Irish Meteorological Society

Newsletter
Number 41

May 1994

Sincere thanks to the

Bank of Ireland,
College Green, Dublin2 .

They have very kindly supplied for each member of the Irish Met Society a guide to USA '94.

This gives a complete listing of all the games, the dates and the venues in a handy, portable 'slide pack'.

Mr. Eamon Murphy,
Meteorological Service,
Glasnevin Hill,
Dublin 9.

Table of Contents

Committee notes

The Irish Meteorological Society (IMS) includes members not only from Ireland but from all over the world who are interested in weather and weather- related topics. The membership is drawn from the ranks of those who work in Meteorology, Aviation, Marine and Agriculture, from teachers and lecturers and indeed anyone who is interested in meteorology and the environment.
The objects of the Society are :
1) The promotion of an interest in meteorology .
2) The dissemination of meteorological knowledge, pure and applied.

The Annual General Meeting of the Society was held on 16April following the one-day. 20 members attended. A full report follows on Pg 5. We welcome five new members to the Committee. Mr Bill Wann, retired from the Met. Service in 1990 after a distinguished career spanning over 40 years and having been Assistent-Director for the last seven. Mr Kyran Dollard is a Systems Analyst in the Computer Division of the Met Service. Mr Douglas Gordan is Technical Director in his own company, *Gordan D.A.*, which specialises in Enviornmental Instrumentation and Data Capture. Mr John Flannery is an Analyst Progammer in Semperit Tyres. He is also on the committee of the *Irish Astronomical Society* and edits its Newsletter. Mr Kieran Cummins is a Meteorologist in the Instruments and Observations Div. and served as chief Scientist for 4 years in Valentia Observatory.

Committee for IMS 1994-1995

President---------- Mr. Bill Wann
Vice-President-------- to be filled
Secretary---------- Mr. Kieran Cummins
Assist-Sec.---------- Mr. Edward Graham
Treasurer---------- Mr. Kyran Dollard
Assist-Treas.---------- to be filled
Mr. Dermot McMorrow
Mr. Liam Campbell
Dr. Pat Shannon
Mr. Paul Halton
Mr. John Flannery
Mr. Douglas Gordan

Editor----------Ms Evelyn Cusack

Irish Meteorological Society 1993-1994 Season

Dr John Sweeny addressed the Society on 4March. It proved to be a most interesting and educational lecture and was enjoyed by the large number of people present and we are delighted to present his paper in this Newsletter.

Despite the sunny weather over 50 people attended the one-day meeting on 16April and judging from the general reaction it was a success. We were addressed by Dr Ray Bates, Mr Liam Bourke, Dr Paul Dowding, Prof John Prichard, Ms Marcella Dunne and Comdt Alan Woolhead. We hope to present resumes in future Newsletters.
Sincere thanks to all the speakers and to the chief organisers of the event, Paul Halton, Edward Graham and Peter Lynch.

Our field trip, 21May, was to Birr and details will be given in Newsletter 42. Apart from the educational aspects of the trip we all had a great day out and thankfully the weather held out.

September 17th 1993----------Lecture-"*Fronts and Cyclogenesis*"

October ----------*Newsletter No. 39*

November 19th. ----------Lecture-"*Past Met. Conditions From Irish Tree-Rings*"

December 10th ----------Lecture-"*Policy aspects of Climate and Climate Change.*"

January ----------*Newsletter No. 40*

January 22nd 1994----------*Annual Dinner Central Hotel, D2.*

March 4th ----------Lecture-"*Human Impact on Irish Climate*"

April 16th ---------- One Day Meeting
A. G. M.

May 21st ----------Field Trip to Birr

May----------Newsletter No. 41

Summer ----------Newsletter No. 42

PHOTO GALLERY
One-Day Meeting, 16April,1994

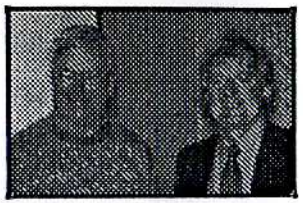
Photographs JOHN DOYLE

Ray Bates Paul Dowding Liam Bourke

Aodghain Roddy

Sean McCarthy
Bill Wann
Evelyn Cusack
John Flannery

Paul Halton - Denis Fitzgerald
Tony Scott - Peter Lynch



John Doyle - Ray B.

Report on the Annual General Meeting Irish Meteorological Society Tara Tower Hotel, Dublin 16 April 1994

Item 1 Secretary's Report --- Adopted

The final event in the '92-'93 season was the One-Day meeting and A.G.M. held in the Tara Tower Hotel on April 24th 1993. An interesting and varied series of talks by John Flannery, Liam Campbell(39), Edward Graham (39), Richard Butler(38) and John Lynch(38) preceded the A.G.M.

The first lecture of the 1993-1994 season was on 17Sept by Prof H Davis, lecturer in Physics in the Institute for Atmospheric Physics, Zurich and it covered the historical theoretical advances in fronts and cyclogenesis.(40)

Prof. Baillie, Palaeoecology Centre, Queen's University, Belfast, spoke to us on19Nov on oak tree-ring chronologies.(41)

On 10Dec Dr John Maunder, President of the WMO Commision for Climatology and a visiting lecturer to the Geography Dept, UCD,told us about the policy aspects of climate change.(40)

A very successful fourth Annual Dinner took place in the Central Hotel, Dublin on January 22nd although the pudding was not as nice as last year.

Dr John Sweeny, lecturer in Geography, Maynooth, gave a widly appealing discourse on the impact man has made on local and global climates.(41).

The committee met twice during the new season 28May93 and10Dec93 - So aspiring new committee members need not be daunted by the prospect of over-work!

The Irish Meteorological Service has continued to allow us use the facilities of the Service to operate and for this we are most grateful. Our thanks also to Brendan McWilliams whose "Weather Eye" always ensures a large attendance. Indeed, all those who have lectured to, prepared articles for and advertised the Society in the past year deserve our thanks, as do the many people in the Meteorological Service who have assisted through mail-metering, mail collection / delivery and printing.

This season a new style Newsletter was introduced. It was felt that an A5 size would be more 'user-friendly'. Members are invited to contribute. An additional feature is 'Weather Corner'.

My term of office now expires but I will finish Newsletter 41 and oversee our field-trip to Birr on May21. Over the last four years I have been priveliged to work with people who have shown dedication and committment and have given freely of their time in the interests of the Society in their roles as officers or members of the committee; my sincere thanks to all involved.

I also thank the members of the Society who deserve special mention , not just for their attendance at events, but for supporting the Society during the past year and my thanks and welcome also to all new members. I would also like to thank Dr. Aidan Nulty and Mr Colm Flaherty and as always Dr Tony Scott and UCD, Earlsfort Terrace.

I wish the Society every success in the future and may it grow from strength to strength.

Evelyn J. Cusack.

Item 2 Treasurer's Report ----- Adopted

Statement of Accounts for Year ending 31st Dec. 1993

INCOME:

Membership Country/Dublin/Student etc.	IR	656.00
Subs. British Wx. Mag. by 11 @ 24.00	IR	264.00
(3 subs recd during 1992 accounts)		
One Day Meeting B of I Contribution	IR	50.00
Arrears/Forward Payment of Subs.	IR	234.00
Interest on Savings	IR	47.56
Annual Dinner Cash Recd.38 @17.50 apx	IR	666.90
Subs. to Met. Service IMS monthly wx. 3 @15	IR	45.00
Total Income	IR	1963.46

EXPENDITURE:

Payment to BMO for Wx. Mags.	IR	256.35
Lecture Expences	IR	266.00
One Day/AGM	IR	270.43
Bank Charges on C/A	IR	26.99
Misc. Stationary Etc. Treas./Sec.	IR	28.90
Ann. Dinn. 45 (includes 6 guests) @ 17.43 apx each.	IR	732.00
Subs Paid on to Met Service for monthly wx by 3	IR	45.00
Total Expenditure	IR	1625.67

Income vs Expenditure

Total Income	IR	1963.46
Total Expenditure	IR	1625.67
Difference	+IR	337.79

C/A Balance carried over from 1992	IR	29.70
S/A Balance ,, ,, ,, 1992	IR	1355.25
Cash in hand ,, ,, ,, 1992	IR	14.00
Total Assets at end of 1992 carried to 1993	IR	1398.95

C/A Balance at tne end of 1993	IR	145.14
S/A ,, ,, ,, 1993	IR	1591.79
No cash held.		
Total	IR	1736.93

Increase in funds in 1993 over 1992	IR 337.98
Increase due income vs expenditure	IR 337.79

Compiled by :Sean McCarthy

Signed: Sean McCarthy

Item 3 Elections to the Committee

I.M.S. Outgoing Committee (1993-1994)

++ **President**---------- Dr. Peter Lynch
*** **Vice-President**-------- Mr. Philip Vardon - Retired
*** **Secretary**---------- Ms. Evelyn Cusack
Assist-Sec.---------- Mr. Edward Graham
*** **Treasurer**---------- Mr. Sean McCarthy
Assist-Treas.---------- Unfilled
Mr. Dermot McMorrow
Mr. Liam Campbell
*** Mr. Seamus Walsh
++ Dr. Pat Shannon
Mr. Paul Halton
++ Capt. Kilian Tormey

*** Elected 1990 - re-elected 1992 - term of office now expired

Sean McCarthy
Seamus Walsh
Evelyn Cusack

++ Elected 1992 - Available for re-election

Dr. Peter Lynch
Dr. Pat Shannon
Capt. Kilian Tormey

Elected 1993 - member of committee until April 1995

Edward Graham
Liam Campbell
Dermot MacMorrow
Paul Hallon

The following members were elected to the 1994-95 Committee

	Proposed by	Seconded by
Bill Wann	Aoghan Roddy	Paul Halton
Kyran Dollard	Sean Mc Carthy	Paul Halton
Kieran Cummins	Evelyn Cusack	Denis Fitzgerald
Douglas Gordan	Edward Graham	Michael Walsh
John Flannery	Peter Lynch	Tony Scott

Item 4 Activities
Item 5 AOB

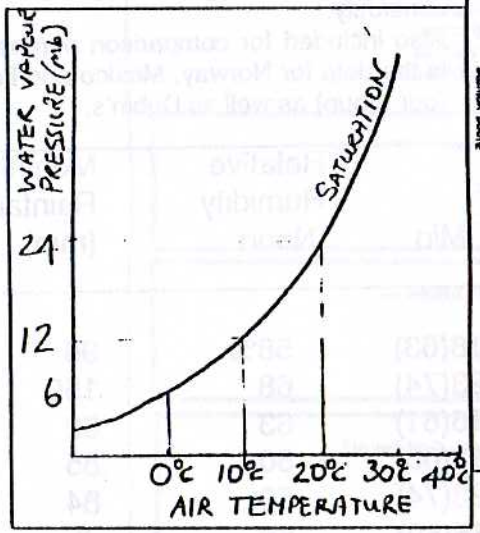
Mr Flannery suggested that the Newsletter Editor need not necessarialy be the Sec. Members are invited to write in with their own proposals. A vote of thanks was expressed to all involved in the 93-94 season.

World Cup Weather

Soon after the inital euphoria of the Republic of Ireland's qualification for USA '94 began the deliberations on the weather conditions our players would experience.
Much has been made of the fact that the oppressive heat and humidity would not suit, and in fact would inhibit, our hard running game. Also the match times coincide with (usually) the hottest time of the day. This led the Dutch medical team to appeal for a rescheduling of the matches to relatively cooler evening slots - but this was in vain.
Below are the average weather conditions fot the various venues for June/July.
Also included for comparison purposes is the data for Norway, Mexico and Italy (our group) as well as Dubin's.

Venue	Temp degC (degF) Max (shade)	Min	Relative Humidity Noon	Monthly Rainfall (mm)
New York	27(80)	18(63)	58%	96
Orlando	33(92)	23(74)	68	150
Boston	26(79)	16(61)	63	82
Chicago	26(79)	18(65)	60	85
Dallas	33(92)	23(74)	50	84
Los Angeles	26(79)	15(59)	56	3
San Francisco	18(65)	12(53)	66	3
Washington	26(78)	12(53)	30	24
Detroit	26(78)	16(61)	55	87
Dublin	19(67)	10(51)	77	63
Oslo	21(70)	11(52)	57	76
Monterrey (Mexico interior)	33(91)	22(71)	52	67
Rome	29(84)	18(64)	45	26
Cagliari	29(84)	20(67)	58	7

Orlando has the highest relative humidity and is one of the warmest venues.The temps are measured in a Stevenson's screen - in direct sunshine the temps actually experienced would be more than 10 degs higher. The relative humidityof air(RH) is the actual vapour pressure expressed as a percentage of the maximum possible at that temperature. The amount of moisture air is capable

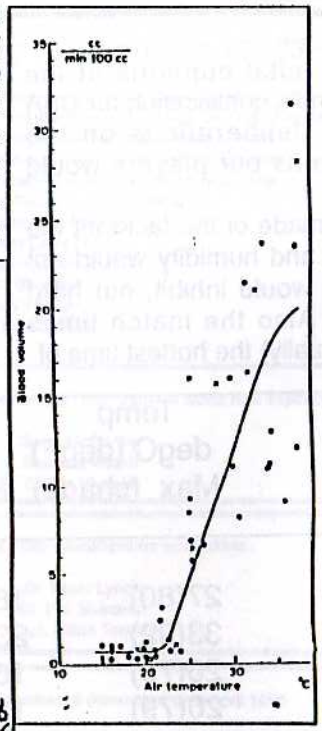


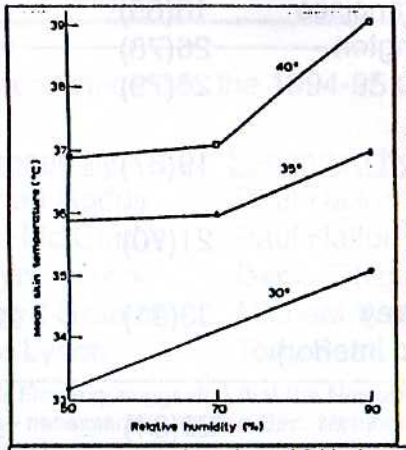
of holding depends upon its temperature - **the warmer the air the more moisture it can accommodate.** In fact we see above that the water vapour pressure increases very sharply with temperature. For example at 20degC it is twice that at 10degC.

The human body is a machine that works efficiently only at 37degC. It has its own control mechanisms to prevent overheating in warm/sunny weather. The heart begins to pump more blood, the blood vessels dilate to accommodate the increased flow, and blood is circulated closer to the skin's surface.

1) If the air temp is significantly below 37C excess body heat drains off into the cooler atmosphere.

2) As the air temp climbs towards 37C there is a reduced tendency for the excess heat to dissipate. Then water is exuded on to the surface of the skin through millions of sweat glands. Cooling of the body then only occurs when the excess water is removed by evaporation. The ability of the air to absorb water by evaporation is determined by its humidity. **The more water vapour in the air the less the body can cool down.**



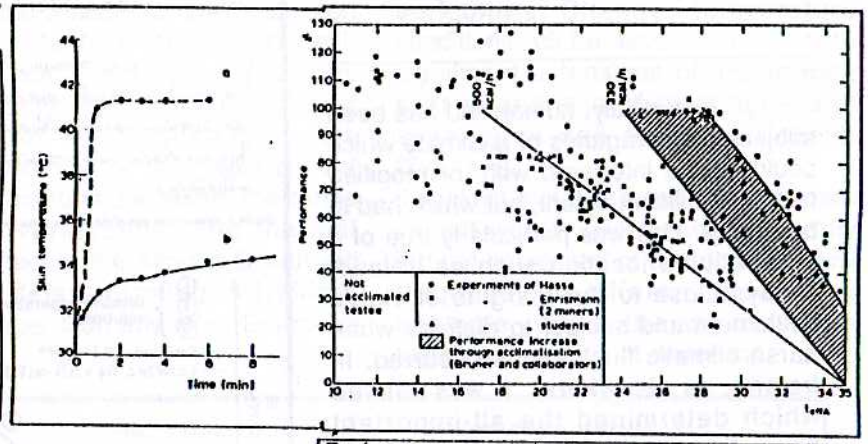


Skin temp as a function of RH after 2.5 hours subjection at 30, 35 and 40degC.

We can see here that high air humidities lead to a rise in skin temps of a couple of degrees.

Heat radiation/sunshine also leads to a significant rise in skin temp. Under an intensive incoming heat radiation such as will be experienced in the early afternoon matches skin temp rises of about 5C will occur

Heat radiation effect on skin temp a = incoming heat rad 1.5 cal. cm min (intense) b = 0.5 cal. cm min (normal)

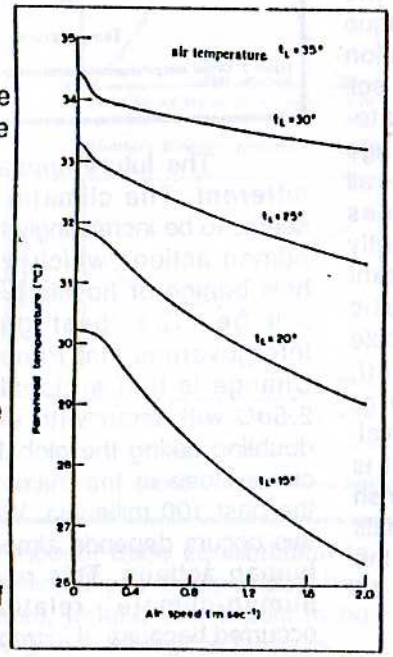


Performance capacity in dependence upon the effective temp with consideration of acclimatizion.

Wind may help to cool the body down.

At an air flow above 0.3m/sec the air temp influence on body temp is the greater, the lower the current air temp and the larger the wind speed.

However we can see here that **wind influences vanish above an air temp of 34degC.**



Acclimatization can help and man's heat acclimatization is quite remarkable. After approximately 10 days close - to - normal conditions can be attained. The teams will however experience difficult playing conditions and consequently there is bound to be some decrease in performance.

The process of keeping cool puts a considerable strain on the whole system as the heart pumps rapidly and the sweat glands pour liquid. (Blood circulation values at 40C air temp are about 10 times higher than at 20C).

It makes physiological sence in these circumstances for nature to prompt us to rest or sleep so as to inhibit the generation of further heat.

Hopefully this option will not be taken up by the Irish team !

Information gleamed from World Survey of Climatology by H.E. Landsberg.
B. McWilliams, L. Shiels and J. Logue (Irish Met Service)

Human Impact on the Climate of Ireland

----------by Dr. John Sweeney----------

Historically, humankind has been subject to the vagaries of a climate which could not be interfered with, or modified to any significant extent, but which had to be feared. This was particularly true of a high latitude location such as Ireland, always close to the margins of viable settlement and subject to distress when harsh climatic fluctuations occurred. In Ireland, as elsewhere, it was climate which determined the all-important harvest surplus on which all social and economic progress depended. For the natural environment it was climate which had earlier been indirectly responsible for blocking out the broad shape of the island, for moulding the general physique of the landscape and for the formation and spatial differentiation of the vital soil resource. Quaternary ice cover, Late-Pleistocene land bridges, the 'golden age of saints and scholars', the Famine - all had climatic dimensions sometimes forgotten by historians and frequently underestimated. Though it is important not to fall into the trap of climatic determinism, it is fair to say Irish people historically were, if not subjugated, certainly dominated, by the role of climate in their daily struggle for survival. Their preoccupation with the subject is therefore well chronicled in the early Irish documentary sources such as the Annals of the Four Masters where perhaps the earliest written references to meteorological events in the western world, a storm on Lough Conn, occurs (Figure 1).

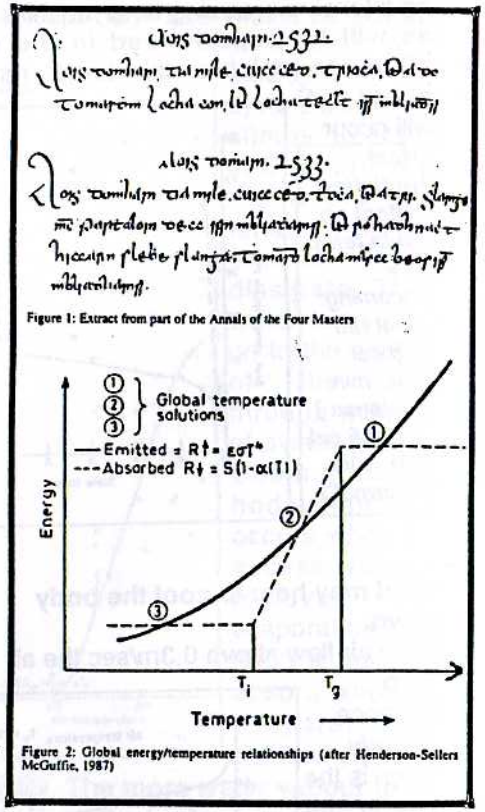


Figure 1: Extract from part of the Annals of the Four Masters

Figure 2: Global energy/temperature relationships (after Henderson-Sellers McGuffie, 1987)

The future appears to be very different. The climatic system now seems to be increasingly the prisoner of human actions which will determine how benign or hostile future climates will be. The 'best guess' of the Intergovernmental Panel on Climate Change is that a global increase of 2.5oC will occur with effective CO2 doubling taking the global temperature curve close to the maximum value of the past 100 millennia. Whether or not this occurs depends almost entirely on human actions. This reversal in the human-climate relationship has occurred because of increased human

composition of the atmosphere. In particular the ability of increased concentrations of 'greenhouse' gases to induce tropospheric warming and stratospheric cooling is now widely accepted, and concern for their impact on global climate has stimulated both scientific research and political initiatives to mitigate adverse consequences. Hard evidence for the expected effects however remain to be seen with current climatic parameters still within the range of natural varaiability. The thermal buffering effect of the Atlantic Ocean will inevitably delay warming in Ireland, perhaps longer than any other European country.

temperature change. Such a situation will undoubtedly have important implications for a wide range of environmental management issues, perhaps most importantly for agriculture. Changed temperature conditions will be associated with both significant extensions of the growing season and also of the lengths and severity of soil moisture deficits (Figure 6).

It is likely that these aspects of human impact will be experienced primarily through increased or decreased airflow frequency of different types. For example, since the equator-pole temperature gradient drives the

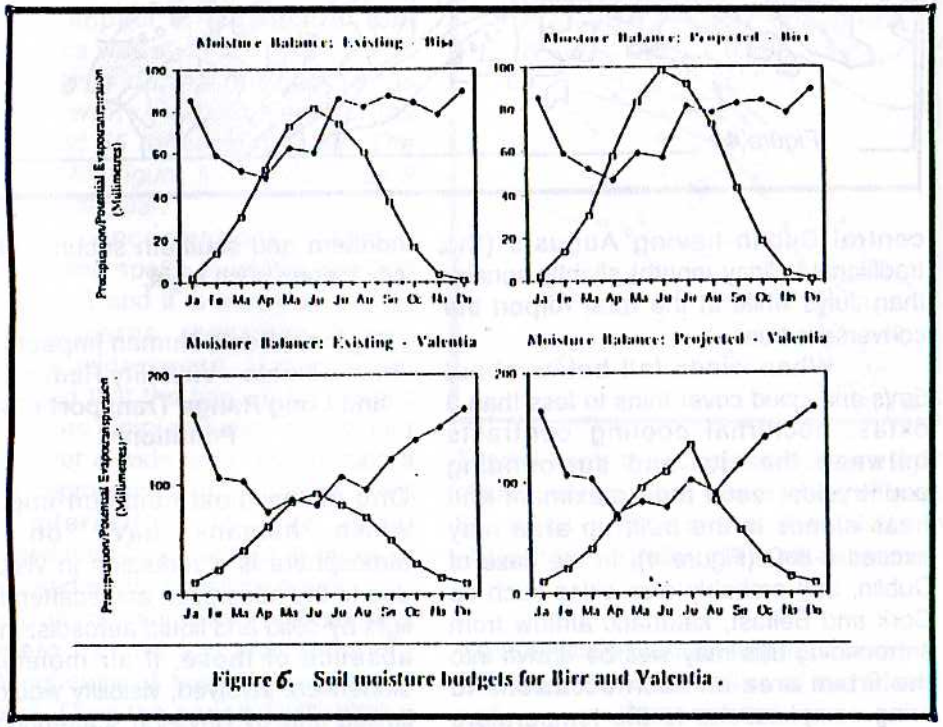


Figure 6. Soil moisture budgets for Birr and Valentia.

Ultimately though, once equilibriation to the new atmospheric composition has been attained, Ireland can expect to be close to the global average in terms of westerly winds, any disproportionate warming of higher latitudes could be expected to reduce the frequency and vigour of depressions passing over

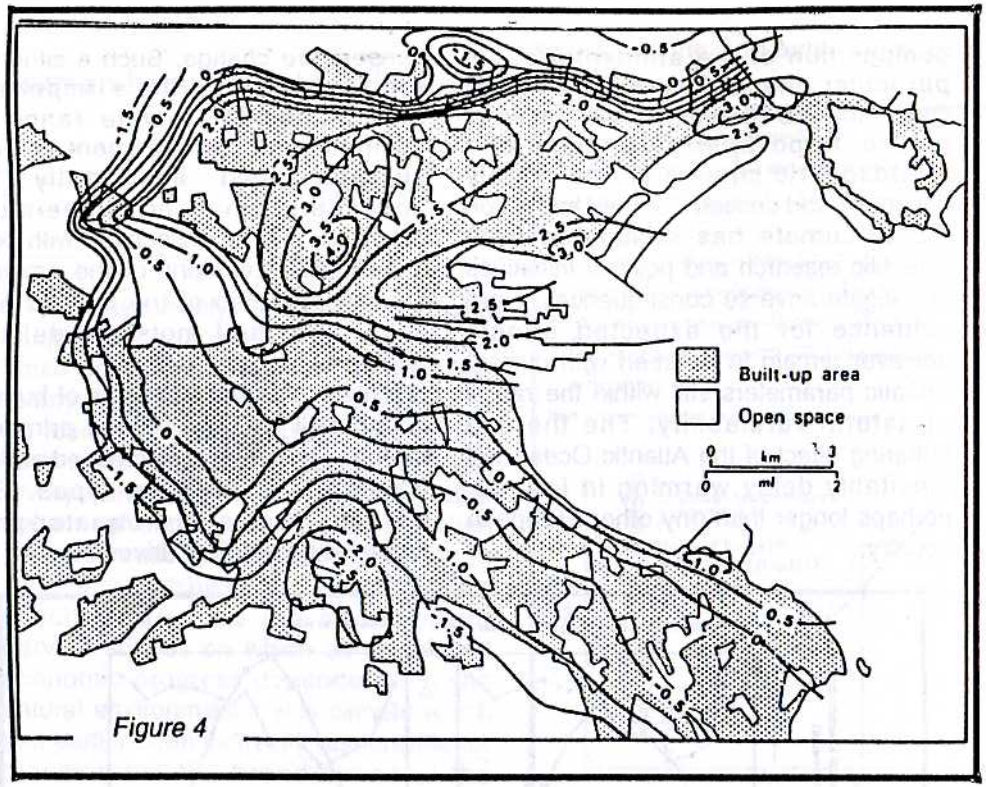


Figure 4

central Dublin having Augusts (the traditional holiday month) slightly sunnier than Julys while at the rural Airport the converse is true.

When winds fall below about 5m/s and cloud cover thins to less than 3 oktas, nocturnal cooling contrasts between the city and surrounding countryside reach their maximum and heat islands in the built up area may exceed 6-8oC (Figure 4). In the case of Dublin, and probably also cities such as Cork and Belfast, katabatic airflow from surrounding hills may well be drawn into the urban area on such occasions to bring complications to the temperature field of concern for the weather forecaster and gas/electricity supply manager. This is shown on Figure 4 by the marked thermal contrast between the northern and southern suburbs of the city for one such night.

Regional Scale Human Impacts on Irish Climate - Visibility Reductions and Long Range Transport of Air Pollution

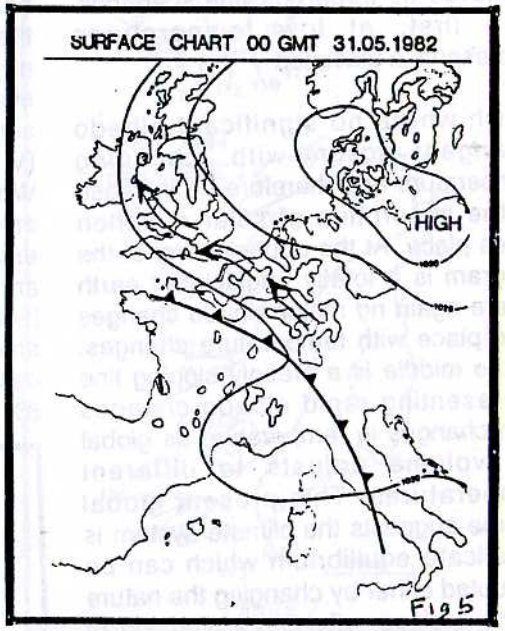
One of the most common impacts which humans have on the atmosphere is a reduction in visibility due to the absorption and scattering of light by solid and liquid aerosols. In the absence of these, if air molecules alone were involved, visibility would be limited only by Rayleigh scattering and would theoretically reach values of up to 250kms. However, values an order of magnitude lower are more normal in the modern atmosphere.

Winter visibility in Ireland is closely related to the proximity of local smoke pollution sources. At Dublin Airport for example reductions in mean winter visibility 1974-1990 show a strong inverse correlation with Dublin smoke emissions, reversing an improving trend apparent through the early 1970s. The background to this is well known. The oil supply crisis of 1979, the national need to diversify fuel supplies away from oil, monopolistic interests in bituminous coal supply, all contributed to a deterioration in air quality throughout the 1980s. Since bituminous coal produces about 3.5kg of smoke per 100kg burned, as opposed to 0.1kg/100kg burned for oil, the impact of a switch in fuel preference was serious.

For a time during the mid 1980s Dublin winter smoke emissions exceeded 55 tonnes/km2/year. The comparable figure for London was 9 tonnes/km2/year.

Daily concentrations during anticyclonic spells in winter reached 1800µg/m3 and it is hardly surprising that concerns regarding health became widespread. It is also not surprising that the ban on bituminous coal sales implemented in October 1990 over a wide area led to such a rapid improvement in air quality. It will be interesting to see what improvement has followed in terms of increased winter sunshine hours.

Summer visibility reductions in eastern Ireland are also largely a consequence of human atmospheric impact. Over the period 1970-1990 a sustained fall has occurred in median summer visibility at Dublin Airport. Matching of the trend with cycles of economic activity is convincing and, in this case, periods of haze appear to be principally associated with light south easterly winds. During episodes of sustained south easterly winds, visibility in eastern Ireland in summer is typically in the range 4-12kms, about 50% of the value with other wind bearings. analysis of individual episodes suggests these visibility reductions relate to importation of aerosol sulphate pollution from British and continental European sources.



Typical back trajectories implicate light stable airflows from these areas (Figure 5). Such airflows are also rich in photochemical pollutants such as ozone.

Global Scale Human Impacts on Irish Climate - Transformation of the Global Atmosphere

Perhaps the most explicit impact of humans on Irish climate will come as part of global scale alterations in the

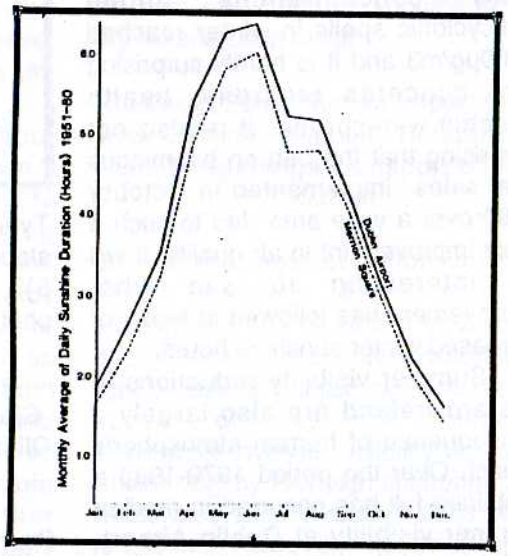
numbers and technological capabilities, but also because human environmental impacts particularly affect the weak links in the climate system.

For long term stability the earth's energy budget must balance. Energy receipt from incoming short wave radiation must equal losses due to outgoing long wave radiation. As can be seen on Figure 2 this can be achieved by three possible scenarios. The first, at low temperatures represents a glaciated

earth where no significant albedo changes occur with changing temperature and therefore no increase in the absorption of solar radiation takes place. At the opposite end of the diagram is a totally unglaciated earth where again no major albedo changes take place with temperature changes. In the middle is a steeply sloping line representing rapid albedo changes with changes in temperature as global ice volume adjusts to different temperatures. This present global regime suggests the climate system is a delicate equilibrium which can be disrupted either by changing the nature of the surface (affecting absorption of incoming radiation) or the nature of the atmosphere (affecting both incoming and outgoing radiation flows). These are the pressure points where human impacts can be expected to have an influence on the global climate system.

Local Scale Human Impacts on Irish Climate - Transformation of the Surface

The first significant transformation which people achieved on climate was as a result of urbanisation. Cities are micro climatic constructs designed to bring tolerable climatic conditions and shelter to living and working environments. In so doing they transform the micro climatic conditions external to the structures. The precise manner in which this occurs is complex, but possible causes are: (i) increased counter-radiation from the urban pollution 'dome' (ii) trapping of long wave radiation beneath the urban 'canopy' (iii) the high thermal admittance of concrete brick and asphalt (iv) the reduction of evapotranspiring surfaces (v) trapping of sensible heat in the street 'canyons' and (vi) anthropogenic heat production. Whatever the mix of causes, Irish cities are undoubtedly warmer than their rural environs, in the case of Dublin by an annual average of 1.2oC. By virtue of the high condensation nuclei from domestic smoke they are also less sunny; in the case of Dublin a loss of perhaps about 8% in its annual sunshine occurs (Fig 3).



The anthropogenic influence is particularly clear in high summer with

Ireland. Significant airflow frequency changes have already been occurring in Ireland in recent decades. A substantial reduction in westerly days from about 80 per year in the 1940s to around 50 in the 1970s has occurred. This may or may not be related to global warming effects though it does have important implications for rainfall. The most likely scenario of a continuing decline in the westerly circulation type and its replacement by cyclonic and other types is likely to reduce the current west-east contrast in rainfall geography and also to have more significant impacts in areas dependant on westerly borne rainfall (Figure7).

Using hypothetical circulation frequencies drawn from warm and hot summers in the recent past the conclusion appears to be that future warming will be associated with more prolonged drought periods in summer. These are likely to be felt most acutely in in north eastern Ireland, though research continues in elaborating this further. The consequences of this for water resource management are clearly very substantial.

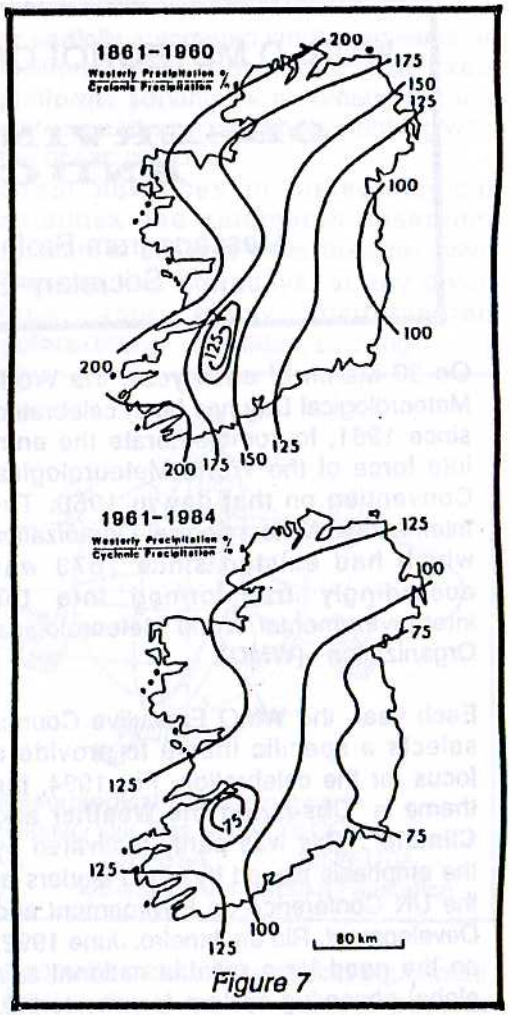


Figure 7

Conclusion

Once a prisoner of climate, Irish people will it seems in future become subject to climatic changes which people have caused. The uncertainty of the future course of climate means that careful management of climate-related resources will be required to ensure that any adverse effects of human impact on climate are mitigated as far as possible.

All that we can perhaps say for certainty is that whatever the regime human impact delivers, climatic variability and climatic hazards will continue to be the short term concerns, ensuring the future employment prospects of the meteorologist at least !

WORLD METEOROLOGICAL DAY 23 March 1994

OBSERVING WEATHER AND CLIMATE

Message from Professor Godwin O.P. Obasi, Secretary-General of WMO

On 23 March of each year, the World Meteorological Day has been celebrated, since 1961, to commemorate the entry into force of the World Meteorological Convention on that day in 1950. The International Meteorological Organization which had existed since 1873 was accordingly transformed into the intergovernmental World Meteorological Organization **(WMO).**

Each year, the WMO Executive Council selects a specific theme to provide a focus for the celebration. For 1994, the theme is **"Observing the Weather and Climate"**. This was partly motivated by the emphasis placed by world leaders at the UN Conference on Environment and Development, Rio de Janeiro, June 1992, on the need for a reliable national and global observing system for monitoring, understanding and predicting the behaviour of the global environment. The theme also provides an opportunity to highlight the key role of national Meteorological and Hydrometeorological Services in sustainable development.

From earliest times, mankind has been dependent upon his natural environment, and in particular, on weather and climate. It is often said that "*if you do not measure or quantify it, you cannot understand it*".

And without understanding, it is not possible to predict weather and climate or limit human interference with it.

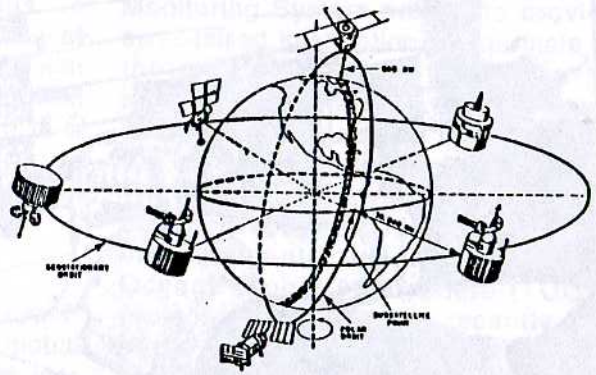
Systematic observations of the global environment, the atmosphere and water, are thus fundamental to understanding their behaviour and enormous impact on our lives.

Organized international collaboration in meteorology began in **1853** when at a meeting of seafaring nations, a programme for obtaining weather observations over the oceans was developed, to increase the safety of life at sea. At about this time, countries also began to establish national Meteorological Services. With observations available both over land and sea, there was need for a more formal collaboration for their collection on a wider scale. This led to the creation of the International Meteorological Organization in 1873.

As a result of these institutional developments and the progress made in various scientific fields, meteorology advanced rapidly. Improved methods of observing the atmosphere evolved, numerous networks of observing stations on land appeared and merchant ships' made more regular observations from the sea.

The upper atmosphere was explored by balloons and kites and later by aeroplanes, radiosondes and rockets. Arrangements were made for the inter-service exchange of observational data, which became quicker and more reliable as telecommunication technology improved.

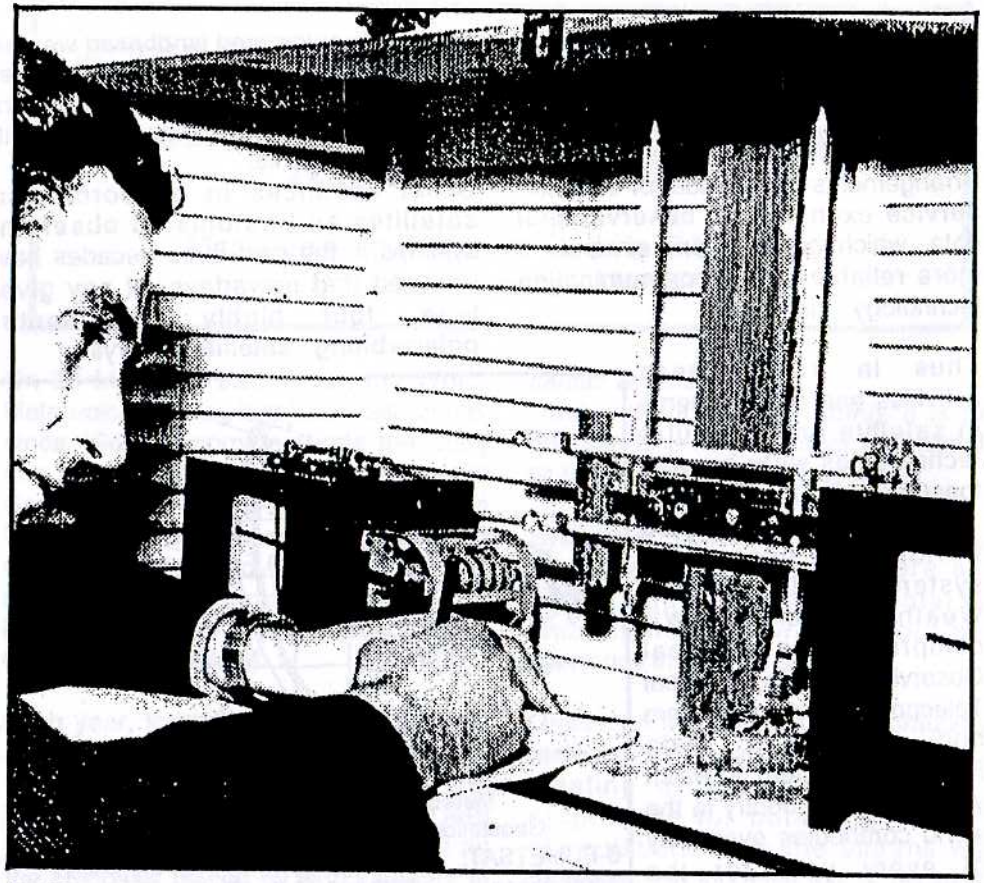
Thus in 1963, these activities and developments in satellite and computer technologies were brought together with the creation by WMO of an integrated world-wide operational system called the World Weather Watch **(WWW)**, comprising a Global Observing System, a Global Telecommunications System and a Global Data Processing System, to which virtually every country in the world contributes every day of every year for the common good.



Meteorological satellite network
Geostationary satellites of WMO's GOS:
0-EUMETSAT, 75W-USA, 135W-USA, 140E-Japan, 80E-India & the Russian Federation

Today, there are some 9,000 observing stations on land and 7,000 voluntary observing ships which make observations over the world's oceans. Most of these provide basic weather measurements every three hours. About one in ten of the land stations and a few of the ships make upper-air soundings once or twice a day to obtain data on pressure, temperarure, humidity and winds up to heights of 30 km. These are complemented by observations from commercial aircrafts currently producing some 10,000 reports per day, some 350 automated or partially automated landbased weather stations, 300 moored buoys or fixed platforms serving as automatic marine stations and some 600 buoys drifting with the ocean currents.

Great advances in meteorological satellites and automated observing systems in the past three decades have ensured that nowadays, at any given time, four highly instrumented **polarorbiting satellites**, carrying automatic picture-transmitting equipment, orbit the earth and provide meteorological surveillance of every point on its surface twice per day. They provide global observations of the earth's cloud cover, vertical temperature and humidity profiles, sea surface and land temperatures and snow and ice cover. A second system of **geostationary** or earth-synchronous satellites over the equator, revolving at the same speed as the earth and thus "stationary" relative to it, provide meteorological information of the same areas on a near-continuous basis.



An observer taking temperature and humidity readings at a Stevenson screen. Instruments shown are: wet and dry bulb thermometers(horizontal), bimetallic coil thermogram (at left) and hair hygrogram (relative humidity recorder).

The observation and analysis of daily weather is the first step towards understanding climate and its variations.

These can be applied towards the myriad of economic and social decisions that have to be taken daily. Examples of these include preparedness against the growing effects of natural disasters like floods, tropical cyclones and droughts as well as environmental emergencies. However, in order to achieve a better understanding of climate and its possible changes, other parameters need to be observed.

Fresh water, a very important component of the environment, appears very obviously in rivers, lakes and reservoirs and also as snow and ice. It is less obvious when stored in the soil, vegetation and in the aquifers. Measuring the storage and movement of wáter on the surface of the earth is the task of the world's Hydrological Services.

River flow measurements were first made on a regular basis at the start of the 19th century. Now, there are approximately 60,000 river gauging stations in operation around the world, but many important rivers are still not measured. Measurements of the materials being carried by the river water in solution, in suspension and by saltation were not started until the 20th century. But today, there are few stations where the water quality of rivers, wells and boreholes is observed. These measurements of surface and ground water together with those made of the meteorological parameters have contributed to a better understanding of the environment and the weather and climate that characterise it.

However, surface observations, upper-air soundings and systematic global satellite measurements do not provide all the required information to investigate the mechanisms that are at the root of past natural climate variations, much less to predict them in the future.

The dynamics of climate involve a vast range of interactive processes, from the formation of clouds and their effect on radiative transfer to oceanic circulations that respond to minute changes in surface air-sea fluxes.

For these reasons a scientifically adequate climate observation programme calling for numerous additions to the basic operational Global Observing System of the WWW is required to understand, in quantitative terms, the interplay between the global atmospheric circulation, water and energy transfers, the world ocean circulation and sea-ice, the land surface moisture, vegetation and hydrology.

Much innovative research is thus being undertaken to address these critical issues about the climate. It is essential to know if the climate is undergoing change, what are the consequences of climate change, and what is the role of human activities in affecting this change. In 1984, WMO established a Climate Monitoring System project to provide synthesised information on the state of the climate system and diagnostic insights into climate events of regional and global consequence such as those associated with El Nino periods.

Through the massive array of special oceanographic and atmospheric measurements under the Tropical Oceans Global Atmosphere (TOGA) project, scientists have recently had some success in predicting El Nino/Southern Oscillation (ENSO) events and the related climate anomalies such as droughts and floods in tropical regions around the globe. For such phenomena, observations of selected parameters will be required on a more permanent basis once the TOGA research project is over in 1995.

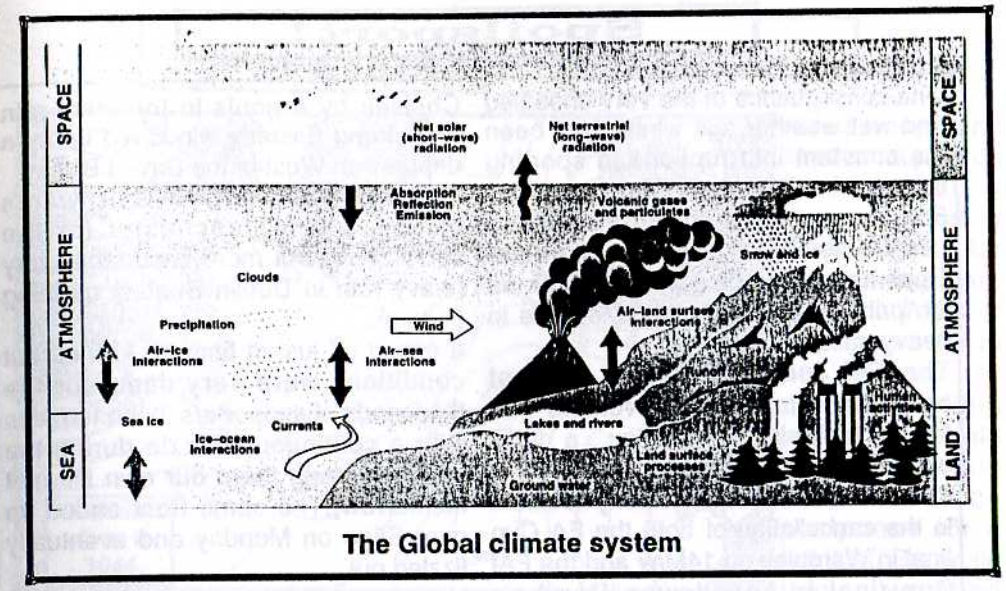
The World Ocean Circulation Experiment (WOCE), like the TOGA, required for the understanding of the long-term responses of the couple atmosphere-ocean system and others are all components of the World Climate Research Programme (WCRP), a global research undertaking jointly implemented by WMO with other agencies. WCRP is itself one of the components of the World Climate Programme (WCP) created in 1979 to address the full gamut of climate

and climate change issues. WCP is the major international.l programme supporting the work of the Intergovernmental Panel on Climate Change (IPCC), the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC/FCCC) and that on Desertification (INCHED), and other activities undertaken by Members in the context of UNCED and its Agenda 21.

In order to meet such long-term observational requirements for a more enhanced description of the earth climate system, as envisaged under Agenda 21, WMO and three other international organisations established the Global Climate Observing System (GCOS) in 1992. Currently in its early planning phase, GCOS is taking a comprehensive view toward these requirements, and will of necessity include observations from the ocean, in concert with the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS) in addition to the current observational programme on the atmosphere. Increasing threats to the marine environment through human activities have put an even greater emphasis on the need for extensive, rapid and accurate ocean data to be made available to governments and the public; GOOS will also provide long-term, operational monitoring of physical, chemical and biological variables of the world's oceans which cover 70 percent of the surface of the globe and play a major role in the global climate system. Though a huge undertaking, GOOS is being built on firm foundations, through the hundreds of ocean observations now being made and exchanged every day under the umbrella of the World Weather Watch and the global ocean research programmes.

The present world-wide concern about climate has its roots in the changing chemical composition of the atmosphere. These changes are occurring quite rapidly under the impact of human activities, with consequent environmental problems of acid rain, airborne toxic chemicals, severe ozone layer depletion and greenhouse gas induced global warming. These are the danger signals that mankind is seriously contaminating the atmosphere and is thus threatening some life forms, human health, water supplies and food production. Measurements of the changes taking place are essential to diagnose these trends, their likely impacts and the sources of the polluting substances, and to reduce the human burden on the atmosphere.

The basic world-wide network for these observations is the Global Atmosphere Watch of WMO, initiated in 1989 to coordinate two long-standing measurement programmes: the Global Ozone Observing System (G0 0S) and the Background Air Pollution Monitoring Network (BAPMoN). These activities are providing vital information on the chemical and physical constituents and properties of the global atmosphere including their dispersion, transport, chemical transformation and deposition of atmospheric pollutants over land and sea, among other things. Complementary data on air pollution within cities are coordinated through the World Health Organization (WHO) and UNEP.



The Global climate system

From all the foregoing, it is clear that, as providers of meteorological, hydrological, oceanographic and other environmental data and services, national Meteorological and Hydrological Services are the indisputable pillars in the world-wide efforts to monitor, understand and predict weather and climate and towards the planning and implementation of reliable sustainable development programmes.

I would like to use this occasion to renew my special appeal to all governments, as signatories to the UN Framework Convention on Climate Change, toenhance their support to their national Meteorological and Hydrological Services in order to ensure increased effectiveness and efficiency in monitoring weather and climate for a safe and more sustainable future for all mankind.

I would like to end this message by dedicating this year's World Meteorological Day to the thousands of dedicated professionals as well as voluntary observers who, day in and day out, from the polar regions to the tropics, and often under extreme and inclement weather conditions, make the hundred of thousands of observations which are basic to the monitoring, understanding and the prediction of weather and climate.

Without these observers, even the great technological advances made in global observing systems would prove to be inadequate for our preparedness to confront the challenges posed by weather and climate now and into the 21 st century.

N.B.
Oue sincere thanks to Mr Joseph Kearns who gave us a brilliant tour of Birr Meteorological Station on 21May.

Spoilsport !

One consequence of the very unsettled and wet weather this winter has been the constant interruptions in sporting fixtures.

For example the National Hurling League semi-final between Cork and Tipperary due to be played in Cork on 24April was deferred until 1May due to heavy rain.

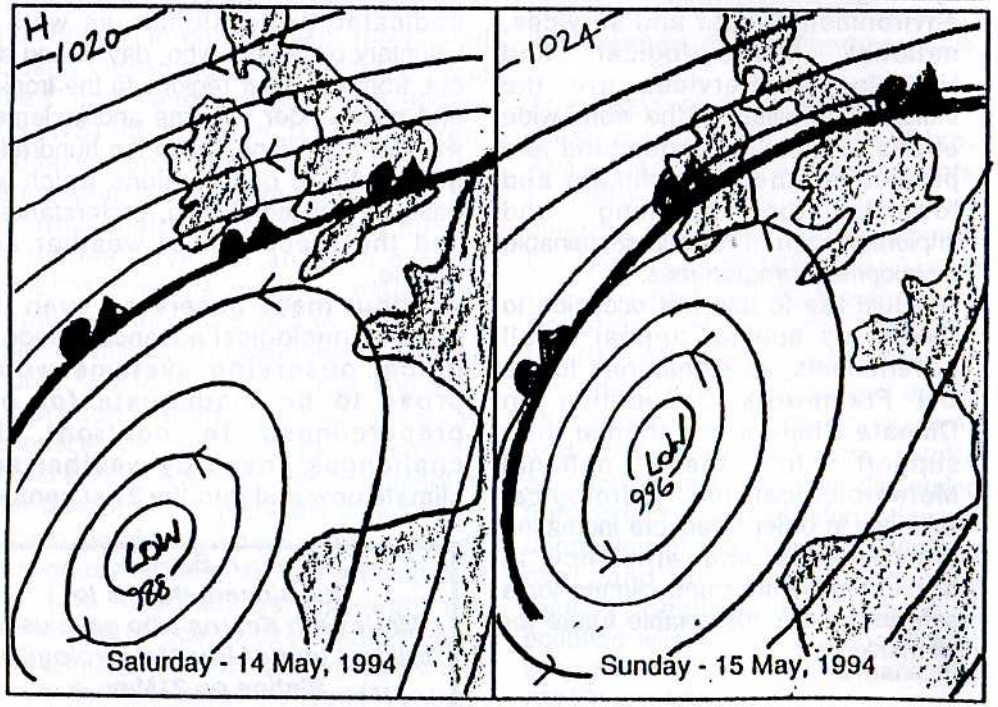
The FAI Junior Cup final (largest competition in Europe involving 700 teams) took place on 22May , a delay of three weeks !

In fact the bad weather nearly resulted in the cancellation of both the FA Cup final in Wembley on 14May and the FAI Cup final in Lansdowne Road on 15May and, most interestingly from a meteorological point of view, by the same weather front. Man. United beat Chelsea by 4 goals in torrential rain and strong Easterly winds fed up by a depression West of the Bay of Biscay.

The front then moved Northwards giving rain in Manchester for the celebrations but more importantly very heavy rain in Dublin Sunday morning (1 inch).

It eased off just in time for kick-off but conditions were very damp for the thousands of supporters in the terraces with a continuous drizzle during the match (among them our own Dermot McMorrow).The same front ended up over Sligo on Monday and eventually fizzled out.

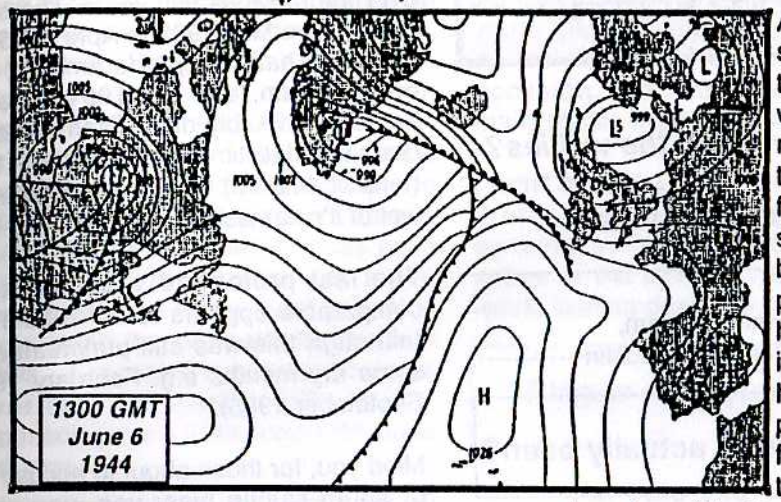
However no amount of rain could dampen the enthusiasm of the Sligo Rovers Supporters. They beat Derry City by 1 goal to win a unique treble.



Saturday - 14 May, 1994

Sunday - 15 May, 1994

Forecast for Overlord



J. M. Stagg, General Eisenhower's chief weatherman, advised on the weather for the Allied invasion of Europe, Operation Overlord, in June 1944.

For many weeks, Dr. Stagg had been presenting trial forecasts to the Supreme Commander, which had been agreed in consultation with the experts of three weather forecasting centres, one American and two British. Suddenly four days before D-day, when the first orders were being issued for the opening moves in the invasion, a stormy period became imminent and the experts were divided about the outlook. No one could say whether or not conditions on D-day would permit landings to take place.

As the Allied naval forces gained momentum towards the coast of France, so also did the storm areas over the Atlantic, so that 24 hours before the scheduled time of landing, engines had to be reversed and operations suspended, leaving many thousands of Allied troops and seamen at peril on the high seas. It was a frightening responsibility for the weathermen, for if the fleets of ships were not to be allowed to proceed within hours, the whole invasion would have to be postponed for a fortnight. But while they wrestled anxiously with their doubts, the forecasters spotted the likelihood of a brief interlude among the storms and Overlord went forward to success.

After the war was over Dr Stagg revealed that it was a report from Blacksod which resolved the disagreement between the Americian and British forecasters. The report was not consistent with the Americans' analysis: so the British view was accepted, and the forecasts vital to the successful outcome of D-Day were based on it.

In the citation for the US Legion of Merit, which was awarded to Dr Stagg in 1946, President Truman says, "*The value of Group Captain Stagg's advice has since been proven, as the day selected for the continental assault was probably the only day during the month of June on which the operation could have been launched.*"

WEATHER CORNER

-Time to put away the wellies?-

-Dust fallout on May-day-

----------by Edward Graham,
Clonskeagh, Co.Dublin----------.

How wet has it actually been?

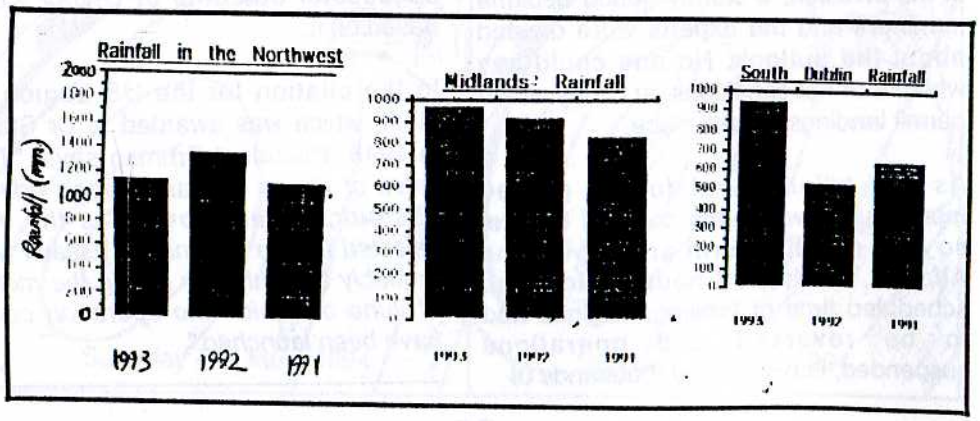
Following on from a succession of dry and undramatic previous few years, the past 12 months in south Dublin have produced a remarkable wet period.

Provisional figures for my garden rain gauges (inverted plastic bottle-top variety!) show that the period 1st May 1993- 30th April 1994 recorded some 1180mm, which is about 150% higher than the expected mean in this part of Dublin for any 12 month period. It's all the more dramatic when one takes into account the relative increase of rain over the previous few years. The same period from May 1992 to April 1993 had less than half this year's amount, with only 530mm, and the 1991-2 period had a remarkably dry 505mm. Another dramatic statistic is that February 1994 (total of 142mm) was nearly 6 times as wet at it's namesake in 1993.

The last prolonged very wet spell comparable appears to be 1985-1986 (although this was still punctuated by some dry months e.g. February 1986, September 1986).

Mind you, for those about to accuse me of south Dublin bias; yes, you are perfectly correct! Living in this part of the country, one normally escapes the full brunt of the southwesterlies -I suppose it's when we get a spell of the weather associated more with Cloone Lake than Dublin 4 that it's then we marvel at how exciting, changeable and unpredictable our weather can be!

So to compensate for any partiality on my behalf, I have produced some graphs on the computer to show how rainfall how varied in other places over the past 3 years.



The first thing is that you will notice that some parts of the county have been dryer in the past 12 months than the same periods between 1991-93, particularly those of you in the NW. You had your wettest spell between August 1992 and April 1993. The rest of the country, including the Midlands has had a slow, gradual increase in rainfall over the past 3 years. Here in Dublin, and the southeast, it has been the very wet spells of moist southeasterlies in the past year that have given the dramatic increase in totals. I recorded a running mean of over 500% of normal rain for the monsoon period 10th May-14th June last year.

More floods after heavy rain

But as the saying goes - "There are lies, damned lies, and statistics! So, if the rain statistics prove anything, they say that we're just a bunch of sissies in south Dublin, who can't recognise a good drop of rain when we get one!

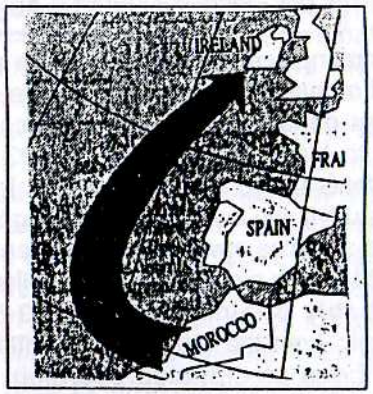
First 20°C day

Each year I like to note down the date of first and last ground and air frosts, as well as the first and last days to reach 20°C. On April 27th last, I recorded a warm 20.2°C, which appears to be the earliest date for 20°C since 1987. On that occasion, 21°-23°C was reached at many places inland on 25th April.

I won't hazard a guess what this beholds, if anything, for our summer, but it's certainly in line with the unpredictable nature of the last few months - fine one week, lashing down the next !

Plague of Locusts next !

I'm sure you all noticed the widespread fall of reddy-orange dust that fell countrywide overnight on the 1st/2nd May. Light rain intercepted a dust cloud at 10,000 feet which had moved up from the Sahara.



Dust clouds over Ireland are not as uncommon as you may think, spreading as far north as Ireland several times a year, but only encounter the necessary conditions for precipitation once every few years.

In Mediterranean countries, dust falls are

Sahara dust, seen by satellite blowing across Iberia and Biscay on 21st August 1980.

commonplace, and often contain pollen and organic material. For example, while I was partaking on a Geographical field trip to Majorca during April 1993 (yes, students do go to the Balearics Islands on study!), we awoke one morning to find most surfaces covered in a thin veneer of bright yellow pine pollen. This pollen had probably originated from 20-50km distant, from the Majorcan mountains. It had been precipitated overnight by a small shower.

Lest you get complacent, even in Ireland, stranger things have been known to fall from the sky. In **1224 A.D.**, the Annals of the Four Masters state
" *An awful and strange shower*", followed by "*Terrible and strange diseases and distempers in cattle that grazed on where the shower fell, and persons that drank their milk*" Again, the Annals state a similar shower of "*Yellow butter substance* " falling in Limerick in **1695.**

On a more humorous side, the poor unfortunate Lord Chancellor of Dublin awoke one morning in **1736** to find his prestigious bowling green covered in frog spawn!
In May **1867**, a man in Capel Street identified fallen berries as hazelnuts!

The reason behind the apparent heavenly hazelnuts and frog spawn are probably local whirlwinds and cumulonimbus shower clouds, with powerful updraughts strong enough to keep airborne any objects they pick up. Maybe the phrase "***raining cats and dogs***" does have some sort of significance afterall!

Have you any suggestions on what you think this summer will be like? - or perhaps you've some temperature/ rainfall figures you could send in, and we'll produce some computer graphs of your area for Weather Corner.
Irish Met. Society, Meteorological Service, Glasnevin Hill, Dublin 9.

Climatological Observers Link

The Climatological Observers Link (**COL**) was founded in 1970 by a small group of amateur meteorologists. The aims of COL are to: **exchange meteorological information and to exchange data.**
COL membership is open to anyone with an interest in the weather. The Organisation caters mainly for amateur meteorologists, but the membership also includes many professionals and observers from other bodies, eg Schools, Universities and Research Establishments. COL has no age limits —- members range from the preteens to the quite senior, the current total being close to 330. The distribution of membership is quite widespread. The majority of COL members run their own weather station, but this is not a condition of membership.

Monthly Bulletin

In order to achieve the Objective of COL, an early decision was taken to issue a bulletin which would include meteorological data and information, and the first one was published in MAY 1970. This immediately became a monthly feature and has continued to the present day without a break. Each issue contains a synopsis of the previous months weather and extensive colums of data from about 200 reporting stations. Also included is a wide-ranging correspondence section and an equipment/ books exchange spot where many a bargain has been offered. Each monthly volume contains about 50 pages and, at the end of the year, an annual summary edition is produced. One of the essentials of publishing meteorological data is to do it early. COL aims to publish the bulletin about the 24th of the month — whilst the previous months weather is still relatively fresh in the mind.

COL Directory

In an attempt to assist members to keep in touch with each other and find common interests, a Directory has been published at intervals. The Directory contains a brief history of COL, full details of the membership and, for each operating station, also includes the site location, times of observation, equipment in use, length of site records, site details and the observers particular interests in meteorology.

Bulletin Data

Being an amateur-based organisation, it is difficult to lay down stringent standards of accuracy for data submitted to and published in the bulletin. Any climatic station, whether amateur or professional, is likely to have some aspects peculiar to that site. Many COL sites are approved by local meteorological offices/national weather services with whom they co-operate.
Members are also encouraged to submit items for the bulletin on any matter related to meteorology. As many stations have been operating for a long time, it is hoped during the near future to publish a booklet which will provide a comprehensive record of long-term

The current annual rate for members is £20 (£15 to anyone aged under 18). COL is a non-profit making organisation, run by enthusiasts for enthusiasts.

***COL is currently recruiting observers in Ireland** and would love to hear from you. Further enquiries to the secretary Roger Brugge, 16 Wootton Way, Maidenllead, Berkshire, SL6, 4QU---------*

ROYAL METEOROLOGICAL SOCIETY
104 Oxford Road, Reading, Berkshire, RGI 7LJ
Telephone: Reading (0734) 568500 Fax 568571

The Society has recently published jointly with the American Meteorological Society a new pack called 'hurricane!'. The idea behind the pack is to attempt to improve knowledge and understanding of hurricanes in general and to look at the details of Hugo in particular.
It is aimed primarily at teachers and students at upper school levels and at introductory courses in Universities and Colleges.

The pack has had an excellent response here and in North America. It starts with a short history of hurricanes, then goes into the life and times of hurricane Hugo, investigating Hugo, the authorities response to Hugo, satellite pictures, maps, figures and teaching notes.
There are 81 pages in a loose leaf pack for easy photocopying.

Price

Members RMS :	£8 + £1.40 p & p US $18.50 surface mail US $23.00 air mail
Non Members :	£9.50 + £1.40 p & p US $20.50 surface mail US $25.50 air mail