.K. Meteorological Office for up to five days ahead.

Charts are produced in CAFO using two off-line Calcomp Plotters. Data may also be called up on the digital GIGI Video Display Unit in CAFO, and hard-copy obtained if desired. Exchange of graphic data throughout the Service still relies largely on analogue facsimile at present, but has been supplemented recently by the installation of a GIGI unit at Shannon Airport. It is proposed to extend the use of computerised methods for the transmission of graphic data over the coming years. Towards the end of the year, radar pictures from Shannon became available in real time, displayed on a Jasin Video Display Unit.

General Forecasts

The Automatic Telephone Weather Service (ATWS) operated by the Meteorological Service continued to be remarkably popular during 1984. The total number of enquiries on all systems increased by 19%, from 915,340 in 1983 to 1,090,892 in 1984. On 1st May the South Connaught Area was included with the North Munster Area on the Shannon

NON-AVIATION REQUESTS FOR FORECASTS BY TELEPHONE

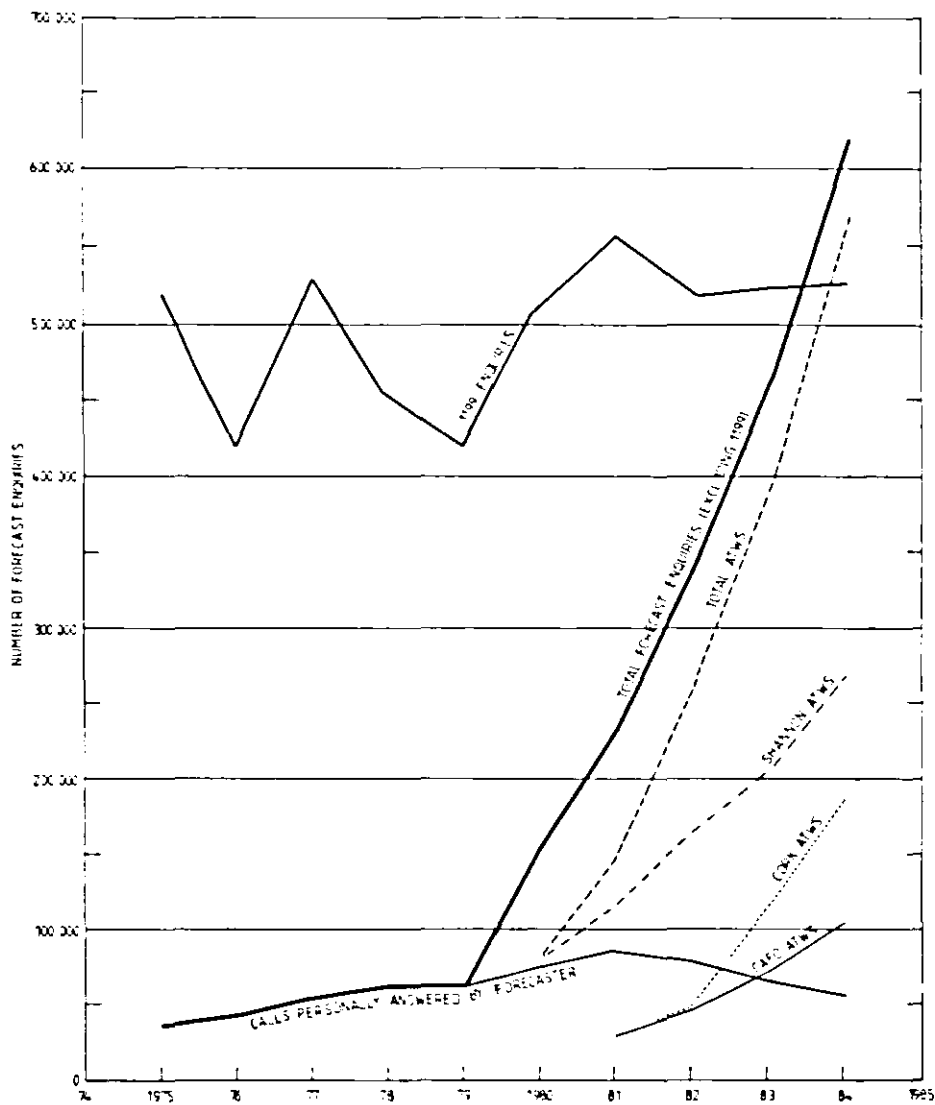


Figure 2.

ATWS, bringing another substantial area of the country into the system. Details of the individual elements of the system are given in Table III, while the overall performance of the system over the past ten years is shown in Figure 2.

The 1199 (Dublin Area) system is operated by Telecom Eireann, while the other systems are operated independently by the Meteorological Service. It is noteworthy that demand for the former has been more or less constant in recent years, whereas the use of the Meteorological Service systems has been increasing dramatically, a fact which suggests that there is considerable scope for providing service to a wider public on the Dublin Area system. Negotiations are at present in train with Telecom Eireann with a view to cooperation in providing wider availability and an increased range of facilities on the ATWS system as a whole.

All the ATWS forecasts are prepared with the farming community very much in mind and give a forecast for 24 hours with an outlook for the following days. 1199 provides a short term forecast, and in addition to the general public, caters for those interested in sailing in the Dublin Bay area. The whole country, except North Connaught and West Ulster, is now covered by ATWS.

As in previous years the demand for the ATWS facility was found to be strongly weather-dependent, and to have a marked seasonal variation. Changeable weather conditions, or weather of unusual severity results in an increase in the number of calls, while fewer demands are made in periods of settled weather. Also, demand generally increases during the summer months, due mainly to an increase in farming activity, as is illustrated in Figure 3 which shows the number of calls registered each month during 1984 on the Shannon ATWS.

The ATWS systems are intended to reduce and ultimately to eliminate the demands made on the forecaster for routine weather information, thereby allowing him to concentrate on more detailed analysis of the synoptic situation, and to give closer attention to enquiries of a more specialised nature. Although the number of direct telephone enquiries, additional to ATWS calls, to the various forecasting

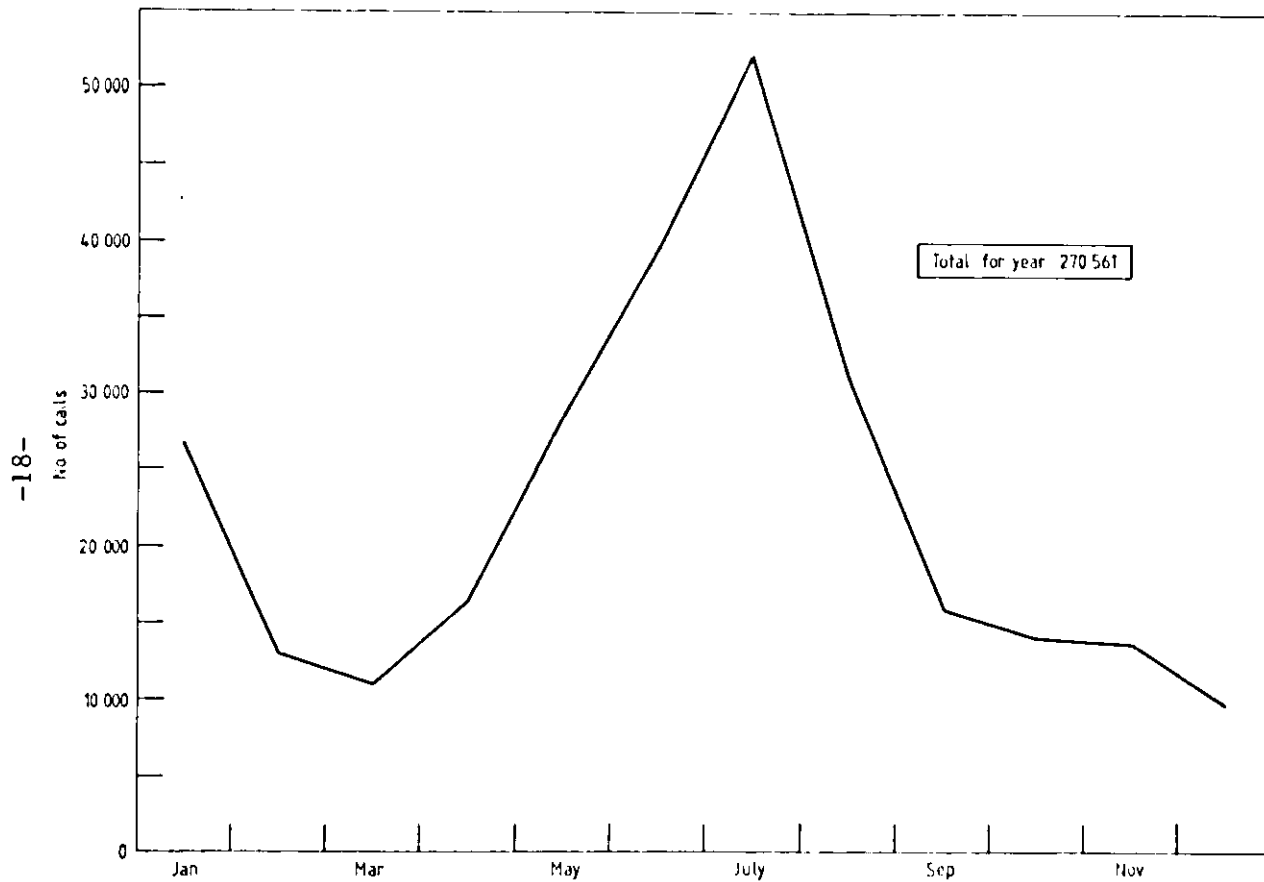


Figure 3: Calls during 1983 on Shannon Airport ATWS.

offices is still significant, the number is decreasing, as shown in Table III.

During 1984 forecasters from CAFO continued to make a daily personal presentation of the weather forecast on RTE television after the main news bulletin of the day. Four radio broadcasts were also made each day at 0755 (0745 from 5th November), 1204, 1802 and 2352 by the forecaster from the radio studio in CAFO. The daily broadcasts consist of a general forecast, a detailed sea area forecast, weather reports from coastal stations at Malin Head, Rosslare, Roche's Point, Valentia and Belmullet, and gale warnings when necessary. Radio interviews about unusual weather conditions were given by CAFO staff on eleven occasions during the year.

A special forecast was presented on RTE television twice each morning during the period from 30th July to 12th August when the television station broadcast special early morning programmes during the Olympic Games in Los Angeles. A special TV presentation of weekend weather prospects was also introduced on an experimental basis on RTE television from 5th October to 21st December. Present indications are that the coming years will see a big increase in the requirement for personal presentation of weather information on television by the forecaster.

Forecasts were issued to the national morning and evening newspapers, to the Sunday papers and to a number of weekly provincial newspapers. The number of specialised forecasts and warnings issued by special arrangement to individual commercial, industrial, marine, local authority and public utility interests continues to increase. A daily forecast or warning service is supplied to some thirty commercial concerns, as well as 25 local authorities, the Defence Forces, and the major public utilities.

Warnings of weather conditions suitable for the spread of potato blight were added to radio and television forecasts, when appropriate, between May and September. Special frost warnings for the fruit-growing areas of the southeast were also broadcast with the routine forecasts when necessary. A comprehensive forecasting and

Date of establishment	Responsible Mat. Office	Telephone No.	Area Served	Calls In		Increase %
				1983	1984	
1. 1967	CAFO	1199	Dublin Area	524,299	526,670	-
2. 1979	Shannon	(061)62677	North Munster and South Connaught	205,292	270,561	32%
3. 1981	CAFO	(061)425555	Leinster & Counties Cavan & Monaghan	71,173	105,263	48%
4. 1982	Cork	(021)964600	South Munster	114,576	188,388	64%
5. Planned	CAFO	-	West Ulster and North Connaught	-	-	-
TOTAL				915,340	1,090,832	19%

TABLE II: AUTOMATIC TELEPHONE WEATHER SERVICE

warning service to agricultural interests was provided during the year as detailed in the Chapter of this Report on "Agricultural Meteorology". 388 gale warnings for coastal waters of Ireland and the Irish Sea were issued by CAFO for broadcast on radio and television during 1984, accounting for a total of 2020 hours during which the wind was expected to be gale force or stronger. Advance notice of fire hazard conditions was issued to the Forestry Division to assist in anticipating the outbreak of forest fires, while CAFO was an information provider for the Patric Videotex system from January 1984 until the end of the year. Forecasts for 24 hours were entered on the system each morning.

During the Winter-Spring period the scheme for co-operation with the Automobile Association proved very useful. The AA receives special forecasts from the Meteorological Service and transmits them to their clients through their various regional centres. In return, the Meteorological Service receives reports on road conditions throughout the country, updated when necessary, which are very useful when dealing with enquiries from the public.

The Model Output Statistics (MOS) scheme, introduced in 1983 continued in use during 1984, to assist in the forecasting of daily maximum temperatures in Dublin for up to five days ahead. The programs are based on a software package developed at ECMWF and using correlations between climatological data for Dublin Airport and past ECMWF forecasts. The ECMWF model output is used to produce temperature forecasts which are then employed by the forecasters as an aid. Two sets of correlations are used, one for the summer and one for the winter.

Most of the services supplied by CAFO are provided free as a public service. Where, however, specialised forecasts are provided to commercial interests, they are supplied on a repayment basis. Income to the Meteorological Service from charges for forecasts supplied by CAFO on a repayment basis in 1984 (excluding those provided to offshore oil-exploration interests), amounted to IR£22,500.

Table III: Telephone Enquiries to the Forecaster

Originating Enquiries	Interests				TOTALS
	CAFO	Shannon	Cork	Dublin Airport	
Agriculture	15,472	1,988	118	111	17,689
Industrial & Commercial	3,521	991	185	42	4,739
Marine	7,944	1,378	60	21	9,403
Defence Forces	40	5	8	1	54
Other Government Departments	917	681	12	-	1,610
Press	613	19	20	4	656
Sporting	1,556	934	93	54	2,637
Private	13,785	3,061	861	309	18,016
Local Radio	-	-	259	-	259
Miscellaneous	-	-	218	17	235
TOTALS	43,848	9,075	1,834	559	55,298

Aviation Forecasts

Routine services to civil aviation were maintained at the three airports at Shannon, Dublin and Cork. At Dublin Airport some 29,300 flights were given full meteorological service before departure. Of these 23,365 were commercial aviation flights, while some 6,000 were general aviation or military air traffic. In addition some 9,000 telephone enquiries or requests for briefing were dealt with at the Airport from pilots of light aircraft, Air Traffic Control, airline personnel, etc.

At Shannon during 1984, there was a general increase in the volume of services provided for aviation operations compared with 1983, with a 15% increase in both flight documentation provided for commercial operations and services provided for general aviation and other organisations. Some 6,000 flights were supplied with documentation, with an additional 3,500 requests for aviation weather briefing. It was still necessary for the Shannon Office to provide considerable service for the helicopter operations out of Cork. At Cork Airport 2,068 commercial flights were supplied with documentation. 296 warnings of hazardous weather conditions for aviation, termed SIGMETS, were issued by the Meteorological Office, Shannon Airport which acts as the Meteorological Watch Office for the Shannon Flight Information Region. Local aerodrome warnings were also provided as necessary.

The supply of forecast winds and temperatures in grid point form to Aer Lingus for flight planning purposes continued, data being supplied twice-daily on a routine basis. These data are extracted from the output of the numerical weather prediction models and sent to Aer Lingus at Dublin Airport in digital form over a telephone line.

In addition to the routine needs of aviation, the usual selection of special events in the aviation world, such as gliding and hot-air balloon activities, the European Precision Flying Championships at Casement, and the Annual Air Spectacular at Fairyhouse, was catered for by means of detailed special forecasts as necessary. Forecasts were also provided for eleven airlines who operated crew training schedules at Shannon during the year.

The 24-hour service of forecasts provided to the Air Corps at the Meteorological Office at Casement Aerodrome was continued. Flight documentation and direct briefing were provided for basic and advanced flight training of Air Corps pilots for helicopter and fixed wing flights. The activities involved included search and rescue, air ambulance, national security, air exercises and national and international flights for transport of government ministers and officials. Briefing was provided locally during the hours of duty of the Casement forecaster, and otherwise by the Dublin Airport forecaster. Copies of orbiting satellite pictures relayed from CAFO were supplied to Maritime Squadron for Sea Fishery Patrol flight planning. The duration of flying activity as well as the number of flights were significantly increased during the year due to both improvements in landing aids and the increased number of available pilots.

New chart formats for commercial aviation, as specified under the new ICAO World Area Forecast System, were introduced throughout the Service on 1st February.

Work is in hand at present on planning the centralisation at one of the airports, of the aviation forecasting function with the proposed establishment of a Central Aviation Office (CAO). The precise location of the CAO had not been decided at the end of 1984, but it is envisaged that the ensuing rationalisation of aviation activities will release staff from that area for use in other Divisions of the Service. Use will be made of modern technological aids to provide a comprehensive self-briefing facility at those airports where forecasting staff are not deployed.

Expenditure on meteorological services supplied to Civil Aviation (but not military or general aviation) are recouped from the airlines by means of Route Charges collected through the agency of EUROCONTROL. Expenditure for recoupment under this arrangement was assessed at IR£2.6 million in 1984.

Marine Forecasting

During the Summer months, the Shannon and Cork Forecast offices

provided briefings and forecasts for helicopters servicing the oil-exploration Installations operating in Irish coastal waters. Forecasts for offshore oil activities were provided as before from CAFO with forecasts of wind, weather, waves and swell being made available on a routine basis at various times throughout the year for five companies engaged in offshore oil exploration.

Daily forecasts during the sailing season (June to August) were provided to 4 yacht clubs in the Dublin/Dun Laoghaire area, and the awareness of the value of meteorological services to marine interests was increasingly apparent from the level of interest in the forecasts made available.

CLIMATOLOGY

The Climatological Division continued its work of compiling and processing statistical information on the weather, and making it available in a form suitable for use by other branches of the Service and by outside agencies. A large volume of enquiries about past weather was received as usual from legal, commercial, industrial and other interests. Many of the queries from legal and insurance interests entailed attendance in court by Meteorological Service personnel. A total of 4993 enquiries was dealt with during the year, fees being charged for 588 of them. Receipts for 1984 from the supply of climatological information and professional services on a repayment basis, and the sale of climatological publications, amounted to some IR£13,000.

Part of the resources of the Climatological Division is directed towards the publication of the Monthly Weather Report (MWR) which provides for each month detailed tabulations of the various parameters available from locations throughout the country. The MWR is published in three separate parts viz,

Part I: "General Weather Report" which gives values of air and soil temperature, pressure, visibility and wind at a large number of stations around the country. The locations of these stations are given in Figure 4.

Part II: "Rainfall" which gives the rainfall for the month at some 750 rainfall stations, and

Part III: "Selected Data for Synoptic Stations", which gives detailed hourly values of the more important parameters at the Service's 15 Synoptic Reporting Stations.

During 1984 all parts of the Monthly Weather Reports from January 1983 to July 1984 were published, and monthly weather summaries and an Annual Summary for 1983 were supplied to the press. Current data for the synoptic, climatological and rainfall stations were keyed-in and



Figure 4. Climatological Stations

transferred to the main frame computer on a routine basis, and global and diffuse solar radiation data up to the end of 1983 were put on tape and quality controlled, as were Climatological Station data for the years 1966 to 1979.

Other work done by the Climatological Division during 1984 included:

- (I) the preparation of nine maps showing the variation of rainfall amounts over the country for specified durations and return periods,
- (II) the preparation of tables and maps for the publication of the 1951-80 sunshine and temperature averages.
- (III) the development of computer files and sorting programmes for data connected with enquiries.

A total of 657 Rainfall and Climatological stations were visited during the year. Sixty-seven new Rainfall Stations and nine new Climatological Stations were opened, while sixty-one Rainfall and Six Climatological Stations were closed. Consultations took place with local authorities throughout the country seeking cooperation in expanding the network of rainfall stations, and the response has been encouraging.

During 1984, the Climatological Division was represented at meetings of the Irish Committee of the International Hydrological Programme, the Solar Energy Society of Ireland, and the Agmet Group.

COMPUTER DEVELOPMENTS

Equipment

The Meteorological Service's computer system at its Headquarters in Glasnevin is based on a DEC-2050 mainframe computer (used for numerical weather prediction, graphics, climatological data processing, research projects and as the Service's general purpose computer), and two DEC PDP 11/40 minicomputers, (used mainly for meteorological telecommunications). During 1984 a number of peripheral devices were acquired. These were:-

- (a) Four VT101 visual display units in January.
- (b) Five VT220 visual display units in December.
- (c) A Toshiba dot matrix printer in January for use in the production of high quality print for publications;
- (d) A DEC LA50 dot matrix printer for the Central Analysis and Forecast Office, to print out selected bulletins from the W40 Global Telecommunications System. This replaces two 100 baud teleprinters;
- (e) A Gould-Bryan Colourwriter pen plotter, capable of producing A3 size plots in ten colours, used to evaluate the driving of remote graphics devices from the computer.

In addition a terminal Access Controller was acquired in December. This allows some users to have access to both the PDP 11/40 system and the DEC-2050 system from a single terminal and also provides port contention on the DEC-2050 computer, i.e. the number of terminals attached to the system can be greater than the number of terminal ports. There are now 28 VDUs and 8 printers connected to the DEC-2050.

Telecommunications Systems

The PDP 11/40 computers control the reception of meteorological data from the International and deomestic networks, identification and storage of the data, and routing to the various forecast offices or to the International circuits. The major enhancements to the telecommunications systems during the period were:-

- (a) In December a facility for transmitting METAR reports from all the Irish airports to the computer by public telex was introduced. This complements the existing methods involving the AFTN network and the private RJE teleprinter circuits.
- (b) On 1st November the new procedures laid down by the World Meteorological Organisation and the International Civil Aviation Organisation for identifying retard, corrected and amended bulletins were applied to the Irish bulletins transmitted on International circuits.
- (c) From mid-October onwards the Service participated in an International experiment to exchange seismological bulletins on a routine basis on the GTS. This involved the relaying of bulletins received on GTS to the Dublin Institute for Advanced Studies, and providing the latter with a means of entering data by telex into the computer for insertion on the GTS.
- (d) From 9th May hourly weather reports from the Kinsale Gas Platform were collected and transmitted on the GTS.

Numerical Weather Prediction and Automatic Plotting

The twice-daily numerical analysis and forecast runs and the eight-times-daily automatic plotting of charts continued. Some modifications to the Automatic Data Extraction system were made to make it more efficient and to reduce the rate of rejection of data. The Model Output Statistics scheme for predicting maximum temperatures for Dublin continued in operation.

Processing of Grid-point Data

The reception of forecasts in grid-point form from the European Centre for Medium-range Weather Forecasts continued. The data are received on the PDP 11/40 system and transferred to the DEC-2050 computer for processing. From October the data were received on a smaller area, effecting a 30% reduction in volume, and the forecast period extended from seven days to ten days ahead.

On 2nd May a system for the reception, processing and graphic display of grid-point forecasts from the British Meteorological Office was introduced.

The twice-daily supply to Aer Lingus, Dublin Airport, of forecast winds and temperatures for flight-planning purposes continued. In October the area of coverage was increased to allow them to offer flight-planning services to a wider range of airlines.

Climatological Data Processing

A procedure for checking the integrity of the climatological data which had been transferred from 7 track Honeywell tapes to 9 track tapes on the DEC-2050 was completed.

AGRICULTURAL METEOROLOGY

The Meteorological Service has from its earliest days given special attention to agriculture. Apart from aviation, the agricultural community has always been the biggest single group requiring weather forecasts. Some 40% of the direct calls to the Central Analysis and Forecast Office come from this sector. Since the Automatic Telephone Weather Service (ATWS) was first introduced in 1979, and gradually extended since then, the number of calls to the system (excluding the 1199 Dublin City facility) has increased steadily and now exceeds 560,000 per annum. A very large proportion of the calls to the regional services may be attributed to the agricultural sector.

During 1984 the Agrometeorological Bulletin continued to be the main publication of the Agricultural Meteorology Unit. About 300 copies are circulated monthly to agricultural scientists, advisers and to a number of commercial enterprises. The "Special Topic" page introduced in 1982 continued to be a valuable means of improving awareness of agrometeorology. A number of the topics were contributed by researchers from An Foras Taluntais (the Agricultural Institute). The main change in presentation of data in the Bulletin introduced in 1984 concerned potential evapotranspiration and soil moisture. Since heavy rainfall occurring near the end of a ten-day interval would frequently not have worked its way through the Thornthwaite lysimeter, and spurious calculations of potential evapotranspiration might ensue, the cut-off date on these occasions was not strictly applied; the adjusted dates were noted in the Bulletin.

The Unit has responsibility for monitoring conditions favourable to the spread of potato blight during the active growing season, 1st May to 30th September. During the 1984 season a sharp contrast in conditions developed between the north and west of the country, where seasonal accumulations of effective blight hours, according to Bourke's Irish Rules, were near or above average, and the south and east, where accumulations were well below average. Six warnings were issued during the season.

The processing of reports from the Irish Phenological Gardens Programme was continued and the results were transmitted to the International directorate of the Phenological Gardens Programme. The year was again unfavourable for growth; because of the very dry spring and summer, the ground for most of the year was dry and hard. As a result, the leaf buds at Valentia Observatory did not open on the top branches of some trees, particularly the *Betulae Pubescens*, *Populi Tremulae* and one *Populus Canescens*; however, no plant died during the year.

Cooperation was continued with the Department of Agriculture in a programme aimed at reducing the incidence of Liver Fluke. Weather Information is an Important Indicator (in addition to field observations and faecal and liver examinations) of the likely prevalence of the disease. The 1984 weather Indices suggested a low incidence in the autumn and following winter.

The pilot scheme of Fire Danger Warnings (meteorological conditions indicating the existence of fire hazard) to the Limerick Division of the Forestry and Wildlife Service was renewed in March. The warning service which was provided by the Central Analysis and Forecast Office, was continued to the end of August. Current studies being undertaken at the Forestry Department, University College, Dublin, indicate that an improved warning service may be possible, based on meteorological parameters.

The Service continued to cooperate with the agricultural advisory service, ACOT, in the production of its weekly Cereal Disease and Pest Report Bulletin to local advisers and the farming media during the season April to July, inclusive. In each bulletin, a summary was provided of the past weeks' weather and a forecast for the coming week together with an indication of the diseases likely to be favoured by the conditions.

Weekly forecasts of certain weather parameters were sent to the Johnstown Castle Research Centre of An Foras Taluntais (The Agricultural Institute), for input to a computer grass production simulation model. Weather parameters from six stations were provided,

and predictions from the model were published in the Farm Management section of The "Farmers' Journal". According to the model, dry matter losses from drought in 1984 to the end of August, compared to average, varied from 4.6% in the north Midlands to 11.8% in the south Midlands. In the latter region the replacement feeding costs as estimated by the Research Centre would be increased by 40%.

The Agricultural Meteorology Unit provided expert meteorological advice to agricultural researchers, advisers and to the farming community in general as well as to the Central Analysis and Forecast Office in relation to agricultural needs.

The Agricultural Meteorology Unit was asked by Bord na Mona (The National Peat Board) to visit the Board's works at its bog at Boora, Co. Offaly, in May. The purpose of the visit was to evaluate the usefulness of current weather observations to the Board's operations and in particular to assess their relevance to improved operational methods. The Board was then examining its current milling procedures and was anxious to determine the relative importance of the weather elements which assist drying. The review may lead to better weather monitoring procedures being adopted as well as taking more precise account of weather in an integrated management system.

Another interesting project, begun during the year for the Game Conservation Committee, was the use of meteorological data to decide if the ground would be so covered in snow or so frozen as to seriously affect the ability of game birds to feed during prolonged periods of harsh weather. The results may lead to criteria to decide on whether shooting should be suspended under certain weather conditions.

On the initiative of the Agricultural Meteorology Unit and members of An Foras Taluntais, a Joint Working Group on Agricultural Meteorology (AGMET) was formed during the year. Its members were drawn from the Meteorological Service, An Foras Taluntais, ACOT (An Comhairle Oiliúna Talmhuíochta), the Department of Agriculture and a number of University Departments. The Group met to study and report back to the appropriate organisations on the coordinated requirements of agricultural meteorology to serve the needs of agriculture better, to

review the level and type of agrometeorological services that could be provided with existing technology and to follow through by promoting activities towards achieving these ends. The first report of the Group, to be published early in 1985, will be a comprehensive review of the current position with recommendations for future action. In its short existence, the AGMET Group has made a worthwhile contribution towards an increased awareness of agrometeorology in Ireland.

MARINE METEOROLOGY

Offshore Operations

Activity in offshore drilling operations has tended to fluctuate considerably since the Meteorological Service began providing forecasts in 1977. Receipts for forecasts in the various years have varied from IR£46,000 in 1978 to a low of IR£13,000 in 1980. Total income to the Meteorological Service from these sources in 1984 was IR£22,500.

Special 3-day forecasts of weather and wave conditions were issued by CAFO throughout the year to the rigs of five companies drilling for oil at eight locations in the Celtic Sea and the Porcupine and Fastnet Basins. Similar forecasts were issued in conjunction with maintenance work on the Marathon Gas Platform. In addition CAFO provided a 24-hour weather watch on each rig. Routine reports of actual weather and wave conditions were received from most of the rigs concerned.

As an aid to the marine forecaster, the spectral wave model was made operational in August, wave charts and print-outs of sea swell and the combined wave system at individual grid points for the Atlantic coast are produced automatically. A sea wave analysis and 12-, 24- and 36-hour forecasts are available in the CHARTS program, along with the usual meteorological charts. In addition every 6 hours, a hardcopy chart of wind and wave reports from ships is produced automatically. The actual combined wave parameters at seven grid points around Ireland are archived after each run. The actual and forecast wind and sea, swell and combined wave parameters at the relevant grid points are compared monthly with the reports from the Ocean Weather Stations "LIMA" and "ROMEO" in the Atlantic.

Automatic Weather Station on the Marathon Gas Platform:

The measurement and transmission ashore of meteorological parameters were generally satisfactory. A report is transmitted every twenty

minutes from the platform to the Meteorological station at Roche's Point. Since February 25th, 1984 hourly reports are recorded by the local observer, and then telexed to the Meteorological Service Computer for transmission on the Global Telecommunications System and to the airports. During 1984 data extracted from the printout in Roche's Point were archived by the Marine Unit in manuscript form. Summaries of these data and of earlier wind data from Light Vessels were processed at Shannon Airport.

Enquiries.

The vast majority of marine-orientated enquiries came from yachtsmen and professional mariners, who required weather forecasts which were supplied by CAFO. However, a considerable number of marine climatological enquiries and reports on conditions during accidents at sea were dealt with by the Marine Unit.

Marine Observations

The following marine interests cooperated with the Service by making observations of weather during the year:

- | | | |
|---------------------------------------|----------------------|---|
| <u>Irish Shipping:</u> | (4 deep-sea vessels) | - Irish Cedar,
Irish Maple, Irish
Spruce, Irish
Rowan |
| <u>Cross Channel and Continental:</u> | (6 vessels) | - Leinster,
Connaught,
Kilkenny, Wicklow,
St. Killeen and St.
Patrick II. |
| <u>Naval Service</u> | | - The fishery
protection vessels
Emer, Deirdre, |

Aolfe and Aisling continued to send weather reports during the year.

Others

- The sail training vessel Asgard II and the marine research vessel "Lough Beaitra" also returned observations.

CAFO operated as a collection and retransmission centre for real-time weather observations from ships in the seas around Ireland. About 3,000 reports from foreign ships and 200 from Irish ships were received through the coastal stations at Valentia and Malin Head in 1984, and an additional 250 reports were transmitted to CAFO via coastal radio stations in the United Kingdom.

Approximately 1,350 reports from Irish Navy ships were also received via the Naval Headquarters in Haulbowline. From January 1st, 1985 a variation of the ship's code will be used by the Navy, following a trial on the L.E. Emer.

During the year Port Meteorological Officers visited ships in port to check or replace equipment as follows:-

Dublin	40 visits
Cork	8 visits (all to Naval Service vessels)
Rosslare	7 visits

In addition the Port Meteorological Officer in Cork visited the oil rig SEDCO 704 during its drilling operations south of Ireland, and a meteorologist from the Marine Unit visited the Marthon Gas Platform to inspect the Automatic Weather Station.

Officers of the Naval Service were given a course in observing and coding weather reports as well as in aspects of meteorology related to

aviation, in anticipation of the commissioning of a new fishery protection vessel which will have facilities for helicopter operations.

INDUSTRIAL METEOROLOGY

The Department of Energy Wind Power Study made little progress during 1984. The Marine Unit did, however, continue its statistical investigations into the wind regime in Ireland using Meteorological Service data, and data from a number of ES3 stations, as well as light vessels and the Marathon Gas Platform.

The first phase of the EEC Wind Energy Atlas Project came to an end during 1984 without reaching its goal. It is expected that it will be revived during 1985.

METEOROLOGICAL SERVICE LIBRARY

The major advance in the Library during 1984 was the completion of the computerized cataloging and retrieval system, which was put on public access in the summer. All staff with terminals linked to the HQ mainframe computer can now consult the catalogue on-line, and conduct searches in their own subject areas. A booklet has been published to familiarize staff with the new system (Internal Memorandum 104/84: "Computer Access to the Library Catalogue: A Users Guide" by Lisa Shields). A three-year accessions list (1981-1984) was also brought out, generated automatically from the computer files.

The Library serves not only staff at the Meteorological Service Headquarters in Glasnevin, but also those at many other locations around the country. To cater for the needs of the latter, an elaborate and efficient system of loan records needs to be maintained. (About 1,000 items are currently assigned on permanent or temporary loan to various stations, sections, or individuals). It is planned to computerize those records and link them to the Library retrieval system. A start has been made on the designing and writing of a set of programs for this purpose.

Much effort has been spent on the development of the new systems, but it is hoped that it will result in a better service to staff and other users of the Library, and an increased use of the valuable facilities available.

INSTRUMENTS & EQUIPMENT

Satellite Receiving Stations

At Shannon Airport and CAFO, pictures were received from the METEOSAT and GOES EAST geostationary satellites, and from the American polar orbiting satellites. Alden parabolic dish aerials, 1.9 metres in diameter, were used for reception of Meteosat. Reception of the polar-orbiting satellites was by means of a crossed yagi aerial in Shannon and an Alden omni-directional aerial in CAFO. The quality of the pictures was usually satisfactory but varied considerably with the seasons, the amount of radio interference and the condition of the equipment. The roof of the new HQ building is proving to be a disappointing site for reception of radio facsimile and orbiting satellite broadcasts. Work is in progress to attempt to filter out the radio interference which has increased considerably in the last year. A standby radio was purchased in December with which satellite pictures can be obtained and displayed on a colour visual display unit.

Satellite signals received in CAFO were routinely relayed to Dublin Airport and Casement Aerodrome; those received at Shannon were relayed to Cork Airport. In practice, the pictures from the American polar-orbiting satellites were the most frequently used as these provided a better coverage of the areas of most concern to the forecaster. The American polar-orbiting satellites continued to be used nightly on Radio Telefís Éireann as part of the television weather presentation.

Anemometers

The program of overhaul and calibration of the Dines anemometers at the airports and synoptic stations was delayed during the year because essential spare parts were not available. Shortage of staff is also affecting this programme, but it is hoped that further progress can be made in 1985. Three Munro wind speed generators were overhauled by the Service and a complete unit was prepared for installation on an E.S.B. site on Inlisbofin, off the west coast.

Dansk Impulsfysik Anemometers are in use at Dublin and Shannon Airports. A third system, Intended for use at Cork Airport, has not been installed because of industrial relations difficulties. The Dublin Airport system suffered considerable damage in an electrical storm on 26th August, the power supply being severely affected as were a number of modules in the transmitter and receiving units.

Weather Surveillance Radar

The Shannon digitised radar project (see chapter on International Cooperation) became operational towards the end of December. Digitised pictures are now being received in Shannon and CAFO and are also transmitted to the United Kingdom Meteorological Office.

The Selenia weather surveillance radar at Dublin Airport continues to operate satisfactorily. However, its age (it was installed in 1966) makes spare parts increasingly difficult to come by, and some have to be specially manufactured.

Automatic Weather Station (AWS)

The Dildcot AWS installed in cooperation with the Electricity Supply Board near Gweedore, Co. Donegal was dismantled and brought back to HQ in July. Its operation was satisfactory in all respects except that some unexplained anomalies occurred in the readings of the wet bulb thermometer's sensor. Alternative platinum resistance sensors have been acquired and are being evaluated for use with the AWS, and for direct recording on a Chessel 306 4" recorder.

Searchlights

As the old type large tungsten lamps can no longer be obtained for the cloud height searchlights in use at the Service's Synoptic Reporting Stations, a change to halogen lamps is being made, necessitating the manufacture of new mountings and connectors.

Advisory Service

The number of requests to the Meteorological Service for information and specifications on subjects related to meteorological instruments by outside agencies and members of the public has increased dramatically in recent years. Many such requests were dealt with during 1984.

LABORATORY WORK

There was no change in the routine work of collecting and processing air, precipitation, tap water and total fallout samples by the Meteorological Service, for radioactivity measurement. The measurement of these samples for radioactivity levels and the publication of the results continued to be carried out by the Nuclear Energy Board. Some enquiries were received seeking information on radioactivity levels and wind patterns for October 1957 which coincides with the time of an accident in the nuclear processing plant at Windscale in the United Kingdom.

The established programme for the chemical analysis of monthly air and rain samples was continued during the year. A request from the World Meteorological Organisation to change the sampling period of the BARMON Station at Valentia Observatory from monthly to weekly sampling with an overlap of both periods for a year was received. Weekly averages for certain parameters calculated from daily results for Valentia Observatory are being sent to the WMO.

In cooperation with the European Air Chemistry Network Centre in Sweden, a network of sites for chemical analysis sampling is to be established in the Binn area of Co. Offaly during 1985. The purpose of this network will be to gain information on the variability of the concentrations of the constituents analysed in order to select the most representative of the sites for long term sampling purposes.

Samples of daily, weekly and monthly precipitation were analysed and examined for acidity content during 1984. Data, already published, on acid rain were updated, no trend towards an increase in acidity was found. Many enquiries seeking information on acid rain were received. The collection of daily precipitation samples continued at Casement Aerodrome and Dublin Airport in connection with a project being carried out by An Foras Forbartha on acid rain in the Dublin area.

Interlaboratory calibration tests on reference samples for the European Monitoring and Evaluation Programme and the World

Meteorological Organisation were also carried out by the HQ laboratory during 1984. The results received were satisfactory. A computer terminal was installed in the HQ laboratory and chemical analysis data are being transferred to the HQ computer.

RESEARCH & INVESTIGATION

The Research Division of the Meteorological Service at present comprises three Meteorologists and one Meteorological Officer, and has had a fundamental impact on the practical work of the Service over the past few years. The forecasters both in the Central Analysis and Forecast Office (CAFO) and at the airports now rely more and more on the output of the computer to aid them in producing forecasts. Analysis of upper air data is now performed on the computer and plotted automatically. The Research Division has played a vital role in bringing about the computerisation which now encompasses so much of the work of the Service.

The work of the Research Division can be summarised under the following headings:

- (1) Analysis System
- (2) Forecast System
- (3) Forecast Verification System
- (4) Computer Graphics System
- (5) Flight Planning
- (6) Assistance to other sections
- (7) International Cooperation
- (8) Research

Analysis System

Recent activities of the Research Division have led directly to the implementation of a sophisticated automatic computer analysis and forecast system. The objective analysis scheme automatically analyses meteorological fields on the computer, using the most recent observations in combination with a first guess field derived from a previous forecast. The output from the analysis is used directly by the forecaster. The analysis scheme is undergoing a process of continual refinement and future plans include (a) modifications to the analysis to allow it to show smaller scale features, (b) an extension

to the system to analyse humidity and (c) a better initialisation scheme to remove noise in the early stages of the forecast.

Forecast Model

The forecast model is run twice daily to produce 24-hour and 36-hour forecasts which are given directly to the forecasters for guidance. In addition, wind forecasts derived from the model, are used as input to the Wave and Swell Model run by the Marine Unit. Such winds are essential to enable the latter model to be run. The emphasis in the Research Division has been, and continues to be, (a) improving the quality of the forecasts and (b) improving the efficiency of the time integration. In fact, original work by the Research Division, has led to the development of a numerical scheme that reduces the computer time required by the model by 30 percent. Further refinements, to be implemented in the near future, include (a) a new computer scheme which will speed up the model by a further factor of two, and (b) the inclusion of moisture in the model which should lead to a marked improvement in the quality of the forecasts.

Forecast Verification System

The numerical forecasts produced by the Irish Meteorological Service (IMS) model are verified objectively and subjectively. Verification is important because it provides a method of (a) comparing the quality of IMS forecasts with those produced by other centres, (b) monitoring the performance of the model and (c) evaluating changes to the forecasting system in terms of their effect on forecast quality. Skill scores produced by the verification programmes have been published in a number of external publications such as the WMO progress report, the European Working Group on Limited Area Modelling (EWGLAM) newsletter etc. In addition a study of the impact of the numerical forecasts on the accuracy of subjective forecasts have been prepared and published as an Internal Memorandum.

Computer Graphics System

The computer graphics system developed by the Research Division has four applications; (a) plotting of observations, (b) contouring of

charts, (c) interactive graphics and (d) miscellaneous. The routines for plotting observations have replaced an earlier manual system. The contouring package is used to produce plots of forecasts from models developed by the Meteorological Service, (both the forecast model and the wave/swell model) and from the models of the UK Meteorological Office and the European Center for Medium Range Weather Forecasts (ECMWF). There is no other practical method of displaying the output of such models. The interactive graphics system has been installed in CAFO, and also at two of the airports (Shannon and Dublin). Finally, a number of graph-plotting packages have been used by the Climatological Division and Marine Unit to display data in an easily assimilated form. The graphics system is still undergoing development and major enhancements are envisaged when the communications computers are replaced in the near future.

Flight Planning

Forecast upper-air winds and temperatures are sent to Aer Lingus, as a twice-daily routine. This information is used for flight planning and has a direct economic benefit in fuel economy. The data requirements are expected to change significantly in the short term and this will require a major enhancement of the computer system.

Research

Research has gone hand in hand with the development and improvement of the Numerical Weather Prediction suite. At the analysis stage, a new initialisation procedure has been constructed which, when implemented, will dramatically improve the early stages of the forecast. At the forecast stage, new time integration procedures have been invented which have significantly reduced the time it takes to produce the 24 hour and 36 hour forecasts. At the display and presentation stage, a novel interactive graphics system has been developed for use by the forecasters which is particularly powerful and user-friendly. In addition to its direct contribution in these areas, the research division has raised the standing of the service internationally. This is witnessed by the fact that Dr. J.R. Bates, Assistant Director with

responsibility for research matters, was recently appointed chairman of the WMO Working Group on Short and Medium Range Weather Prediction Research. He has also served as chairman of the Scientific Advisory Committee of ECMWF.

In addition to the work of the Research Division, the following research work was in hand or was completed by other members of the staff of the Service:

- GLEESON, S. (Meteorological Office, Shannon Airport)
An investigation into rainfall accuracy by arranging to have gauges with turf wall shelters installed at the Mullingar and Balmullet Synoptic Reporting Stations and at Valentia Observatory. Discussions are in progress with the Climatological Division regarding the possibility of constructing a pit gauge for further research.
- HEUSSAF, P.A. (Meteorological Office, Dublin Airport)
"A Survey of References to Weather in Historical Records in Ireland 1200 - 1840 AD".
- O'LAOGHOG, S. (Training Division)
A research project to compare the wind speeds recorded by a pressure-tube anemometer and a rotating-cup anemometer, mounted on the same mast.
- SHIELDS, L. (Meteorological Service Library)
(1) Early manuscript and printed sources of Irish climatological and weather data.
(2) Weather lore in Irish folk tradition.

INTERNATIONAL COOPERATION

European Centre for Medium Range Weather Forecasts (ECMWF)

ECMWF is a cooperative venture by 17 European countries, established in an effort to improve the quality of weather forecasts for periods ranging from 3 to 10 days. The products of the Centre are located at Reading in the United Kingdom available to all Member States, including Ireland, by direct computer link, and are now used on a routine daily basis at the forecasting offices of the Irish Meteorological Service. By means of Graphics Display Units an extensive range of ECMWF products is readily available to the forecaster, while a Graphics Printer linked to the system gives a hard copy option.

Mr. D.L. Linehan, Director, represented Ireland at meetings of the ECMWF Council in May and November. Mr. W.H. Wann, Assistant Director, and Chairman of the ECMWF Technical Advisory Committee (TAC) attended meetings of the ECMWF Council, TAC, the Scientific Advisory Committee and Finance Committee during the year. On 1st September, Mr. L. Campbell (Computer Division) left (on leave of absence) for a three year tour of duty at the Centre.

International Civil Aviation Organisation (ICAO)

Mr. P.A. Lyons Officer-in-Charge of the Meteorological Office at Shannon Airport attended two meetings of the Meteorological Advisory Group (METAG) of the European Air Navigation Planning Group (EANPG) at the ICAO European Office in Paris 7th - 11th May and 22nd - 26th October. METAG concerns itself with the meteorological content of the regulatory material which governs the operation of Civil Aviation throughout Europe. The work of the group during 1984 was concerned, inter alia, with the implementation of the new World Area Forecast System (WAFS) in Europe, the regulations for the provision of warnings of low-level wind shear, and the further development of the material for the Meteorology Section of the new EUR Air Navigation Plan Publication.

World Meteorological Organisation (WMO)

WMO is the international body responsible for coordinating the activities of national meteorological services throughout the world. During 1984, Ireland was represented at a number of meetings held under the auspices of the Organisation. Dr. J.R. Bates Assistant Director, is a member of the WMO/CAS Steering Group on Numerical Experimentation, and attended a meeting of the Group in Geneva in November. He also attended a WMO Workshop on Numerical Weather Prediction in Erice, Italy in October. Dr. Bates was chairman of the organising Committee for this project.

Mr. E. J. Murphy, Officer-in-Charge of Valentia Observatory attended a regional comparison of national standard pyrheliometers of Region VI (Europe) in Carpentras, France, in June. Mr. K. Commins also of Valentia Observatory attended a WMO Technical Conference on Instruments and cost-effective meteorological observations held in Noordwijkerhout, Netherlands, in September and Mr. W.G. Callaghan, head of the Applications Division, attended two meetings of the North Atlantic Ocean Stations (NAOS) Board in Geneva in June and December. The latter meeting was called to consider the implications for the NAOS network of the expected withdrawal of several of its Member States at the end of 1985. Mr. D.J. Murphy, Head of the Computer Division, attended a meeting of the Working Group on the Coordination of the Implementation and Operation of the World Weather Watch in Region VI (Europe) in Geneva, in September.

World Meteorological Day, organised by the WMO to promote interest in the science of meteorology, was celebrated as usual on March 23rd. The theme for 1983 was "Meteorology Aids Food Production". A Press Release was issued on behalf of the Meteorological Service to draw attention to the occasion.

Shannon Weather Surveillance Radar

In cooperation with the U.K. Meteorological Office, the Weather Surveillance Radar at Shannon Airport was enhanced and the output digitised. The output is now displayed on Video Display Units in the forecasting offices in Shannon and CAFO, and is also relayed by

land-line to the U.K. Radar Network. It is expected that in due course the composite radar picture available on the U.K. Network will be received in the forecasting offices of the Irish Service. Mr. P.A. Lyons, Officer-in-Charge of the Meteorological Office at Shannon, and Mr. W.G. Callaghan, head of the Applications Division, met Dr. Pettifer of the U.K. Meteorological Office in Dublin in June to discuss the project.

Ireland was represented at meetings of the COST-72 Weather Radar Project (project 72 of European Cooperation in Science and Technology) in Brussels in February and November, by Mr. G. McDonald, Officer-in-Charge of the Meteorological Office at Casement Aerodrome.

Other International Activities

The Director attended the Conference of Directors of Western European Meteorological Services in Vilamoura, Portugal in April, and also a planning meeting for the North Atlantic Observations System in Reading in October.

Mr. W.G. Callaghan attended a meeting of the Management Committee of COST-43 in Brussels in July, which concerned the setting up of an experimental network of ocean stations in the waters around North Atlantic to report environmental data in real-time. Dr. A. McDonald attended a meeting in Bracknell in September on the availability and use of Bracknell Regional Meteorological Centre products, while Dr. J. Hamilton attended the sixth meeting of the European Working Group on Limited Area Modelling in Norway in October. Dr. Peter Lynch began a twelve month tour of duty as visiting scientist with the Royal Netherlands Meteorological Institute in September.

Preparations continued during the year to expedite Ireland's ratification of the EUMETSAT Convention. EUMETSAT is an organisation of European states, set up for the purpose of implementing an operational meteorological satellite programme for Europe. The initial programme covering the period up to 1995, envisages the continued operation of the present satellites and the deployment of three new satellites which will be launched in 1987, 1988 and 1990.

The Meteorological Service suite of Numerical Weather Prediction programs has attracted attention internationally. Copies of the Service's programme have been requested by the Meteorological Services of Korea, Italy and Iceland. The Service's graphics programs have been requested by the WMO as part of a the Voluntary Cooperation Programme, and will be made available to developing countries. The WMO has estimated the cost to them of developing this software, if this had been necessary, at £250,000.

STAFF TRAINING

Government restrictions on recruitment resulted in a substantial reduction in the number of trainees and in the number of courses held at the Meteorological Service Training Centre in Galway. The following courses were completed during the year:

<u>Began</u>	<u>Ended</u>	<u>Course</u>	<u>No. of Students</u>
8 Nov 1983	9 Feb 1984	Meteorological Officer	1
15 Aug 1983	24 Feb 1984	Meteorologist	1
2 Aug 1983	18 May 1984	Meteorologist	1

Arrangements are being made, in conjunction with the Computer Division, to include an introductory computer course in the training of all future recruits. The content of the Meteorologists' course has been extensively revised.

Contact was maintained with the appropriate authorities in University College, Galway in connection with the proposed M.Sc course in Meteorology.

The Meteorological Service continued its membership of DEVCO, the State Agencies Development Cooperation Organisation, and as a result of this involvement provided in-house training in the Management and Organisation of a Meteorological Service to a meteorologist from Zimbabwe.

The following training Courses in Meteorology were provided for Air Corps personnel at Casement Aerodrome, Baldonnel:

- (1) 13th Air Corps Cadet Class, to Commercial Pilots Licence level, with final examination in June.

- (ii) Maritime Squadron Captains' Training Course, relating to fishery patrol activities with final examination in September.
- (iii) Naval Officers' Training Course, in basic aviation meteorology for 3 Officers assigned to the new helicopter-carrying vessel 'LE Eithne' in May.

During 1984 Mr. C.O'Connor, Officer-in-Charge of the Meteorological Office at Cork Airport, continued to act as Examiner in Meteorology for the examinations for the Airline Transport Pilots' Licence and Commercial Pilot's Licence, conducted by the Department of Communications. Examinations were held twice during the year.

The involvement of some individual staff members in educational or training activities is given below.

1. Ms. A. Clifton, Meteorological Officer, Applications Division completed the first year of a BSc (Computer Science) course at Trinity College Dublin.
2. Messrs. G. Fleming and R. McDermott, Central Analysis and Forecast Office attended courses organised by RTE in Radio-Broadcasting.
3. Mr. M. Hopkins was awarded a First Class Honours BSc degree from the New University of Ulster, Coleraine.
4. Messrs B. Barry, J. Bourke, and J. O'Brien successfully completed a course in Computer Basics at the National Institute for Higher Education in Glasnevin in April. Messrs P. Lee and S. O'hEilidhe commenced a similar course in September.
5. Mr. C. Mac Gabhann Meteorological Officer, Computer Division, attended a Systems Design course organised by Fitzwilliam Computer Services in Dublin in April.
6. Mr. R. McGrath, Meteorologist, Computer Division, attended a workshop on the use and quality control of Meteorological

Observations for Numerical Weather Prediction, at ECMWF, in November.

7. Mr. B. McMahon, Meteorological Officer, Shannon Airport completed a Computer Programming Basic Intensive Course at NIHE, Limerick.
8. Mr. F. O'Murchadha, Senior Meteorological Officer and Mr. M. Kingston, Meteorological Officer, Shannon Airport, attended a course at the U.K. Radar Research Laboratory from 30th April to 5th May on the computerisation and modification of the Shannon Weather Radar in order to make it compatible with the U.K. Meteorological Office network. Both officers also attended a basic computer course at HQ in June given by Computer Division Personnel in connection with the Radar Project.
9. Mr. T. Sheridan, Meteorologist, Shannon Airport attended a course in ECMWF, Reading, from 30th April to 11th May entitled "Meteorological Training Course Module 1". He also commenced a course at the School of Engineering, Limerick, leading to membership of the British Computer Society.

ADMINISTRATION

Staffing

Government restrictions on recruitment and promotion continued to affect the Service during 1984 causing considerable difficulties in areas of the Service where redeployment is not possible. The Meteorological Office at Dublin Airport, and the Research Division, both continue to operate without a permanent Officer-in-Charge, while at many of the Service's stations, shortage of staff at the supervisory level has led to difficulties in maintaining the required levels of service.

The Government restrictions on payable overtime which began in 1982 continued during 1984, and in some cases minor curtailments of services were necessary in order to stay within the prescribed allocation.

The efficient organisation of some areas of the Service is still hampered by an inadequate grading structure, a problem which has been in evidence for some years, and which has been exacerbated in recent times by reductions in the numbers of staff serving in higher grades. Efforts continued during 1984, in consultation with the Department of the Public Service, to effect an improvement.

Plans were formulated during the year for the rationalisation of services to aviation, and are expected to be implemented from 1985 onwards. These will involve the centralisation of the aviation forecasting function by the establishment of a Central Aviation Office. It is also proposed to provide improved briefing facilities for air-crew at Dublin Airport, incorporating the use of sophisticated computerised aids.

The numbers of staff serving in the Meteorological Service on 31st December 1984 were:

Director	1
Assistant Director	2
Senior Meteorologist	9
Meteorologist	41
Principal Meteorological Officer	9
Senior Meteorological Officer	36
Meteorological Officer	148
Assistant Meteorological Officer	31
Other grades	<u>36</u>
Total	313
Part-time staff	<u>14</u>
OVERALL TOTAL	<u>327</u>

Mr. Austin H. Nagle, first and founding Director of the Meteorological Service died in the United States in September at the age of 90.

The history of the Irish Meteorological Service is generally reckoned to have formally begun with Mr. Nagle's appointment on 8th December 1936. Mr. Nagle joined the Service from the British Meteorological Office, and played a central role in the development of the Irish Service in its early years. He became an internationally-recognised authority on aeronautical meteorology, and played an important part in the formation of the World Meteorological Organisation after World War II. In 1948 he resigned from the Meteorological Service to take up a senior post with the U.S. Weather Bureau, and last visited Ireland on the occasion of the official opening of the new Headquarters Building of the Service in 1979.

Mr. M.H. Gilligan, Meteorologist, died after a short illness on 9th January, 1984. Michael Gilligan graduated from University College, Dublin in 1949 and joined the Meteorological Service as a meteorologist in 1951. He served at Shannon and Dublin Airports before joining the Central Analysis and Forecast Office on its establishment in 1961. During the succeeding twenty-three years he became well known to viewers and listeners throughout the country from his regular presentation of the daily weather forecast on television and radio. His distinctive style and affable good nature have been greatly missed since his untimely death.

The Service was also saddened during 1984 by the sudden death in April of Mr. Florence Moran, Services Attendant.

There were six retirements during the year. Mr. A. O. Roche, Principal Meteorological Officer joined the Meteorological Service in 1939, and was one of the few remaining staff members to have seen service in Foynes, where he was stationed for much of the period between 1939 and 1947. He was promoted Senior Meteorological Officer in 1947, and Principal Meteorological Officer in 1978. He made substantial contributions to the development of the Service as Officer-in-Charge of the Meteorological Office at Casement Aerodrome, and in later years as Head of the Outstations Unit in Headquarters.

Mr. Dermot Keane retired in September, having been with the Meteorological Service for forty-four years. He too saw service in Foynes, and after a number of short-term postings, was transferred to the Climatological Division in 1953. It is for his work in this Division that he will be best remembered, particularly for the vast store of climatological information which he acquired over the years, and which he could recall at will. Dermot Keane was promoted Senior Meteorological Officer in 1952, and Principal Meteorological Officer in 1978.

Mr. J.D. Kelly joined the Service in 1940 and retired in January 1984. "Maxi" Kelly, as he was affectionately known, pursued his career almost exclusively in the aviation area, and was highly valued for his expertise in aviation meteorological codes, his deep knowledge of observing procedures, and the organisational skills which he brought to bear on his work. He was promoted Senior Meteorological Officer in 1949.

Mr. P.S. MacGraine, Meteorological Officer, retired in March, having served with distinction, mainly in the Headquarters area, for thirty-seven years. Mr. T.J. Foley joined the Service in May 1946 as a Meteorological Officer and served at a number of stations until his appointment as Officer-in-Charge of the meteorological station at Birr, Co. Offaly, in 1951. He occupied this post until his retirement in September 1984.

Mr. R. McCann retired in January, having served successively as Services Attendant and Messenger in the Headquarters of the Service for five years.

PRINCIPAL OFFICERS OF THE METEOROLOGICAL SERVICE

ON 31st DECEMBER 1984

DIRECTOR

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

ASSISTANT DIRECTORS

W.H. Wann B.A. MSc

J.R. Bates BSc.PhD

SENIOR METEOROLOGISTS

C O'Connor B.Sc.	Meteorological Office, Cork Airport
P.A. Lyons B.Sc.	Meteorological Office, Shannon Airport
W.G. Callaghan B.Sc.	Applications & Instruments Division
B.E. McWilliams B.Sc.	Services Division
E.J. Murphy B.Sc.	Valentia Observatory
S.S. O Looghog B.Sc.	Training Division
D.J. Murphy M.Sc.	Computer Division
D.L. Fitzgerald B.Sc.	Climatological Division
P. MacHugh B.Sc.	Central Analysis & Forecast Office
Vacant	Research Division
Vacant	Meteorological Office, Dublin Airport

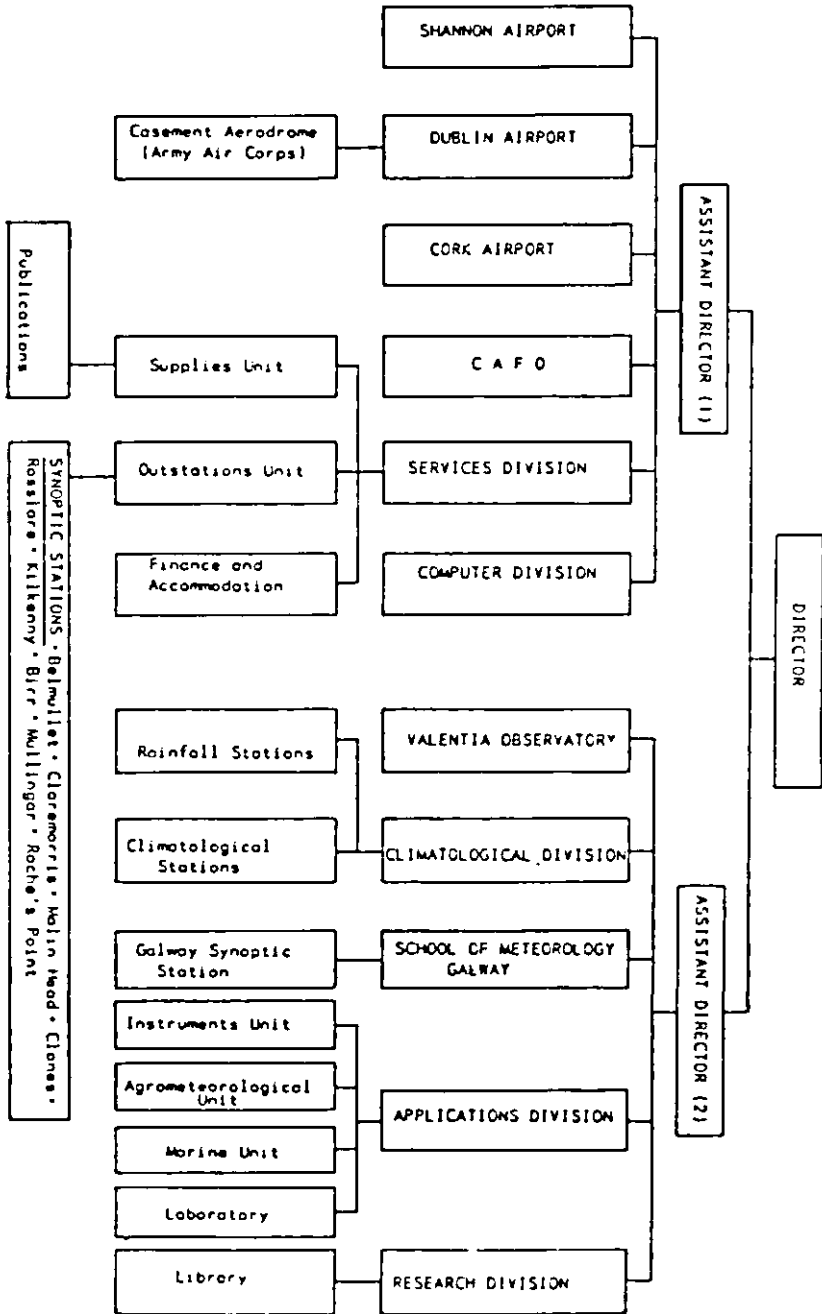


Figure 5. Organisation of the Meteorological Service

APPENDIX I

PUBLICATIONS DURING 1984

(a) Meteorological Service Publications

1. Solar Radiation Observations, 1982.
2. Magnetic Observations at Valentia Observatory, 1982.
3. Climatological Note No. 7 - Monthly and Annual Averages of Rainfall for Ireland 1951-1980 by D. Fitzgerald BSc.
4. Technical Note No. 44 - "Dynamo: A One-dimensional Primitive Equation Model" by P. Lynch, M.Sc., Ph.D.
5. Technical Note No. 45 - "Initialisation using Laplace Transforms" by P. Lynch, M.Sc., Ph.D.
6. Technical Note No. 45 - "Initialisation of a Barotropic Limited Area Model using the Laplace Transforms Technique" by P. Lynch, M.Sc., Ph.D.
7. Internal Memorandum 103/84 - "An Objective Intercomparison of CAFO, IMS and ECMWF Forecasts of the Pressure Pattern over Ireland" by J.E.M. Hamilton. B.Sc., Ph.D.
8. Internal Memorandum 104/84 - "Computer Access to the Library Catalogue - A User's Guide" by Lisa Shields. B.A. (Mod).
9. Internal Memorandum 105/84 "Checking of Forecasts In the Meteorological Service 1983" by M.Hogan, G.Reid and D.Cahalane B.Sc.
10. Monthly Weather Report, Parts I, II and III, January 1983 to December 1983.

11. Annual Weather Report, Parts I, II and III, 1983
12. Monthly Weather Summary, December 1983 to November 1984.
13. Agricultural Meteorological Bulletin, January 1984 to December 1984.
14. Meteorological Service Annual Reports 1982 and 1983.

(b) Other Publications

- Bates, J.R. - "An Efficient Semi-Lagrangian and Alternating Direction Implicit method for Integrating the Shallow Water Equations". Monthly Weather Review, Vol. 112, No. 10 (October 1984), 2033-2047.
- "Semi-Lagrangian Advective Schemes and their use in Meteorological Modelling", Lectures in Applied Mathematics, Vol. 22, American Math. Soc. (in press). (1984).
- Keane, T. - Chapter in An Foras Taluntais publication "The Soils of Fota Island Estate"
- "The Spring and Summer of 1984 in Perspective" - published in the Irish Tillage Farmer, October 1984.
- MacDonald, A - "Accuracy of Multiply-Upstream Semi-Lagrangian Advective Schemes", Monthly Weather Review, Vol. 112, No. 6 p. 1267-1275, (June 1984).
- Shields, L - "Computer Access to the Library Catalogue: A User's Guide". By Lisa Shields (Dublin, Irish Meteorological Service, Internal Memorandum 104/84.

A SELECTION OF LECTURES GIVEN BY MEMBERS OF THE STAFF

- Rates, J.R. - Four Lectures presented at the World Meteorological Organisation Workshop on Limited Area Numerical Weather Prediction Models for Computers of Limited Power (Erice, Italy).
- "Use of the Semi Lagrangian technique in Numerical Weather Prediction". U.K. Met. Office, Bracknell, 18th April.
- Byrne, C.M. - Three talks on "Weather for Sailing" at St. Enda's Community College.
- Campbell, L. - "Aspects of Computer Impact on the Meteorological Service" to Trinity College Computer Society, in March.
- Kingston, M. - Two lectures on "Technical Aspects of Satellite Signal Acquisition" to third year Electronic Technician Students at the School of Engineering, Limerick.
- Keane, T. - "Some possible uses of Degree Days and Thermal Time in Agriculture"; A lecture given at the Oak Park Research Centre of An Foras Taluntais, Carlow, in November.
- "Agrometeorology in Relation to Horticulture". A talk to 2nd year horticulture students, Department of Horticulture, University College Dublin in March.
- McCurtain, S. - A lecture entitled "Understanding and Applying Meteorological Information" to a Limerick Flying Club Seminar in March.

- McDonald, G. - A talk on aviation meteorology and film
"Interpreting the Weather Map" to Dublin Airport
Flying Club in December.
- MacHugh, P. - A talk on Weather Forecasts to Howth Branch of An
Taisce in January.
- Murphy, D.J. - "Telecommunications in Meteorology" UCD Scientific
Society, February.
- "Telecommunications in Meteorology" Dun Laoghaire
Rotary Club, March.
- Walsh, M. - A series of lectures to Fingal Sailing School,
Malahide, in January and February.

APPENDIX 2

SPECIAL TOPICS IN PREVIOUS ANNUAL REPORTS

- 1975 Development of the Meteorological Service
- 1976 Valentia Observatory
- 1977 Our Voluntary Observers
- 1978 The Meteorological Office at Foynes
- 1979 The New Headquarters Building
- 1980 The Use of Computers in the Meteorological Service
- 1981 The Use of Satellites in the Meteorological Service
- 1982 Telecommunications in the Meteorological Service
- 1983 The World Climate Programme

APPENDIX 3

ABBREVIATIONS

ACOT	Council for the Development of Agriculture
AFT	An Foras Taluntais (The Agricultural Institute)
AFTN	Aeronautical Fixed Telecommunications Network
AMCS	Aviation & Marine Communications Service
ATWS	Automatic Telephone Weather Service
AWS	Automatic Weather Station
BMO	British Meteorological Office
CAFO	Central Analysis & Forecast Office
COST	European Cooperation in Science & Technology
EA/PG	European Air Navigation Group
ECMWF	European Centre for Medium Range Weather Forecasts
EMEP	European Monitoring & Evaluation Programme
EMTN	European Meteorological Telecommunications Network
ESB	Electricity Supply Board
GTS	Global Telecommunications System
IAEA	International Atomic Energy Agency

ICAO International Civil Aviation Organisation
IGY International Geophysical Year
METAG Meteorological Advisory Group
MOTNE Meteorological Operational Telecommunications Network for Europe
MWR Monthly Weather Report
NAOS North Atlantic Ocean Stations
RTE Radio Telefils Eireann
WMO World Meteorological Organisation