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Foreword

Accurate forecasting of weather conditions – whether for public safety, recreation, aviation, industry, marine or agriculture purposes – is a core task of any National Meteorological Service. It entails an on-going commitment to improve forecast services – by utilising the latest scientific and technological advances, by monitoring forecast accuracy and by consulting the views of end-users. I am happy to record that Met Éireann made noteworthy progress in all three areas during 2001.

In the science and technology area, Met Éireann implemented an enhanced version of the numerical weather prediction model (HIRLAM 5) on a new high-speed computer system. The new model runs at higher resolution and avails of improved boundary values from the European Centre for Medium-Range Weather Forecasts (ECMWF). Initial results have been very positive, and we are confident that HIRLAM 5 will lead to further improvement of Met Éireann's forecasts over the coming years.

Ultimately, the value of Met Éireann’s forecasts depends on their usefulness to end-users. Following on the recommendations of the Value for Money study conducted by the Comptroller and Auditor-General in 2000, Met Éireann introduced more systematic procedures to measure the accuracy of forecasts issued to the public. In this Annual Report we publish the first results from these accuracy measurements. We hope they help to demonstrate the usefulness and value of Met Éireann’s services to all sectors of Irish society.

This Report also details the results of a survey of public attitudes towards Met Éireann conducted by Irish Marketing Surveys in November 2001. The survey revealed a keen public awareness of the value of Met Éireann’s weather forecasts and warnings, and a high recognition of Met Éireann as the primary provider of weather information in Ireland.

Other important developments during 2001 included the introduction of Met Éireann’s web site, www.met.ie, and the deployment in the Irish Sea of the second weather buoy in the series planned as a joint initiative by Met Éireann, the Marine Institute, the Department of the Marine and Natural Resources and the UK Met Office. Met Éireann also successfully developed a prototype automatic weather station for use in climate and synoptic stations.

The issue of climate change continues to be a cause of public concern, and it has long been Met Éireann’s ambition to devote more attention to this important subject. In particular, we wished to enhance our capability of providing predictions of future climate trends in Ireland.

Declan Murphy
Director

Met Éireann annual report 2001
It gives me great satisfaction to report that during 2001, in collaboration with partners in the education / research sector, Met Éireann secured support for the establishment of a Regional Climate Analysis, Modelling and Prediction Centre. This will function as the hub for a wider initiative in climate studies to be known as the Community Climate Change Consortium for Ireland.

The programme for modernisation in the Irish Civil Service continued with vigour during 2001. The implementation of the Performance Management and Development System (PMDS) in Met Éireann was supported by the most ambitious training effort ever undertaken by the organisation. Because Met Éireann’s operations are widely dispersed throughout the country, training programmes were delivered at several locations. A happy side-effect of this process was the opportunity it afforded staff to meet colleagues from other offices. Training, of course, is only the first step and it will take some years before the benefits of PMDS to Met Éireann become fully evident.

Every year produces some unexpected events which engage the attention. In 2001 it came in the unwelcome form of the Foot and Mouth emergency. Met Éireann played an important role in coping with the crisis, supplying additional weather observations from its network of synoptic stations and developing systems to estimate the airborne spread of the disease. For their efforts in dealing with the Foot and Mouth episode, and their overall commitment to delivering high-quality customer service, I would like to express my gratitude to all Met Éireann’s staff.

Declan Murphy
Director

August 2002
Mission Statement

Our Mission is to meet the national requirement for high-quality weather forecasts and associated services, with optimum efficiency and value for money.

Organisational Structure (December 2001)
The HIRLAM 5 Numerical Forecasting Model

In modern weather forecasting, the output from computer-based Numerical Weather Prediction (NWP) models provides invaluable guidance to operational meteorologists. The meteorologists interpret the NWP output and, using their skill and experience, combine it with other data to produce the best possible forecasts for end-users.

How does an NWP model work? Essentially, weather observations (reports of air pressure, temperature, wind etc.) over a wide geographical area are collected at a specific time and passed to the model, which uses them to generate a 3-dimensional representation of the state of the atmosphere (the 'analysis'). This representation is then advanced forward in time by numerically solving the dynamical and physical equations describing the behaviour of the atmosphere, so producing a new state (the 'forecast').

Since 1989, Met Éireann has developed its NWP capability as part of an international collaborative project called HIRLAM (High-Resolution Limited Area Model). The HIRLAM project aims to develop and maintain a highly-accurate, short-range forecasting system covering an area which each member state can choose to suit its own requirements. In Met Éireann, the forecast area is as shown in Figure 1, and the HIRLAM model is run operationally four times per day (starting at midnight, 6 am, midday and 6 pm), each time producing a forecast out to 48 hours ahead.

In 2001, Met Éireann implemented a major upgrade from Version 4 to Version 5 of the HIRLAM model. The new system features a finer model resolution, and as would be expected, is much more demanding of computer power. Comparison tests show that the new model's forecasts are significantly better than those of the earlier version.

Model Resolution

At any given time, the state of the atmosphere is described in terms of physical parameters such as pressure, temperature etc. HIRLAM, in common with other NWP models, computes values for these parameters at points on a rectangular grid covering the area of the forecast. The size, or 'mesh', of the grid is crucially important; a finer mesh helps in the accurate depiction of the surface terrain, and in the description of small-scale weather features.

The new model has a horizontal grid of 438 x 284 points, giving an average separation between grid points of about 15km. This compares with an average separation of 33km in the old model (See Figure 2). The denser grid of the new model results in a more exact description of atmospheric variables, which in turn leads to more accurate forecasts. Improvements are especially noticeable near coastlines and over hills, due to a more detailed modelling of surface features.
The atmosphere, of course, is 3-dimensional and cannot be represented simply by a surface network of grid points. To describe its vertical structure, HIRLAM stacks a whole series of grid networks one above the other, in layers extending to about 30km above the earth’s surface. The new model has 31 such layers, as compared to 24 in the previous version (see Figure 3). Just as in the case of the surface grid, the finer vertical resolution also contributes to greater forecast accuracy.

In principle, forecast precision could be improved by using ever-finer surface grids, and further increasing the number of vertical layers. In practice, both horizontal and vertical resolutions are limited by the available computer power, and the need to deliver the NWP output sufficiently quickly for it to be useful to the operational meteorologists.

**Computer Power**

The new model requires enhanced computational resources in order to produce forecasts within an acceptable timescale. In order to run HIRLAM Version 5, Met Éireann needed a computer having at least 10 times the power of existing hardware. An IBM RS/6000 SP Large Scale Server was selected for the task. This is a distributed-memory computing system comprising 10 nodes, each in itself a powerful computer containing several processor units. The separate nodes are interconnected by an SP (scalable parallel) switch, so enabling tasks to run concurrently across some or all of the processor units. The system is designed for high availability; failure of a single node will not cause a complete shutdown.
In addition to improving the operational weather forecasts, the RS/6000 SP will play a key role in Met Éireann's on-going research programme aimed at further development of the HIRLAM model.

Performance of HIRLAM 4 and HIRLAM 5

The charts below show predictions of accumulated rainfall for 7th-8th December 2001, from the old and new forecasting systems. The HIRLAM 5 forecast clearly displays much greater detail, reflecting the impact of the higher model resolution. When the forecasts are verified against observations, the superiority of the new model is immediately apparent. For example, up to 55mm of rainfall was recorded over the Wicklow Mountains, and a similar amount fell at Rosslare, while at Valentia only 6mm was recorded – all in much better agreement with the new model than with the HIRLAM 4 predictions. The advantage of the higher-resolution system in forecasting rainfall is also evident from similar comparisons conducted on other dates.

McGrath, R. 2001: HIRLAM 5 on the IBM RS/6000 SP, HIRLAM Progress Report No. 22.
The Met Éireann Web Site - www.met.ie

The Site Launch
An exciting development occurred on 20th June when Met Éireann's new web site was successfully launched. The launch was the result of a rewarding team effort by Met Éireann staff in collaboration with external design consultants.

Focus on Content
The site is packed with high-quality content delivering important weather information to the general public and to specialised user groups. It features national and regional forecasts for today and tomorrow, along with a three-day outlook. Also included are hourly weather reports, sea area forecasts, all active weather warnings, satellite images etc. There are sections dealing with the climate of Ireland and a wealth of information on the structure and history of Met Éireann. Complementing the site is an FTP service that is used to channel data through the Internet to Met Éireann customers.

On-going Development
The web site has proven to be very popular, with around 35,000 page views per week in the months following its launch. For the future, Met Éireann plans to develop the site further through the inclusion of additional content, with the aim of making www.met.ie the authoritative on-line source for all aspects of Irish weather and climate information.
Celebrating 25 Years Service in Limerick, Cork and Cahirciveen

Continuing the programme that began in 2000, celebrations to acknowledge the contributions of staff who have completed 25 years service were held in Limerick, Cork and Cahirciveen.

The Limerick celebrations were held at the Limerick Inn on 2nd March, and catered mainly for staff at Shannon Airport and stations in the Midwest region. Declan Murphy (Director, Met Éireann) attended and made presentations to over 20 staff members.

In Cork, the 25-year celebrations were held at the Great Southern Hotel, Cork Airport, on 9th November. The Director presented awards to a total of 9 staff – 5 based in Cork, 2 in Shannon Airport and 2 in Kilkenny.

On 25th October the Daniel O’Connell Hotel in Cahirciveen was the venue for celebrations in the Southwest. In the course of a very pleasant evening the Director presented awards to 12 staff.
Forecasting Programme

While Met Éireann's forecasting programme draws on all the organisation's resources, the two Divisions most directly involved in delivering services to end-users are the General Forecasting Division and the Aviation Services Division. These Divisions rely on essential support from other sections of Met Éireann – for example, in the areas of observing systems, instrumentation and Information Technology. Especially important is the computer-based guidance provided to the operational meteorologists by the Research and Applications Division.

General Forecasting

The General Forecasting Division supplies a wide range of forecast services through the Central Analysis and Forecast Office (CAFO) and the RTÉ Weather Office.

During 2001, the Division continued its routine provision of general weather forecasts and warnings. Specialised forecasts were provided to the marine and agriculture sectors, the Defence Forces and the emergency services. Forecasts of pollen and sunburn index were issued during the spring and summer months.

The Division supplied customised weather services to national and local media, energy utilities, the building industry, and several other business and commercial interests. In collaboration with the National Roads Authority, winter road maintenance forecasts were provided for over 50 sites nationwide. The Telephone Consultancy Service (which provides direct customer access to the operational weather forecasters) continued to prove popular with many industrial and commercial clients.

The premium-rate Weatherdial service received over 1.1 million calls, a slight decrease on the 2000 total.

As part of Met Éireann's on-going commitment to quality customer service, the Division implemented a new forecast verification scheme for 2001, based on the 07.55 a.m. RTÉ radio forecast. Each morning, forecast values of temperature, wind, rainfall and sunshine duration are recorded for selected sites and stored in a computer file. The forecast values are later verified against observed conditions. The current system focuses on forecasts out to 24 hours ahead, but verification of the further outlook will be included later. Initial results from the new verification scheme are presented elsewhere in this Report.

CAFO's office accommodation has been in continuous use, 24 hours a day, for almost 25 years. To the great satisfaction of all concerned, a major refurbishment programme was completed during 2001.
Aviation Forecasting

The Aviation Services Division provides a wide range of services to civil, military and general aviation, in accordance with International Civil Aviation Organisation (ICAO) standards and national procedures. It comprises the Central Aviation Office (CAO) at Shannon Airport, at which the Head of the Division is normally based, together with the Meteorological Offices at Dublin, Cork and Knock Airports and at Casement Aerodrome. The Division is also responsible for services to a number of Regional Airports around the country.

During 2001 the Division issued SIGMET warnings for the Shannon Flight Information Region (FIR), and Terminal Aerodrome Forecasts (TAFs) for Shannon, Dublin, Cork and Knock Airports, and for Casement and Gormanstown Aerodromes. Local Area Forecasts (LAFs) were provided for the airports at Donegal, Sligo, Galway, Kerry and Waterford. The Division also provided support for Search and Rescue operations and telephone briefings for private pilots.

In collaboration with staff of the Instrumentation and Environmental Monitoring Division, Aviation Services Division helped ensure the smooth installation of a new enclosure for meteorological instrumentation at Cork Airport.

Aviation Services Division is the focal point for liaison between Met Éireann and the various international agencies involved in the regulation of aviation meteorology. During 2001, staff continued work on the development of a new forecast display system as part of a major ICAO project. The Division also participated in meetings of the Meteorology Group of ICAO’s European Air Navigation Planning Group (EANPG), and of the WMO’s Commission on Aeronautical Meteorology (CAeM).

### Summary of services provided by the Division in 2001

<table>
<thead>
<tr>
<th>Service</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of SIGMET Warnings for Shannon FIR</td>
<td>84</td>
</tr>
<tr>
<td>Number of Flight Folders provided</td>
<td>17,490</td>
</tr>
<tr>
<td>Number of aerodrome and wind shear warnings</td>
<td>846</td>
</tr>
<tr>
<td>Number of telephone aviation briefings</td>
<td>9,801</td>
</tr>
<tr>
<td>Number of Terminal Aerodrome Forecasts issued</td>
<td>19,890</td>
</tr>
<tr>
<td>Number of Local Area Forecasts issued</td>
<td>5,110</td>
</tr>
<tr>
<td>Number of Search and Rescue forecasts issued</td>
<td>223</td>
</tr>
</tbody>
</table>
Research and Applications

Numerical Weather Prediction (NWP)

During 2001 the major achievement in the NWP area was the operational implementation of the HIRLAM Version 5 programme suite. The new HIRLAM model runs in a parallel computing environment on IBM RS/6000 hardware. It operates on a 15 km horizontal grid, as compared to 33 km for HIRLAM Version 4, and shows improved predictive skill especially for wind and precipitation forecasts.

In response to the Foot and Mouth emergency, a numerical model for the airborne spread of the disease was adapted to use HIRLAM output and provided information to the veterinary authorities for the duration of the crisis. HIRLAM data was also supplied daily to the Radiological Protection Institute of Ireland (RPII) as input to models for estimating levels of fallout in the event of a nuclear accident.

Theoretical work continued on lateral boundary conditions. Because HIRLAM is a limited-area model and cannot 'see' what is happening outside its domain, there is a particular problem in computing pressure, temperature values etc. along the area boundaries themselves. Proper handling of these boundary-value calculations is essential to ensure continuity and minimise model forecast errors.

Agrometeorological Unit

The Agrometeorological Unit provided support to Government Departments and Agencies throughout the Foot and Mouth emergency. Mr. Denis Fitzgerald, Head of the Research and Applications Division, became co-ordinator of AGMET, the Joint Working Group on Applied Agricultural Meteorology.

During 2001 AGMET published a new book entitled 'Agro-Meteorological Modelling – Principles, Data and Applications', which was launched at a ceremony in University College Dublin. The AGMET group also made significant progress on a general review of weather services for Irish agriculture.

Marine Unit

Met Éireann's operational wave model (WAM) was upgraded to use the finer-resolution winds from HIRLAM Version 5. Initial results indicated an improvement in the accuracy of the wave forecasts.

A new weather buoy was deployed in the Irish Sea, the second to be installed as part of a joint Marine Institute / UK Met Office / Department of the Marine and Natural Resources / Met Éireann initiative. (The first was deployed off the Aran Islands in 2000). Both buoys functioned reliably and provided valuable data to Met Éireann's meteorologists.

Reports of Visibility from five automatic lighthouses operated by the Commissioners of Irish Lights were evaluated (Dundalk, Fastnet, Roche's Point, Baily and Kish), and are now being used in the operational forecast offices.
Observing and Technical Support Programme

Synoptic Network

Met Éireann's network of synoptic weather stations, at which hourly observations of weather conditions are made, comprises a mix of manned and automatic sites. A full programme of 24-hour observations was maintained throughout the year at all stations.

The existing Automatic Weather Stations (AWSs) do not provide adequate information on some weather parameters—e.g., visibility and cloud conditions. A set of intelligent sensors capable of monitoring these parameters was deployed at the synoptic stations in Mullingar and Kilkenny, for real-time assessment by the meteorologists in the Central Aviation Office.

A new logger-based on-line AWS, with most sensors duplicated, was designed and built in-house for deployment in The Unified Climatological and Synoptic Observational Network (TUCSON). At the year's end, a prototype was under test in the Instruments Unit.

A sensor calibration and equipment maintenance programme was carried out by the Instruments Unit. This included site visits throughout the synoptic network.

Library & Information Services

Good progress was made in implementing the Library's new cataloguing system. Three issues of Met Éireann's staff magazine Splanç were produced during the year. The librarian adopted the role of content manager and contributed to the maintenance and development of Met Éireann's new web site. By the end of the year a project to provide electronic access to subscription journals was well on the way to implementation.

The M2 Buoy ready for launch at Howth, Co. Dublin.

Staff at Met Éireann's synoptic station at Rosskare.
Airports

A fully duplicated sensor and telemetry system was installed at the new meteorological enclosure at Cork Airport, in a joint project with Aer Rianta.

A new anemometer and wind display system for airports was tested by the Instruments Unit. This was part of a major project to replace an older system and to meet the requirements of the Irish Aviation Authority over the next few years.

Meteorological Radar and Satellite Receiving Systems

Met Éireann operates two networked weather surveillance radars, located at Dublin and Shannon Airports. The microwave link between the Dublin Airport radar installation and Met Éireann's Glasnevin offices was partly renewed in 2001.

Images from meteorological satellites continue to play an important role in Met Éireann's forecasting activities. Preliminary investigations confirmed that new antennas, designed to receive images from the next generation of geostationary and polar-orbiting satellites, could be sited on the roof of the Glasnevin offices.

Valentia Observatory

The solar radiation monitoring systems at the Observatory were replaced and deployed in a new location. This completed a two-year project to upgrade the sensors, data collection and quality assurance procedures of Met Éireann's national solar radiation network.

A national geomagnetic survey carried out in 2000 and 2001 was completed. Updated maps of geomagnetic declination were prepared for the Ordnance Survey and the Irish Aviation Authority.

Working on the anemometer mast at Valentia Observatory.

A fibre-optic data collection network was installed at the Observatory.

Laboratory

The chemical composition of air and precipitation samples at selected synoptic stations was analysed as part of on-going national and international programmes. Some sampling systems and analysis procedures were changed, necessitating intercomparison of datasets.

Information Technology

The wide range of hardware and software systems supported by the IT Division operated throughout 2001 without any major problems. Among the highlights of the Division's work were:

Numerical Weather Prediction: Met Éireann's new IBM RS/6000 SP computer, named SWIFT, was installed and successfully site accepted. Development work to port the latest version of the HIRLAM forecast model to the new system was completed by the end of September, and the new SWIFT system became operational from 2nd October.
Telecommunications: New WAN communications links were installed between IT Operations at Glasnevin and Dublin and Cork Airports. Work on the completion of the Glasnevin LAN upgrade to Fast Ethernet (100BaseT) was completed. While the RMDCN (Regional Meteorological Data Communication Network) link to the UK Met Office and ECMWF continued to operate satisfactorily, the UK Met Office began work on installing a new electronic traffic routing (ETR) system via ECMWF as a back-up for their data.

Desktop Services: 33 new desktop PCs and 6 laptops were purchased during the year. Firewall and anti-virus systems were upgraded.

Web site: The IT Division played a central role in implementing Met Éireann's new web site which was launched in June.

Foot and Mouth Emergency: To help cope with the Foot and Mouth emergency, Met Éireann, in collaboration with the Department of Agriculture, Food and Rural Development, developed a new Foot and Mouth Dispersion Model. This was implemented on a high-specification workstation, with dual 1GHz processors, 1GB of memory and 40GB hard disk space.

Climate Programme

The main functions of the Climatology & Observations Division are (1) maintaining the National Climate Database, (2) management / quality-control of the observational station networks and (3) operating the Climate Enquiries Office, which delivers climatological data to customers and produces the Monthly Weather Bulletin.

Monthly Weather Bulletin


The new format of the Monthly Weather Bulletin, including colour images and charts, first appeared in January and met with a very positive response from readers.

During 2001 a total of 1,869 customer enquiries were received by post, fax and e-mail, representing an increase of 31% on the previous year. The increased demand for services may have resulted in part from the launch during the summer of Met Éireann's web site.
Routine inspection of rainfall and climate observing stations was seriously delayed by the Foot and Mouth emergency. On average, good-quality data was received throughout the year from some 550 stations, with 15 new stations being opened and 4 closed.

The Division played a major role in planning a joint scientific project with the National Climate Information Centre of the UK Met Office. Using Geographic Information Systems (GIS) techniques, the project aims to produce a comprehensive gridded set of Climatological Normal Indices for the island of Ireland.

The Weather of 2001

During 2001 the weather was generally drier and sunnier than normal, while temperatures were a little above normal.

Rainfall totals for the year were below normal everywhere. The winter and autumn months, which are usually the wettest, were much drier than normal. The heaviest daily falls of the year at many locations were measured during the summer months. Cork Airport's daily total of 65.5mm on 17th July was its highest for July since 1975, while a fall of 84.5mm measured at Johnstown Castle, Co. Wexford, on 13th/14th July included a 2-hour fall of 65mm. Another localised downpour at Dungarvan (Carraiglea), Co. Waterford, produced 124mm in the 2-day period between 19th and 20th October.

### The Weather of 2001

<table>
<thead>
<tr>
<th>County/ Station</th>
<th>RAINFALL (mm)</th>
<th>TEMPERATURE (°C)</th>
<th>SUNSHINE (HOURS)</th>
<th>NO. OF DAYS WITH:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of average</td>
<td>Most in a day date(s)</td>
<td>Mean</td>
</tr>
<tr>
<td>CO. CLARE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shannon Airport</td>
<td>793.5</td>
<td>85</td>
<td>19.9</td>
<td>5 Oct</td>
</tr>
<tr>
<td>Cork Airport</td>
<td>1077.3</td>
<td>91</td>
<td>65.5</td>
<td>17 Jul</td>
</tr>
<tr>
<td>Co. Donegal</td>
<td>856.7</td>
<td>80</td>
<td>27.4</td>
<td>10 Jul</td>
</tr>
<tr>
<td>Malin Head</td>
<td>628.6</td>
<td>n/a</td>
<td>33.4</td>
<td>7 Oct</td>
</tr>
<tr>
<td>Dublin Airport</td>
<td>581.1</td>
<td>81</td>
<td>26.2</td>
<td>7 Oct</td>
</tr>
<tr>
<td>Casement Aerodrome</td>
<td>1253.4</td>
<td>87</td>
<td>35.0</td>
<td>6 Mar</td>
</tr>
<tr>
<td>Co. Kilkenny</td>
<td>783.5</td>
<td>95</td>
<td>24.9</td>
<td>14 Aug</td>
</tr>
<tr>
<td>Co. Mayo</td>
<td>990.5</td>
<td>86</td>
<td>27.2</td>
<td>3 Dec</td>
</tr>
<tr>
<td>Belmullet</td>
<td>1081.2</td>
<td>n/a</td>
<td>27.4</td>
<td>6 Oct</td>
</tr>
<tr>
<td>Connaught Airport</td>
<td>731.0</td>
<td>79</td>
<td>20.8</td>
<td>8 Aug</td>
</tr>
<tr>
<td>Co. Monaghan</td>
<td>664.4</td>
<td>83</td>
<td>23.2</td>
<td>14 Aug</td>
</tr>
<tr>
<td>Clones</td>
<td>763.6</td>
<td>82</td>
<td>24.1</td>
<td>6 Jun</td>
</tr>
<tr>
<td>Co. Westmeath</td>
<td>869.1</td>
<td>99</td>
<td>46.6</td>
<td>7 Oct</td>
</tr>
<tr>
<td>Rossave</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Met Éireann annual report 2001 15
Mean annual air temperatures were around half a degree above normal overall, but were nevertheless the lowest for five years almost everywhere. After a relatively cold January and March, mean temperatures for May, October and November were well above normal. During a summer when high daytime temperatures were rare, the hottest day of the year at most stations was 28th July, but both Valentia Observatory and Belmullet had their highest temperatures on 12th/13th May. Unusually, the lowest air and ground temperatures were measured in early spring, during a short spell of very cold weather in the period 1st-4th March.

Sunshine totals for the year were well above normal almost everywhere; there was between 10% and 20% more sunshine than normal at most stations but as much as 23% more than normal at Cork Airport, where it was the sunniest year since records began there in 1962. January, February and December were sunniest relative to normal, while the summer was sunny in the west and south but relatively dull in the east and midlands. Daily sunshine values of over 14 hours were measured at most stations on 23rd May and 1st July.

Mean annual windspeeds of between 7 and 11 knots (8 and 13 m.p.h.) over most of the country were below normal everywhere and were the lowest on record at Valentia Observatory, Shannon Airport, Belmullet and Mullingar. Almost all stations had fewer than half the normal number of gales during the year, while none were recorded at most inland stations. The highest gust of the year, 74 knots (85 m.p.h.), was measured at Malin Head on 28th December.
Strategic Management

High-Level Objectives

Met Éireann’s High-Level Objectives, as identified in the Strategy Statement 1999-2001, are:

- To provide a comprehensive range of high-quality meteorological services to the Irish people and to all sectors of the Irish economy.
- To ensure the long-term sustainability of meteorological services in Ireland through adequate infrastructural investment.
- To help reduce public exchequer costs by engaging in profitable commercial activities, while maintaining a constructive relationship with the private sector and always conforming fully with competition law.
- To obtain optimum benefit from developments in meteorological science by prudent utilisation of modern technology, by a well-focused research programme and by collaboration with relevant bodies.
- To utilise fully the talents and potential of all staff by pursuing a humane and effective human resource policy, and by according high priority to training, communications and participation.
- To examine the current clerical, technical and professional grade structures with a view to matching individual skills to work requirements, and to promoting overall staffing flexibility.

Significant progress was made in achieving these objectives during 2001.

Meteorological Services

Met Éireann continued to fulfil its primary role as Ireland’s National Meteorological Service, delivering a wide range of weather forecast products to public and commercial interests. The full schedule of operational services to aviation was maintained, and a significant increase in demand for climatological information was addressed. All possible meteorological support was provided to Government Departments and Agencies in their efforts to cope with the Foot and Mouth emergency.

Forecast quality was enhanced through upgrades to Met Éireann’s numerical weather prediction (HIRLAM 5) and wave prediction (WAM) models. More systematic procedures for the verification of public weather forecasts were implemented.

A new web site and FTP server facilitated the delivery of weather forecasts and related meteorological services to end-users.

Meteorological Infrastructure

Upgrading and maintenance of Ireland’s meteorological infrastructure is a key aspect of Met Éireann’s mandate.

During 2001, good progress was made on TUCSON (The Unified Climatic/Synoptic Observing Network), a project to design, develop and deploy a network of logger-based Automatic Weather Stations. A prototype system was ready for installation and testing at the end of the year.
Meteorological equipment was installed at a new weather enclosure at Cork Airport in a joint undertaking with Aer Rianta. In co-operation with the Irish Aviation Authority, further technical investigations and planning took place on the deployment of new anemometer and wind displays at the airports.

Weather buoy M2 was positioned some 30 miles east of Dublin Bay, the second in a network planned jointly by the Marine Institute, the UK Met Office, the Department of the Marine and Natural Resources and Met Éireann.

A new database system to assist in the preparation and dissemination of weather forecasts was installed in the General Forecasting Division in November.

**Commercial Activities**

As in previous years Met Éireann's principal commercial activities included services to TV and media, the provision of premium-rate weather forecasts (Weatherdial) and forecasts of severe weather (including winter road ice) to the National Roads Authority and Local Authorities. Miscellaneous forecast services were also provided to a wide range of commercial and industrial interests (construction, marine, agriculture, energy utilities etc).

While overall revenues rose in 2001, there was clear evidence of increased competitiveness in the commercial meteorological market. Growing demands for high-quality client-specific services were accompanied by on-going downward pressure on prices.

**Science and Technology**

Met Éireann continued its participation in HIRLAM, an international project on co-operation in Numerical Weather Prediction. Forecast quality was enhanced through the implementation of Version 5 of the HIRLAM model on Met Éireann's new IBM RS/6000 SP computer.
The project teams established to prepare for the acquisition and exploitation of data from the Meteosat Second Generation (MSG) weather satellite system continued their work during the year. Launch of the first satellite (MSG-1) is expected in the second half of 2002.

Under the Research, Technological Development and Innovation (RTDI) programme administered by the Environmental Protection Agency, and the Programme for Research in Third-Level Institutions (PRTLI) scheme run by the Higher Education Authority, Met Éireann submitted a proposal to establish a Community Climate Change Consortium for Ireland. The Consortium, to be based around a Regional Climate Analysis, Modelling and Prediction Centre in Met Éireann, would seek to embrace all university and other groups active in climate research. Funding for the project was approved, and over the next five years Met Éireann plans to play a leading role in studying the impact of climate change in Ireland.

In discussions with the National Climate Information Centre of the UK Met Office, agreement was reached to undertake a joint project, using Geographic Information Systems (GIS) techniques, aimed at producing 5km gridded datasets of climatological elements for the island of Ireland.

A new national geomagnetic survey was completed by staff at Valentia Observatory, producing updated measurements on magnetic declination over Ireland. (Magnetic declination denotes the angle between magnetic North and true North, and lines on a map joining points of equal magnetic declination are referred to as isogonics).


Staff and Human Resource Management

A long-standing shortfall in staff numbers was significantly reduced during 2001, largely due to improved recruitment procedures. Nonetheless, manning levels in many operational and support areas were still under pressure at the end of the year due to on-going training of new recruits. Met Éireann continued to engage some contract staff to help maintain essential services.
Met Éireann’s Partnership Council was very active during the year - in all, seven meetings were held, one at Connaught Airport, Co. Mayo. At each meeting two 'open seats' were provided to enable as many staff members as possible to attend. A tri-partite gathering of the Partnership bodies in Met Éireann, the Geological Survey of Ireland and the parent Department took place in April.

2001 was also a busy year for the Partnership Subgroups. The Human Resources Strategy Group prepared reports on Direct Recruitment, Devolution of HR Responsibilities and the establishment within Met Éireann of a separate HR Division. Under the aegis of the HQ Accommodation Panel, a consultant was engaged to make proposals for the renovation of the Glasnevin offices. The Staff Customer Service Panel presented a review of the Customer Service Plan, and arranged a professional survey of public attitudes to Met Éireann and its services.

Awards in recognition of exceptional performance were made to nine staff members by the Merit Awards Panel. The Communications Group liaised with the new Communications Committee within the parent Department. The launch and initial training for the Performance Management and Development System was overseen by the PMDS Implementation Group.

North-South Co-operation

Continuing a series of bilateral meetings, staff from the Northern Ireland branch of the UK Met Office visited Met Éireann in June and October, with the aim of further developing existing friendly relationships between the two organisations and identifying possible areas for collaboration. In partnership with the National Roads Authority, agreement was reached on the routine exchange of reports from roadside weather stations throughout Ireland - such information is especially useful to local authority engineers in planning winter road maintenance programmes. Some progress was also made on co-operation in the deployment of meteorological workstations in Met Éireann.
Other Activities

Administration

Total expenditure in 2001 was within the approved allocation leaving an amount to be brought forward to 2002. The underspend of approximately €380K (£300K) was mainly in the capital areas - plans to replace the existing VAX computers were deferred, and payments in respect of the new NWP server and AWS sensors were less than budgeted. In addition, a number of smaller projects were delayed or deferred due to staff shortages.

The 3-year Administrative Budget cycle ended on 31st December 2001 and negotiations on a new agreement for 2002-2004 were expected to commence in early 2002.

All preparations for conversion to the Euro were completed well in advance of the changeover date.

Staff recruitment procedures improved considerably to the extent that it was possible to fill 22 Meteorological Officer and 4 Meteorologist vacancies during the year. New arrangements for direct liaison between Met Éireann and the Civil Service Commission proved very satisfactory and it is hoped that similar arrangements can be agreed with the Department of Finance.

Implementation of the recommendations of the Value for Money Examination carried out by the Comptroller and Auditor-General during 2000 focused on the development of an interim Transparent Accounts system and improved procedures for the verification of forecast accuracy.

Met Éireann is scheduled to produce a new Statement of Strategy in 2002. In September, members of the Partnership Council and the Management Committee attended a seminar presented by Dr. Richard Boyle of the Institute of Public Administration, to review the current Strategy Statement and discuss procedures and options for compiling its successor.

Customer Survey

The Staff Customer Service Panel recommended to the Partnership Council that Met Éireann should arrange a professional survey of public perceptions and attitudes towards its products and services. Following management approval, a number of market research companies were approached and the contract to conduct the survey was awarded to Irish Marketing Surveys. Field research was carried out in November and preliminary results presented to Met Éireann in December.

Among the main questions addressed in the survey were:

- Is there a strong awareness of Met Éireann's role as Ireland's National Meteorological Service?
- By what means is weather information most often accessed – TV, radio etc.?
- Does the public value Met Éireann's forecasts above those available from other sources?
- How important is weather information?
- How useful are Met Éireann's forecasts perceived to be?
- Are times, formats and content of forecasts appropriate / convenient?
- Does Met Éireann provide good value for money?

The results showed that Met Éireann was widely recognised as the principal provider of weather services in Ireland, and that TV / radio were the most-used means of accessing weather information. Overall, people approved of the style and content of Met Éireann’s forecasts, and recognised their value in contributing to safety and the routine organisation of work and social activities.

The analysis of responses to some issues raised in the survey is shown below.

The survey generated much valuable information which will be utilised by Met Éireann in planning the future development of weather forecast services.

**International Affairs**

Met Éireann maintained its active involvement in the work of several international organisations, including the World Meteorological Organisation (WMO), the International Civil Aviation Organisation (ICAO), the European Centre for Medium-Range Weather Forecasts (ECMWF), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Co-operation in Meteorology grouping (ECOMET) and the European Meteorological Network (EUMETNET). Met Éireann also continued its participation in HIRLAM, a co-operative project in Numerical Weather Prediction between the Nordic countries, Spain, the Netherlands and Ireland.

<table>
<thead>
<tr>
<th>Weather warnings issued by Met Éireann are of little importance</th>
<th>Agree</th>
<th>Disagree</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>I never pay any heed to severe weather warnings from Met Éireann</td>
<td>9</td>
<td>8</td>
<td>78</td>
</tr>
<tr>
<td>I couldn't be bothered checking the weather forecast because it's never right</td>
<td>11</td>
<td>9</td>
<td>75</td>
</tr>
<tr>
<td>I often get confused with the level of detail in Met Éireann's weather forecasts</td>
<td>12</td>
<td>11</td>
<td>73</td>
</tr>
<tr>
<td>The style of Met Éireann's weather forecasts is dull and boring</td>
<td>18</td>
<td>11</td>
<td>66</td>
</tr>
<tr>
<td>I only half listen to the weather forecast</td>
<td>23</td>
<td>15</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>10</td>
<td>52</td>
</tr>
</tbody>
</table>
At the EGOS meeting in Dublin: Wil van Dijk (Vice Chairman), Evelyn Murphy (Met Éireann), Volker Wagner (Chairman) and Peter Blouch (Technical Co-ordinator).

A meeting of the European Group on Ocean Stations (EGOS) was hosted in Dublin in June. EGOS comprises nine member states, including Ireland, and its main function is to maintain an operational network of drifting and moored buoys in the North Atlantic and surrounding seas. The buoys are fitted with instrumentation to make weather measurements and transmit them to Met Éireann and other National Meteorological Services. These data make an important contribution to the accuracy of Irish weather forecasts.

Mr. René Hoenson, chief executive of ECOMET, visited Met Éireann in June. Mr. Hoenson gave a presentation describing the nature and purpose of ECOMET and held detailed discussions with management on current ECOMET procedures and likely future developments.

Mr. Anders Persson of ECMWF visited Met Éireann and gave a number of presentations on the use and interpretation of ECMWF's forecast products, focusing in particular on output from the Centre's Ensemble Prediction System. He also gave a public lecture entitled 'Is it possible to understand Dynamic Meteorology?', which was organised in University College Dublin under the auspices of the Irish Meteorological Society.

Volvo Ocean Race

The Round-the-World Volvo Ocean Race started from Southampton on September 23rd 2001. On board the Nautor Challenge Armer Sports Too yacht was Willemien van Hoeve, a native of Holland who has worked in Met Éireann since September 2000. Willemien is an experienced sailor and, with an M.Sc. in Meteorology and Physical Oceanography, was well placed to help guide Armer Sports Too through some of the world's roughest oceans and most extreme weather conditions.

The yachts leaving Cape Town on 11th November, Armer Sports Too is in the foreground.

The EGOS meeting in Dublin: Wil van Dijk (Vice Chairman), Evelyn Murphy (Met Éireann), Volker Wagner (Chairman) and Peter Blouch (Technical Co-ordinator).
Appendix I - Staff Training and Development

General

During 2001, Met Éireann staff attended general training courses totalling 348 training days. Three newly appointed Meteorologists completed the Initial Forecaster Programme at the UK Met Office College. At Casement Aerodrome, seventeen Meteorological Officers completed their initial training and ten Air Corps cadets attended a twenty-lecture training course. A total of eleven staff availed of the Refund of 3rd Level Fees scheme, two of whom successfully concluded their studies.

At the end of the year there were the equivalent of 229.5 staff posts filled in Met Éireann (taking into account work sharing etc).

Performance Management and Development System

The major focus of Met Éireann's training activities was on preparations for the introduction of the Performance Management and Development System (PMDS).

In May, the Taoiseach announced the launch of PMDS as the latest phase of the Strategic Management Initiative (SMI). The PMDS's main goal is to contribute to continuous improvement in performance across the Civil Service by aligning individual and team performance with organisational goals, and monitoring progress in their achievement. It also provides a context in which the development needs of job holders can be addressed.

As in other Civil Service Offices, Met Éireann established a PMDS Implementation Group as a sub-group of the Partnership Council. In addition, a full-time PMDS Officer was appointed to oversee all stages of the PMDS process and in particular to support the major training effort required to familiarize staff with PMDS concepts and procedures.

Trainers and trainees at a Meteorological Officer training course in Casement Aerodrome.
Plans were made to deliver training on a 'just-in-time' basis, corresponding to the three phases of PMDS implementation – the completion of a Role Profile Form by the manager and jobholder (Phase 1), on-going assessment of progress against the performance plan (Phase 2), and a formal review of performance at the end of the cycle (Phase 3). Six staff members volunteered to act as internal trainers, and undertook intensive training to acquire the skills needed to present PMDS to their colleagues.

Phase 1 training began in May, and by July virtually all staff had attended a two-day course at one of 5 locations (Dublin, Sligo, Killarney, Kilkenny and Tullamore). Role Profile Forms were prepared and returned to the PMDS Unit. As soon as Phase 1 was completed, the trainers began preparations for Phase 2, and delivery of a second one-day course began in November at three locations (Dublin, Killarney and Carrick-on-Shannon). By the end of the year about 50% of staff had completed Phase 2 training.

A total of 678 PMDS training days were delivered during 2001. In terms of staff and other resources, this represented a major challenge for Met Éireann and particularly for the trainers who made an enormous personal commitment of time and effort. The fruits of all these exertions will be seen in future years as PMDS becomes fully integrated into Met Éireann's routine procedures.

Learning Resource Centre (LRC)

Operating under the day-to-day management of the librarian, the Learning Resource Centre continued to prove popular with staff. The range of learning / training materials was enhanced, and the LRC continued to be registered as a Testcentre for the European Computer Driving Licence (ECDL).

In 2001 Met Éireann joined EUMETCAL, an EUMETNET project designed to promote the joint development of computer assisted learning (CAL) materials for meteorology.
Appendix II - Forecast Accuracy

Verification of Public Weather Forecasts

During 2001, Met Éireann began implementation of the Comptroller and Auditor-General’s recommendations regarding verification procedures for public weather forecasts, contained in the C&AG’s Value for Money Report Number 35.

As an initial step, predicted daily values of maximum temperature, minimum temperature and rainfall, based on the daily RTÉ 1 radio forecasts at 07.55, were verified at four sites (Dublin, Cork, Birr and Belmullet). Figures 1 and 2 show the monthly variation of the Root Mean Square (RMS) error for the maximum and minimum temperature forecasts (the smaller the RMS error, the better the forecast). Figure 3 shows the verification of rainfall amount by means of Hanssen and Kuipers’ Score – this has a value of 1 for a perfect forecast, and zero for a random forecast, i.e. one lacking any skill. Averaged over the year, the results show an RMS error of about 1.4°C in the maximum temperature, and about 2.0°C in the minimum temperature. For rainfall, the average value of the Hanssen and Kuipers’ Score is 0.42.
An indication of the quality of the forecasts can be got by comparing these scores with the values that would be obtained for a 'standard' forecast. In this case, we use persistence as a standard – i.e., a forecast that assumes that tomorrow's weather will be the same as today's.

The comparative scores, averaged over the year, are shown in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Max. Temperature (RMS Error)</th>
<th>Min. Temperature (RMS Error)</th>
<th>Rainfall (Hanssen and Kuipers' Score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecast</td>
<td>1.42°C</td>
<td>2.03°C</td>
<td>0.42</td>
</tr>
<tr>
<td>Persistence</td>
<td>2.06°C</td>
<td>3.16°C</td>
<td>0.16</td>
</tr>
</tbody>
</table>

As would be expected, in all cases the forecast scores are very substantially better than those for persistence.

**Numerical Weather Prediction**

The evolution of the verification scores for the HIRLAM forecasts of 2-Metre Temperature and 10-Metre Wind Speed from 1996 to 2001 is shown in Figures 4 and 5.

Figure 4 gives the Root Mean Square error scores of forecast 2-Metre Temperature for 24 hrs and 48 hrs, verified against actual temperature reports from the network of Irish observing stations. Both scores show a marginal increase in RMS error compared with corresponding values for 2000.

Figure 5 shows the Root Mean Square error scores of forecast 10-Metre Wind Speed for 24 hrs and 48 hrs. The score for the 24hr forecast is very similar to the value obtained in 2000, while for the 48hr forecast a small improvement is evident.
Road Surface Temperature

Forecasts of road conditions are provided under contract to the National Roads Authority. Verification of the Road Surface Temperature (RST) minimum forecasts was carried out during the winter 2000/2001 season for the so-called critical nights (nights on which RSTs less than 5°C were observed) for all available sites. Table 2 shows the Hanssen and Kuipers’ Score and the RMS error for the 2000/2001 forecasts, along with the corresponding values for the winter seasons 1999/2000 and 1998/1999.

<table>
<thead>
<tr>
<th>Year</th>
<th>Hanssen and Kuipers’ Score</th>
<th>RMS Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2001</td>
<td>0.70</td>
<td>1.7°C</td>
</tr>
<tr>
<td>1999-2000</td>
<td>0.58</td>
<td>1.7°C</td>
</tr>
<tr>
<td>1998-1999</td>
<td>0.55</td>
<td>1.8°C</td>
</tr>
</tbody>
</table>

The Hanssen and Kuipers’ scores show a significant improvement over the three-year period, while the RMS errors have remain largely unchanged.

Air Temperature Forecasts

Early morning forecasts of maximum and minimum temperatures for Dublin and Cork, for the current day and the subsequent two days, are issued by the General Forecasting Division. These forecasts are subsequently verified against observations at Dublin and Cork Airports. Figure 6 shows the annual RMS error scores for Dublin for the period 1997-2001 (Max1 = max. temperature on current day, Max2 = max. temperature on following day etc). Figure 7 shows the corresponding RMS error scores for Cork.

The RMS errors for Dublin and Cork are broadly comparable with those of 2000. Small improvements are evident in, for example, the Max1 and Min2 scores for Cork, but there are also some disimprovements, as in the Max1, Min1 and Min3 scores for Dublin.
Appendix III - Publications


Lynch, P. 2001: Max Margules and his Tendency Equation. Historical Note No. 5, Met Éireann.


McGrath, R. 2001: HIRLAM 5 on the IBM RS/6000 SP, HIRLAM Progress Report No. 22.


Appendix IV - Met Éireann Finances

The figures presented below are approximate and for information only. They do not form part of the official annual accounts of Met Éireann. All amounts are in Euro.

<table>
<thead>
<tr>
<th>Income and Expenditure 2001/2000</th>
<th>2001 €’000</th>
<th>2000 €’000</th>
<th>2001 €’000</th>
<th>2000 €’000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries and Related Expenses (A1)</td>
<td>11,302</td>
<td>10,363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Operating Expenses</td>
<td>2,058</td>
<td>1,978</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Expenditure</td>
<td>1,101</td>
<td>625</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contributions to International Organisations</td>
<td>2,810</td>
<td>1,903</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,271</strong></td>
<td><strong>14,869</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipts from Eurocontrol (Route Charges)</td>
<td>6,487</td>
<td>7,091</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipts from Commercial &amp; Cost Recovery Activities</td>
<td>1,463</td>
<td>1,312</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Receipts</strong></td>
<td><strong>7,950</strong></td>
<td><strong>8,403</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Cost of Operations</td>
<td></td>
<td></td>
<td><strong>9,321</strong></td>
<td><strong>6,466</strong></td>
</tr>
</tbody>
</table>

Some details of above

A1
- Salaries: 10,433, 9,825
- Overtime: 747, 414
- Payment to Observers: 88, 80
- Other Allowances: 34, 44

A2 (Travel & Subsistence): 146, 196
A3 (Training/Library/Printing etc): 442, 359
A4 (Communications & Post): 216, 206
A5 (Computing - Capital): 818, 208
A5 (Computing - Non-Capital): 394, 326
A6 (Maintenance/Energy): 287, 391
A7 (Consultancy): 36, 41
A8 (Instrumentation - Capital): 283, 416
A8 (Instrumentation - Non-Capital): 537, 460

**14,461** **12,966**

Some details of commercial/cost recovery receipts

- Aviation: 22, 32
- Climatological Information: 126, 109
- General Forecasting: 1,293, 1,153
- Miscellaneous: 22, 18

**1,463** **1,312**
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Co. Mayo
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Fax: +353-94-67390
Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGMET</td>
<td>Joint Working Group on Applied Agricultural Meteorology</td>
</tr>
<tr>
<td>AWS</td>
<td>Automatic Weather Station</td>
</tr>
<tr>
<td>CAeM</td>
<td>Commission for Aeronautical Meteorology</td>
</tr>
<tr>
<td>CAFO</td>
<td>Central Analysis and Forecast Office</td>
</tr>
<tr>
<td>CAL</td>
<td>Computer Assisted Learning</td>
</tr>
<tr>
<td>CAO</td>
<td>Central Aviation Office</td>
</tr>
<tr>
<td>EANPG</td>
<td>European Air Navigation Planning Group</td>
</tr>
<tr>
<td>ECDL</td>
<td>European Computer Driving Licence</td>
</tr>
<tr>
<td>ECMWF</td>
<td>European Centre for Medium-Range Weather Forecasts</td>
</tr>
<tr>
<td>ECOMET</td>
<td>European Co-operation in Meteorology</td>
</tr>
<tr>
<td>EGOS</td>
<td>European Group on Ocean Stations</td>
</tr>
<tr>
<td>ETR</td>
<td>Electronic Traffic Routing</td>
</tr>
<tr>
<td>EUMETCAL</td>
<td>European Meteorological Computer Assisted Learning</td>
</tr>
<tr>
<td>EUMETNET</td>
<td>Network of European Meteorological Services</td>
</tr>
<tr>
<td>EUMETSAT</td>
<td>European Organisation for the Exploitation of Meteorological Satellites</td>
</tr>
<tr>
<td>FIR</td>
<td>Flight Information Region</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>HIRLAM</td>
<td>High-Resolution Limited Area Model</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organisation</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>LAF</td>
<td>Local Area Forecast</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LRC</td>
<td>Learning Resource Centre</td>
</tr>
<tr>
<td>MSG</td>
<td>Meteosat Second Generation</td>
</tr>
<tr>
<td>NRA</td>
<td>National Roads Authority</td>
</tr>
<tr>
<td>NWP</td>
<td>Numerical Weather Prediction</td>
</tr>
<tr>
<td>PMDS</td>
<td>Performance Management and Development System</td>
</tr>
<tr>
<td>PRTLI</td>
<td>Programme for Research in Third-Level Institutions</td>
</tr>
<tr>
<td>RAWS</td>
<td>Roadside Automatic Weather Station</td>
</tr>
<tr>
<td>RMDCN</td>
<td>Regional Meteorological Data Communications Network</td>
</tr>
<tr>
<td>RMS Error</td>
<td>Root Mean Square Error</td>
</tr>
<tr>
<td>RPII</td>
<td>Radiological Protection Institute of Ireland</td>
</tr>
<tr>
<td>RST</td>
<td>Road Surface Temperature</td>
</tr>
<tr>
<td>RTDI</td>
<td>Research, Technological Development and Innovation</td>
</tr>
<tr>
<td>SIGMET</td>
<td>Information on occurrence of specified aviation weather phenomena</td>
</tr>
<tr>
<td>SMI</td>
<td>Strategic Management Initiative</td>
</tr>
<tr>
<td>TAF</td>
<td>Terminal Aerodrome Forecast</td>
</tr>
<tr>
<td>TUCSON</td>
<td>The Unified Climate/Synoptic Observing Network</td>
</tr>
<tr>
<td>WAM</td>
<td>Wave Forecast Model</td>
</tr>
<tr>
<td>WAN</td>
<td>Wide Area Network</td>
</tr>
<tr>
<td>WMO</td>
<td>World Meteorological Organisation</td>
</tr>
</tbody>
</table>

Acknowledgements and photo credits

Aer Rianta
University College Dublin
Rick Tomlinson (Volvo Ocean Race)
Met Éireann staff