Irish Meteorological Society

Newsletter
Number 46
Feb 1997

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Irish Meteorological Society

AGM 20 April 1996
Secretary's Report

The final event in the 1994-95 season was the one day meeting held at the Tara Tower Hotel on the 22nd April 1995. Speakers includes John Flannery, Gerry Murphy, Robert Weatherill, Douglas Gordon, Aidan Nulty and John McCarthy who gave talks on the theme of Observations.

The season began with a successful and interesting coach tour through Wicklow where three industrial sites were visited. IFI Fertilisers in Arklow, Avondale Chemicals in Rathdrum and the ESB Pumped Storage Station at Turlough Hill were all on the itinerary. Our thanks to Douglas Gordon who made all the arrangements.

We had a somewhat reduced program of lectures this season. Prof. Peter Hodnett started the season with a lecture on Oceanography. This was followed by the Annual Guest lecture which was presented by Dr Tony Hollingsworth of ECMWF on the topic of coping with Chaotic Systems and new developments at ECMWF.

The annual dinner this year was held at the Old Dublin Restaurant. The dinner was excellent but unfortunately the worst winter weather of the year spoilt the evening and several people could not attend due to treacherous road conditions.

We had only two lectures in the Spring months. Dr Nicholas Betts of the Queen's University in Belfast gave a talk on the Flooding in North Antrim. He discussed some extreme flooding events in places like Ballycastle and looked at some of the possible explanations including land use changes.

Our last lecture was on the topics of the Use of Environmental data in Offshore and Coastal Engineering. It was presented by Brendan Dollard and Gerard Dunne of Forbairt. We were unable to arrange a third lecture. However, three lectures have already been arranged for the Autumn.

The committee met six times during the season to discuss the lecture program or other events.

We have managed to improve the production of the Newsletter. Phil Stokes and Paul Halton joined me on the Editorial Committee. We ran a competition among members seeking contributions to the Newsletter. We would like to thank all those who contributed to the Newsletter.

Met Éireann has continued to allow the society to use their facilities and for this we are most grateful. Without the assistance of Met Éireann, it would not be possible for our Society to operate. Our thanks goes to the staff who have helped with mail, postage and printing. We must also thank the Television Forecasters for mentioning our events on Television and the Mr Brendan McWilliams who covers these events in his Weather Eye column in the Irish Times.

Finally, I wish to thank all the members of the committee who helped with lectures, Newsletters and today's meeting and all the members of the Society. Thanks must also go to Dr Tony Scott and UCD for the use of the lecture theatre at Earlsfort Terrace.

Kieran Commins, Secretary

Irish Meteorological Society

AGM 20 April 1997

Agenda

1. **Secretary's Report**
2. **Treasurer's Report**
3. **Elections to the Committee**

Outgoing Committee

=== President Mr John Sweeney
=== Secretary Mr Kieran Commins
Asst. Sec Mr Paul Halton
=== Treasurer Mr Kyran Dollard
Mr Dermot McMorrow
=== Mr John Flannery
=== Mr Douglas Gordon
Ms Phil Stokes
Mr Denis Fitzgearld
Mr. William Wann

Elected 1993, Re-elected 1995, Not available for re-election
Paul Halton, Dermot McMorrow

Elected 1994, Re- elected 1996, in office until 1998
W. Wann, K. Commins, D. Gordon
Elected 1994, Available for re-election
W. Wann, K. Commins, K. Dollard, D. Gordon, J. Flannery

Elected 1995, re-electable in 1997
Ms P Stokes, Mr D. Fitzgearld

There are 5 vacancies on the committee. Two of the outgoing members are available for re-election. Two other vacancies exist.

4. **Activities**
5. **AOB**

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 committee met 6 times in the new season planning the lecture programme and other activities.

Unfortunately we have been unable to produce Newsletters as frequently as we would wish. The next Issue should be in late spring.

Committee for IMS 1996-1997

President	Mr. John Sweeney
Vice-President	to be filled
Secretary	Mr. Kieran Commins.
Assistant-Sec	Mr. Paul Halton
Treasurer	Mr. Kyran Dollard.
Assistant-Treasurer-	Mr. Paul Halton
	Mr. Dermot McMorrow
	Mr. William Wann
	Mr. John Flannery.
	Mr. Douglas Gordon
	Ms. Phil Stokes
	Mr. Denis Fitzgerald

Editorial Committee--------------Kieran Commins, Phil Stokes

Irish Meteorological Society
1996-1997 Season

Program

February 22th	Annual Dinner
March 7th	Lecture : "Birdstrike Hazards near Aerodromes" Mr. Michel Redden
April 12th	One Day Meeting Topic :"Extreme Weather" AGM
May	Annual Field Trip

Editor's Note:

We include a roundup of the weather over the last year.

We also include articles which cover some of the topics included in our lecture series, including the talks on the Stability of Climate which Denis Fitzgerald gave and also the Talk on Wolfe Tone's unfortunate expedition to Bantry which took place exactly 200 years ago. Also included are snaps from our annual outing which was to the Céide Fields and Bellacorick Wind Farm, both in Co. Mayo.

At the 1996 AGM we lost Dr Peter Lynch, who has been on the committee since 1992 and was ineligible for re-election, and also Dr. Pat Shannon.

There will be a number of vacancies on the committee when those elected 1993, re-elected 1995, must leave office in 1997.

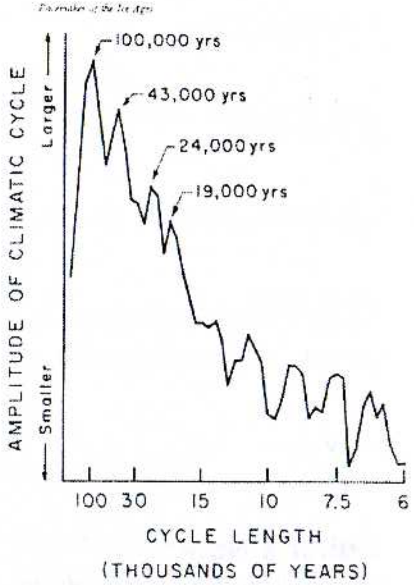
Also there are a number of existing vacancies on the committee. Members should consider this in advance of the upcoming AGM.

The Stability of Ireland's Climate

This article describes:

1. The main influences and ideas which have formed current views of the stability of global climate
2. the indications from some recent modelling studies for Europe
3. the evolution of opinion on the main causes of climate change during the last 50 years and the most plausible scenarios for the next century.

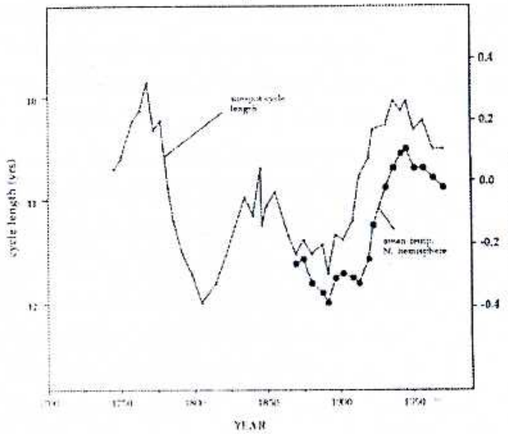
Ice age theory was propounded in the 1830s and gained relatively quick acceptance among the scientific community. By the end of the 19th century most of the causal mechanisms we hear of today had been suggested, including the warming effect of carbon dioxide. As geologists were prominent in the debate, geographical factors such as the distribution of land and sea, changes of size and circulations in the world's oceans, periods of mountain building and enhanced volcanic activity were prominent. Croll suggested the variation of the shape of the earth's orbit from nearly circular to elliptical over a period of 100,000 years(100kyr) and the wandering of the poles, which changes the season in which we are closest to sun with a period of about 23kyr, as possible mechanisms. Later Milankovitch added the 41 kyr cycle in the tilt of the earth's axis, which can be important to seasonal distribution of solar radiation, especially in high latitudes. The degree of acceptance of the variation of the earth's orbital parameters as a cause of ice ages has varied, but work on ocean cores in the 1970s provided strong confirmation (Fig.1) but also something of a puzzle. Over the last 800kyr the 100kyr cycle has



been the most prominent while prior to that the 41kyr and 23kyr cycles dominated.

Sun-weather relations were a preoccupation of the 19th century. The sunspot cycle of about 11 years was known and many efforts were made to link it with surface weather variations. This interest persisted into the early part of the 20th century, having widened into a search for cycles of any period in weather parameters such as temperature or rainfall. What was found was that the period of cycles is irregular and their amplitude may vary widely over time. This made it difficult to use cycles as tools for long-range forecasts. The best-defined and most frequently observed cycles seemed to be the QBO (quasi-biennial oscillation of about 2 years), 20 years and also about 80 to 100 years in the longer records. Interestingly, the sun exhibits a magnetic cycle of about 20 years called the Hale cycle, while the Gleissberg cycle in the length of the sunspot cycle has a period of about 90 years. It has been shown that the latter cycle is in step with the mean temperature in the northern hemisphere over the last 100 years(Fig 2) but no convincing mechanism to explain

Fig. 2



the connection has been established. However, it is a very interesting piece of work as it purports to explain the temperature variations without invoking the increase in greenhouse gases.

A convincing effect of the 11-year sunspot cycle on the atmosphere was not discovered until 1987 and then not in a surface weather parameter but high in the atmosphere - data for the upper-air has been available only since about 1950. Then a connection was found in the stratosphere but only when subdivided according to the QBO(quasi biennial oscillation) of stratospheric winds(Fig 3). In the westerly phase there was a distinct warming around the time of the solar maximum and in the easterly phase a distinct cooling. In the cycle since 1987 the effect has persisted. But how does warming in the stratosphere translate into changes at near-surface levels? What followed makes indeed a cautionary tale. It was noticed that the severity of winters in the eastern US had kept in step with the oscillation since about 1950 and this was used as forecasting rule which then failed in two successive years. The main large-scale factor which was unusual during these winters was the ocean temperature regime in the equatorial Pacific; this also varies in a quasi-cyclical manner but during the period of forecast was in a phase which had not been observed since 1950. Indeed a forecast for the following winter based on this ENSO (El Niño - Southern Oscillation) effect proved a fair success.

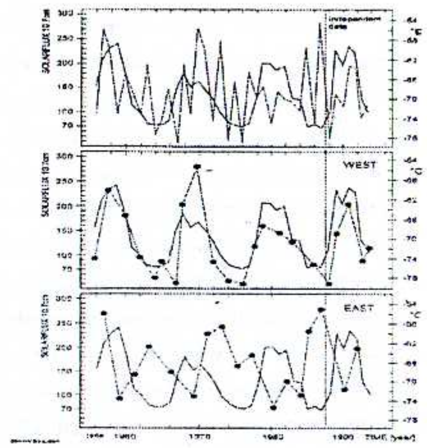
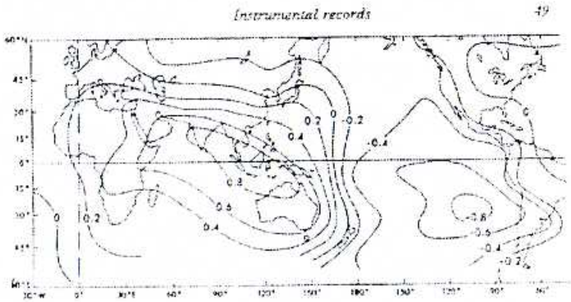


Figure 3

indicating that sea temperatures in the tropical Pacific had more of an effect on winters in the eastern US than the stratospheric oscillations. However, this was not the end of the tale. Abandoning the pursuit of sun-climate relations at the surface, workers looked for and found a TTO (ten to twelve year oscillation) in the heights of surfaces of equal pressure in the high troposphere and stratosphere which accounted for as much as 50% of their variability. It was also found that variations in the heights of the subtropical highs in the troposphere at the 500hPa level(about 6000 metres) were in phase with the TTO (sunspot?) cycle. To render the connections plausible computer modelling studies were undertaken to see if the relatively small change in the solar output over the cycle could produce such effects. The small increase in UV(ultra-violet) radiation around the time of the solar maximum can increase the ozone content of the stratosphere and this in turn causes warming by increased absorption of sunlight. This heating changes the wind regime and exchanges with the troposphere, which are by means of waves. The net effect in the idealised models was to intensify the Hadley circulation and push the tracks of the mid-latitude depressions northwards. The TTO is currently regarded as plausible but hardly established. Indeed, even when such a (solar) cycle has been established and a plausible mechanism propounded, there remains the question of whether a natural mode of oscillation of the atmosphere may also be involved. The existence of such natural modes and their possible periods bring in the subjects of teleconnections and chaotic dynamics.



Teleconnections are statistical connections between atmospheric variables over large scales of space and time. A pioneer in this work was Sir Gilbert Walker who was Director of the Indian Meteorological Office in the 1920s and '30s. He was interested in forecasting the onset of the Indian monsoon and his approach was to examine correlations between time series of monthly mean surface pressures at different locations to see if the large-scale pressure patterns would yield some indicators. His main discovery was an out-of-phase relation between pressures in the eastern and western Pacific(Fig 4) which now bears the name Southern Oscillation (SO). It was discovered that large-scale movements of Pacific waters occurred in association with the SO and nowadays the acronym ENSO is used for the combined phenomena, which as we have seen exerts some influence on weather even as far away as the eastern side of the USA. ENSO is quasi-cyclical with periods mostly between two and seven years : also the episodes vary in strength, but its investigation has led to the hope that useful forecasts of up to one year ahead can be made with some success for the areas most immediately affected by the ENSO phenomenon. But how predictable can we expect weather patterns to be?

Chaotic Dynamics and the Predictability Problem

A turning point in the practice of weather forecasting was the introduction of computers in the 1950s. The success of models using simplified versions of the equations of hydrodynamics in making short-term forecasts was striking. In the mid 1950s a simple global model of the atmosphere was integrated for a month ahead and still gave realistic patterns. This led to something of a false dawn in that it was thought by some that errors due to lack of knowledge of the initial conditions would damp out rather than grow and that the final state of a long-term forecast might be largely independent of the initial state. This view was contrary to the general opinion among meteorologists and in 1957 P. Thompson argued that errors in the initial state would reduce the computer products to being no better than sheer guessing within a week under winter-time conditions in North America. The work of Lorentz in the early 1960s showed the extreme sensitivity of the predicted state to small errors in the initial state. While the full implications of his work on the atmosphere were slow to gain currency there was a gradual realisation that there were unavoidable limits to predictability which currently would be put at 2 to 3 weeks in mid-latitudes. It is the turbulent behaviour of the atmosphere that makes the regularities exhibited not quite periodic and variable in amplitude. But we have seen regularities which have periods well in excess of 2 to 3 weeks. There is nothing contradictory in this as the predictability referred to above is in the production of daily weather patterns which give a useful indication of the weather conditions. Broad general long-term indications are another matter. In chaotic systems such as the atmosphere feedback effects make it difficult to have a good grasp on what is important to the evolution of the system. In

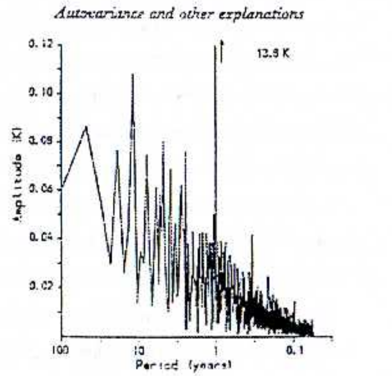


figure 5

the early 1990s an interesting modelling exercise to investigate the internal variability of the climate system was undertaken (Fig 5). The model must have been highly simplified yet it was realistic enough to produce the all-important annual cycle. It also yielded some surprises. There are marked peaks around 12 years and also around 70 years. In the case of the TTO or sunspot cycle, are we witnessing a forcing effect of the sun on the atmosphere or just a natural, if physically obscure, mode of natural oscillation of the climate system or a mixture of both? The question is open.

Ocean-atmosphere Models

Numerical models are attractive to scientists as, at least in principle, they can answer questions in a "physically consistent" manner. Nowadays the hydrodynamic part of weather models is based on sound physical principles but as the data are discrete and the models are integrated in steps over time, errors are introduced which cannot be easily assessed. The thermodynamic processes are described by parameterisations which account for their net effects. The set of parameterisations often bear the somewhat misleading title "model physics" and are a mix of equations which are fitted to satisfy criteria varying from physically sound to sheer intuition. Particularly difficult to parameterise are clouds and fluxes such as moisture at the interface between earth and atmosphere. Coupled atmosphere-ocean models have been developed since the late 1960s and these are used for studies of climate change. The great attraction of such models is that parameters, such as carbon dioxide concentration, an be varied and the effects on the evolving climate 'observed'.... in a sense experiments can be performed on the climate system. As the oceans

(1)act as the lower boundary of the atmosphere over most of the earth's surface

(2) convey and store large amounts of heat

(3) regulate carbon dioxide levels in the atmosphere and

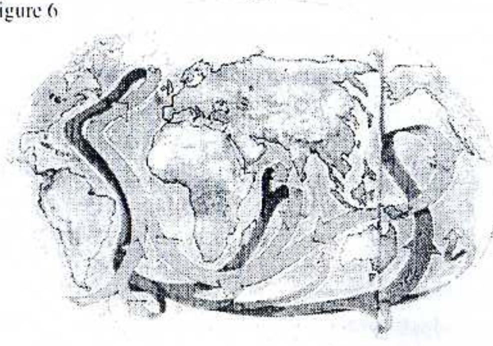
(4) react with the atmosphere in time scales which can be as long as hundreds of years,

the way in which they are coupled to the atmosphere in the models is crucial. Dynamical oceanography developed steadily from the late 1940s and with it theories of the large-scale ocean circulation. The importance of ocean currents to climate (re)gained prominence in the 1980s and '90s and as these ideas were supplemented by ice core data views of climate stability underwent a major change.

Ocean Circulation and Sudden Climatic Shifts

The feature of global climate most in the news in the 1980s and early nineties was the number of times (seven) in which the mean annual global temperature record was broken. Remarkable as this was, there also a very important realisation that significant climate shifts could occur in a relatively short time. The 'Little Ice Age' had shown that interglacial periods have climate shifts which last for some hundreds of years. As very reliable ice-core data on the end of the last Ice Age became available, it was seen that in the midst of the northward retreat of the ice sheets, there occurred a reversal about 11kyr ago called the Younger Dryas. For about a thousand years the glaciers moved back southwards. What was new and alarming was the suddenness with which this reversal set in, especially in Northern Europe - a period of 10 to about 20 years for the most part. A convincing explanation was found involving the injection of large amounts of fresh water into the North Atlantic by melting ice sheets over Canada. To appreciate the effect of this, look at the main conveyor current in the Atlantic(Fig 6). Upper warm water flows northwards to the vicinity of Greenland where it sinks and flows all the way back to the Southern Ocean near Antarctica. The water flowing northwards transports enormous amounts of heat which are transferred to the atmosphere as the warm water cools near Greenland. Near 0°C the salinity of seawater controls its density and Atlantic seawater is more saline than the waters of the Pacific. This high salinity contributes to the overturning but there is a feedback effect in that the high salinity is itself partly due to the overturning. Large volumes of freshwater entering the North Atlantic might well interfere with the process of overturning. Modelling studies show that coupled atmosphere-ocean models can have a regime like the present one and another with no overturning in the Atlantic and much greater symmetry between the Atlantic and Pacific basins - the present situation is highly asymmetric with large scale overturning in the Pacific. The models also indicate that removing Atlantic deep-water formation near Greenland would disrupt the Gulf Stream and cause a marked drop in the mean annual temperature over the Northwest of Europe, including Ireland. The area near Greenland where the water cools prior to sinking is a tongue of ice projecting into the sea. As the warm water cools there, ice forms and the more saline water sinks. In recent decades this pumping action has faltered and in 1994 it failed and has failed to function since. Some see global warming as the culprit. Another possibility is the 'great salinity anomaly' - a body of low-salinity cold water- which wandered from the area of Greenland into the Labrador Sea, across the North Atlantic, into the Norwegian Sea and then back into the area of its origin near Greenland between 1968 and the early 1980s. It then disappeared. In principle it could have reduced the salinity and density of water in the area of the ice tongue called the Odden feature hereby interfering with the sinking action. The origin and lifetime of such huge eddies still requires a convincing explanation. However the salient point is that the warmth of the Irish climate may well depend a lot on this sinking mechanism.

figure 6



Greenhouse Gas Effects

In recent years the warming effect of greenhouse gases has been of much concern. Historically warm periods have been times of high carbon dioxide concentration while levels have been low during ice ages. Geologists ask whether it is a cause or an effect of warming. Recently there has been concern that the greenhouse gases generated by human activity are sufficient to have a warming effect. At current rates of increase climate models indicate that there will be marked effects within a time scale of 100 years; this makes it a matter of more immediate concern than, say, the variation of the earth's orbital parameters. Remember, however, that changes in ocean circulation patterns can occur on decadal time scales. Modelling of the global effects of increasing carbon dioxide have shown the most marked warming near the Poles, especially the North Pole. Only in recent years has there enough computing power to attempt regional modelling of the effects of CO_2 increase. In a recent European study four models were run: one French, one British and two German. The German models differed only in the way the ocean was treated. Maps were produced of the expected changes in the decadal means in winter and summer of air temperature and of precipitation around the time of CO_2 doubling. The results may be summarised as:

1. Air temperature : increase in both winter and summer but the amount very model-dependent and especially sensitive to the assumptions made about the ocean.
2. Precipitation : the results were more variable, with two forecasting an increase and two a decrease in winter precipitation; the details are again very sensitive to the modelling of the oceans. For summer three produced an increase while one indicated a decrease in precipitation. For Ireland the crucial factor in synoptic (weather-map) terms would be the track of the Atlantic depressions and the strength and sphere of influence of the high-pressure area near the Azores. The results of the model comparisons show that the results are very much tentative rather than conclusive.

So here we are with promised warming due to greenhouse gases and threatened cooling if the overturning mechanism in the Greenland area continues to fail. To get a perspective it is instructive to look at the evolution of ideas on climate change through the views of two eminent climatologists, C.E.P. Brooks and H.H. Lamb and follow that with a look at recent thinking.

Climate Through The Ages
C.E.P. Brooks 1948

An assessment of the causes of major climatic shifts: There are nine and sixty ways of constructing tribal lays

Probable that:
1. Dominant causes were geographical distribution of land and sea, currents and vertical circulation in the ocean, and volcanic activity
2. Orbital factors produce lesser fluctuations
3. Continental drift theory dubious
4. Variations of carbon dioxide of relatively slight importance. Theory of reversal of ocean circulation to give warm periods in high latitudes more plausible.

The first edition of the book was in 1926 and so concern about climate change is no recent thing. This distinguished climatologist was making the point that rather than having a single explanation, major shifts of climate were likely due to a conjunction of several effects. He placed less emphasis on orbital variations and on the greenhouse gas contribution than we would nowadays but his emphasis on ocean circulation is very modern. Continental drift is now generally accepted but recall that the ideas on plate tectonics date from the 1950s; prior to that the mechanism by which the continents drifted from far southern latitudes to their present locations was a bit mysterious.

Current Trend of World Climate - Perspective by H.H. Lamb 1975

It seems possible to venture the following conclusions:

1. Development towards an ice age situation about 10,000 years hence (Vernekar 1972).
2. Superposed on a slow general decline of temperature in the millennia ahead will be fluctuations on time scales of 200 to 2000 years which must be expected to produce periods of increasing warmth or apparent stability followed by sharp cooling.
3. The question of whether a lasting increase of glaciation and permanent shift of the climatic belts results from any one of these episodes must depend critically on the radiation available during the recovery phase of the shorter-term fluctuations. An influence which may be expected to tip the balance towards warming - possibly inconveniently rapid warming - is the increasing output of carbon dioxide.

Here we see the influence of the Milankovitch theory upgraded and it continued to be increasingly influential during the 70's. However the greenhouse effect was also gaining ground. Lamb also had shown in his researches that interglacials are not uniformly warm periods but may show considerable fluctuations.

Current Position

1. Greenhouse-gas warming LIKELY to be more important in the short term (100 years).
2. Milankovitch theory seems to have considerable validity. On scale of 10 to 25 thousand years we are headed for considerable cooling. Abrupt shifts may occur rather than smooth progression.
3. Ocean circulation and its stability are very important to the climate of northern Europe.
4. The natural internal variability of the ocean-atmosphere system may also be more influential than was heretofore considered.

Currently carbon dioxide effects are still foremost but there is the realisation that the stability of the North Atlantic conveyor is a key issue. As we have seen the mechanism regarded as the most crucial has altered several times in the last 50 years and may well do so again during the next 50.

This talk was given by Mr Denis Fitzgerald, Head of Climatology, Met Éireann

THE WINDS OF MISFORTUNE - THE WEATHER OF DECEMBER 1796 AND THE FAILURE OF THE WOLFE TONE EXPEDITION TO BANTRY BAY

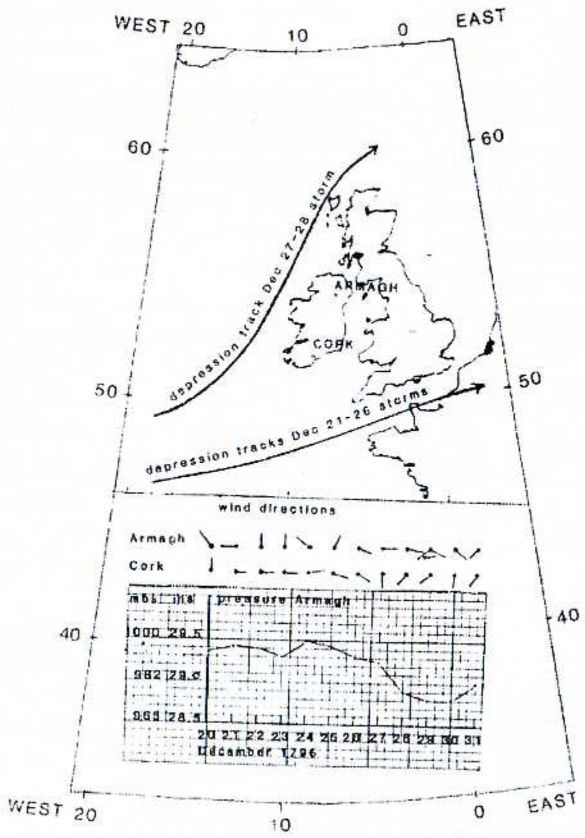
The weather of December 1796 can be reconstructed by using some of the early instrumental records for Ireland (for example, Armagh Observatory, see Figure), but more particularly by plotting wind data contained in ships log-books.

These have been used to construct synoptic weather maps for the period 1st December 1796-5th January 1797, and these reveal a wide range of weather conditions affected the attempted French invasion of Ireland.

A blocking high pressure system produced light easterly winds over northern France and the English Channel during the first half of the month. At Brest, where the French fleet was assembled, this produced balmy, almost summer-like conditions in the shelter of the west-facing harbour. There, Wolfe Tone and the French awaited more opportune weather to break out from the blockade of the superior English fleet. As they waited they had no idea that further westward the easterlies became fierce gales on the northern flanks of depressions whose progress was being blocked by the high pressure, causing damage to the displaced English fleet. With no change to the weather at Brest, the French fleet left on 16th December at night, heading south-westwards through a narrow dangerous channel (Pointe du Raz) to mislead the English into thinking that it was headed for Portugal. A slight change in wind direction made this even more dangerous than normal, resulting in the wreck of one of the ships of the line (with the loss of most on board) and a change in orders by the admiral to leave by the main channel. In the dark, all of this produced immense confusion. Daylight on the 17th found the fleet scattered and heading slowly south-westwards before changing course towards their real destination, regrouping as the ships found each other in favourable weather conditions.

But the weather began to change dramatically. A warm front from the south-west advanced on the night of the 17th, as the blocking high retreated.. This brought dense and persistent fog, which engulfed both the English and French vessels, making the French invisible to the English. The fog was limited northwards to approximately 50°N, so as the French emerged they were able to regroup again as they approached Cape Clear. Ahead of the warm front they found the wind still easterly, making their passage towards Mizen Head, the rendezvous for the fleet if it became dispersed, an easy one. At this point a following cold front caused the wind to veer, the resulting north-westerlies then becoming favourable for progress up Bantry Bay. But, although most of the fleet had made the rendezvous, the Fraternité, with General Hoche on board, was still missing, so the fleet had to wait. The waiting lost an important moment of opportunity created by the weather that had been favourable to the French up to this point.

A series of depressions between 21st and 28th December cancelled out these advantages. The first two of these passed to the south of Ireland bringing strong easterly winds to the south coast (a comparison of wind directions between Cork and Armagh shows that the easterlies were mainly in the south of the country, Fig 1). The resulting gales made progress up Bantry Bay impossible. A widespread easing of the winds late on the 24th (when pressure rose at Armagh, Fig 1) was another moment of opportunity - the last. But no advantage was taken of it, and a landing was anticipated the next day. Then a second storm, following a similar track and more severe than the former, made that plan impossible. But there was another plan. It was decided that a landing on the Shannon would be attempted as an alternative. When the storm eased on 27th December, Bantry Bay was left for the new rendezvous. At this stage the most severe storm of the sequence arrived on the night of the 27th. Armagh records its lowest pressure of the month as this depression moved northwards on the 28th/29th. The depression came from the south-west and, unlike its predecessors, moved northwards, to produce severe south-west winds which nearly sank Wolfe Tone's vessel. While his vessel, the Indomptable, did manage to make the Shannon rendezvous the next day, few others did and it was decided to return to France. The winds were now more westerly, assisting the return. More important to the successful return of most of the French ships was the damage done to the English fleet in the storms and the delay to Lord Bridport's fleet at Spithead caused by the easterly winds preventing them putting to sea at the eastern end of the Isle of Wight.



WEATHER CONDITIONS DECEMBER 1796

John Tyrell

John Tyrell gave a fascinating lecture on this topic on Friday 13th December 1996 - the 200th Anniversary of the expedition.

Mt. Washington - one of the world's windiest locations

Mt.Washington in the 'White Mountains', New Hampshire, U.S.[6,288ft.(1916m)] has recorded the 'highest measured wind gust' of 231 mph(372 kph) on the 12th April 1934 - i.e. outside of tropical /hurricane /tornado events. There is a manned station on the summit operated by the U.S National Weather Service(NWS). It gets its fair share of ice and snow and has to be well bolted down! A cog-wheel railway takes visitors to the summit and is open in summer. A new summer wind speed record was recorded there on 22-Jul.-96 at 19:41 It was an unusually deep summer low pressure system that produced winds in New England rivalling those of the recently departed Bertha. The weather that hit Mt. Washington for a full two days was especially severe. The summit received nearly two thirds of its average July precipitation in only 48 hours, tied a daily low temperature record, and smashed an all time record for highest wind gust for the month (until now the calmest of the year) and also for any of the summer months June through August. The winds averaged 100 mph and a peak gust of 154 mph was attained for the period 7/20 to 7/21. The former peak gust records for June, July, and August were:

Month	June	July	August
Year	1949	1933	1954
Direction	NW	NW	ENE
Speed	136mph	110mph	142mph

Attached are edited observer's comments for Sunday and Monday morning

TODAY'S SUMMIT CONDITIONS
AT 06:00 AM 21/7/96
24 Hour Statistics
Maximum Temperature: 37 F
Minimum Temperature: 32 F
Precipitation: 2.20"
Peak Gust: West 154 mph

The summit's been waging a battle with the wind over the past 24 hrs and it's been pretty much of a draw. We're still here, though various pieces of the building and equipment aren't.' We spent part of the day shoring up doors and windows and pumping water out of the tower as the low over Maine deepened and the wind and precipitation increased. The wind averaged 100mph for the day and the peak gust was 154 mph, a new all time record for July

TODAY'S SUMMIT CONDITIONS
AT 06:00 AM 22/7/96
24 Hour Statistics
Maximum Temperature: 43 F
Minimum Temperature: 35 F
Precipitation: None
Peak Gust: West 125 mph

The weather, life and everything has returned to normal this morning, following the big storm on Sat-Sun. Sat was the windiest summer day ever in the history of the Observatory, averaging 100mph for the day with a peak gust of 154 mph. The temp dropped to 32 and we had a few snow flurries.

Extracted from letter to K.Dollard received via the Internet from his friend at Mt. Washington.

Ireland's Climate 1996

Here are some records of our own which were broken during 1996. One of the more notable records this year were Birr and Valentia with the lowest mean wind speed ever whereas Malin Head had its highest gust in 35 years. No maximum-temperature records were broken this year while some stations had their lowest means for some time

Rainfall, Sunshine and Temperatures and differences from average.

Station	Rainfall % normal	Sunshine %	Temperature mean	diff from av	mean max	diff from av.	mean min	diff from av
Valentia Obs.	112	100	10.4	-0.1	13.3	-0.1	7.5	0.1
Shannon Apt	96	99	10.5	0.4	13.9	0.3	7.0	0.5
Dublin Airport	105	92	9.0	-0.6	12.6	-0.1	5.3	-0.9
Malin Head	89	106	9.4	0.0	11.9	0.0	6.9	-0.1
Roches Point	103	87	10.3	0.0	13.1	0.3	7.4	-0.2
Belmullet	103	102	9.9	0.0	12.8	0.3	7.0	0.2
Clones	101	104	9.1	0.2	12.6	0.2	5.6	0.4
Rosslare	108	100	10.3	0.1	12.7	0.2	7.8	0.3
Mullingar	94	97	8.9	0.2	12.5	-0.2	5.2	0.1
Kilkenny	115	100	9.5	0.1	13.5	0.1	5.4	0.3
Casement	103	97	9.2	-0.1	12.8	-0.2	5.5	0.1
Cork Airport	117	103	9.5	0.0	12.5	0.1	6.5	0.4

List of rainfall records for 1996

Station	Total	Driest in	Previous drier year
Shannon Airport	886.0	5 years	879.6 in 1991
Malin Head	926.6	13 years	923.5 in 1983
Belmullet	1136.0	9 years	1082.7 in 1987
Clones	929.5	5 years	849.9 in 1991
Mullingar	870.6	7 years	812.5 in 1989

List of records of maximum daily rainfall for 1996

Station	Max daily fall	highest daily fall for	Previous highest
Rosslare	47.2	5 years	57.7 in 1991

List of mean temperature records for 1996

Station	Mean	Coldest in	Previous as cold or colder
Valentia Obs.	10.4	9 years	10.3 in 1987
Dublin Airport	9.0	10 years	8.8 in 1986
Roches Point	10.3	9 years	10.2 in 1987
Belmullet	9.9	8 years	9.9 in 1988

List of records of minimum temperatures and grass minimum temperatures for 1996

Station	Min	lowest	Previous as low or lower	Grass Min	lowest Grass Min	Previous as low or lower
Valentia Obs.	-3.8	in 5 years	-5.2 in 1991			
Belmullet	-3.7	in 5 years	-3.9 in 1991	-9.0	in 9 years	-9.0 in 1987
Mullingar				-9.7	in 9 years	-10.7 in 1987

List of mean maximum and mean minimum temperature records for 1996

Station	mean min	lowest mean min in	Previous as low or lower	mean max temp	lowest mean max in	Previous as low or lower
Valentia Obs	7.5	9 years	7.4 in 1987	13.3	10 years	12.5 in 1986
Dublin Airport	5.3	55 years	3.9 in 1941	12.6	10 years	12.1 in 1986
Malin Head	6.9	9 years	6.8 in 1987			
Roches Point	7.4	10 years	6.5 in 1986	13.1	8 years	13.0 in 1988
Belmullet	7.0	9 years	6.5 in 1987	12.8	8 years	12.6 in 1988
Clones	5.6	9 years	5.3 in 1987			
Casement	5.5	9 years	5.3 in 1987			
Birr	5.4	9 years	5.4 in 1987			
Cork Airport				12.5	9 years	12.5 in 1987

List of sunshine total records for 1996

Station	Total	sunniest in	dullest in	Previous as sunny or sunnier	Previous as dull or duller
Malin Head	1371.1	19 years		1376.0 in 1977	
Roches Point	1294.3		11 years		1269.4 in 1985
Belmullet	1393.5	21 years		1434.0 in 1975	

List of records of maximum daily sunshine for 1996

Station	Max	highest daily sunshine in	Previous as high or higher
Rosslare	15.7	25 years	15.9 in 1971

List of mean wind speed records for 1996

Station	mean wind	lowest mean wind	Previous as low or lower
Valentia Obs.	8.8	on record	
Shannon Airport	8.8	in 7 years	8.5 in 1989
Belmullet	13.1	in 8 years	12.9 in 1988
Mullingar	6.8	in 9 years	6.6 in 1987
Kilkenny	6.2	in 9 years	6.0 in 1987
Casement	10.4	in 18 years	10.4 in 1978
Birr	5.5	on record	

List of records of maximum gusts for 1996

Station	Max gust	highest max gust in	Previous as high or higher
Malin Head	92 knots	35 years	98 knots in 1961

WEATHER SUMMARY FOR 1996

STATION	RAINFALL			AIR TEMPERATURE							SUNSHINE			WIND		GRASS TEMP	
	Total	Most in Day		Means of			Extreme Temperature				Total	Most in Day		MaxGaleGust		Lowest Grassmin	
		Amount	Date	Max	Min	Mean Temp	Max	Date	Min	Date		Amount	Date		date		date
Valentia Obs.	1567.7	39.4	6Jan	13.3	7.5	10.4	25.4	16Jun	-3.8	21Feb	1311.3	15.3	17Jun	69	11 Jan	-8.0	21 Feb
Shannon Apt	886.0	23.7	28Nov	13.9	7.0	10.5	27.0	16Jun	-3.6	25Dec	1313.6	15.0	17Jun	66	11 Feb	-9.1	21 Feb
Dublin Apt	784.2	43.4	19Nov	12.6	5.3	9.0	24.3	19Jul	-5.4	6Dec	1358.2	15.1	13Jun	66	5 Nov	-8.6	6 Dec
Malin Head	926.6	37.5	5Aug	11.9	6.9	9.4	24.0	16Jun	-2.4	4Feb	1371.1	15.2	15Jun	92	6Nov	-6.2	4 Feb
Roches Pt	964.4	31.2	12Mar	13.1	7.4	10.3	22.2	10Jul	-1.6	27Jan	1294.3	14.7	13Jun	69	28 Oct	-2.8	21 Nov
Belmullet	1136.0	36.8	3Jan	12.8	7.0	9.9	25.0	4Sep	-3.7	14Feb	1393.5	15.2	14Jun	71	18 Feb 6 Nov	-9.0	25 Dec
Clones	929.5	42.5	6Aug	12.6	5.6	9.1	25.6	19Jul	-4.6	3Feb	1236.1	14.6	17Jul	57	18 Apr 5 Nov	-13.1	3 Feb
Rosslare	961.7	47.2	4Jan	12.7	7.8	10.3	22.3	10Jul	-0.8	27Jan 21Nov	1635.5	15.7	13Jun	68	28 Oct	-5.5	27 Feb
Mullingar	870.6	38.9	6Aug	12.5	5.2	8.9	24.2	18Jul 19Jul	-5.3	4Feb	1279.9	14.7	16Jun	62	5 Nov	-9.7	21 Nov
Kilkenny	951.6	33.1	22Aug	13.5	5.4	9.5	26.5	18Jul	-5.5	27Jan 21Nov	1343.3	15.4	16Jun	56	22 Apr	-13.3	28 Jan
Casement	748.8	58.4	19Nov	12.8	5.5	9.2	25.7	19Jul	-5.9	6Dec	1357.3	15.1	16Jun	59	22 Apr	-8.8	6 Dec
Cork Apt	1433.5	52.8	13Mar	12.5	6.5	9.5	23.6	13Jul	-3.1	21Feb	1487.0	15.0	17Jun	62	28 Oct	-8.9	21 Nov
Birr	837.7	31.9	5Aug	13.0	5.4	9.2	25.7	19Jul	-5.8	25Dec	1174.5	14.7	17Jun	53	11Jan 18 Feb	-12.7	25 Dec

Cloud Corner - December 1996

Edited by Ed Graham (BA, MSc) Cunningham Weathernet Ltd. Bournemouth (UK)

Photo 1: Altocumulus Castellanus: This photo was taken from Wageningen Agricultural University in the Netherlands on the afternoon of 21st July 1995. Altocumulus castellanus (or castellatus) is a medium level cumulus cloud formed by convection high-up within the atmosphere and is not initiated by direct heating from ground level. In this case, cold dry air above is over-running some very warm and moist air below the 500mb level which is giving rise to significant dry and wet bulb potential temperature lapse rates. As a result convection has begun from the upper level of this moist layer. Radiosonde measurements from De Bilt (some 30km west of Wageningen) in the morning confirmed this atmospheric diagnosis and together with a strong anticylonic subsidence inversion at lower levels down to 900mb, it was estimated that a surface temperature of at least 33°C was needed before deep convection (directly from the ground level) could be set off to above 500mb. Indeed, on this occasion temperatures actually reached 34°Cin the southern Netherlands and violent thunderstorms with tops approaching 200mb (with large hail) developed that evening.

Photo 2: This is the same altocumulus castellanus viewed from directly underneath. The patchy quiltwork design is obvious from this picture which was taken at around the same time as photo 1. Castellanus tends to occur during the summer half of the year and is generally associated with unstable south-easterly thundery situations. Occasionally however, it does occur in Ireland on the rear edge of cold fronts as they pass through from the west. This happens when the upper cold front over-runs the warmer air beneath which creates instability. More often than not, altocumulus in Ireland is related to spreading out of convective cumulus rather than castellanus-style formation.

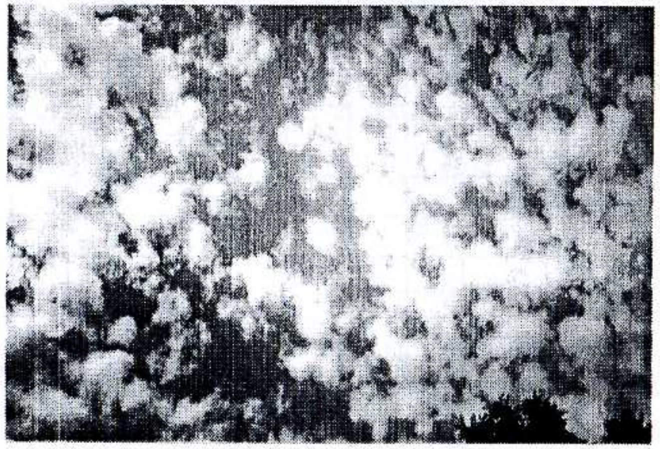


Photo 3: Fair weather cumulus: This photo was taken during the late afternoon of 20th August 1992, looking north-west from Dun Laoghaire east pier. It had been a fine day across the Dublin region with some pleasant sunshine at times and temperatures reaching over 20°C. Winds were generally light south or south-westerly, but occasional south-easterly sea-breeze pulses affected the coastal areas at times (such as at Dun Laoghaire). However, the classic sea-breeze (rather common during the summer months on the east coast) failed to develop fully. In this picture, the cumulus are probably at a height of some 3,000 or 4,000 feet, and are characteristically shallow in depth and widely-spaced.

Photo 4: Cumulus street: This well developed cumulus street was photographed on the afternoon of 12th July 1992 looking south-west (directly into the regional wind) from Howth summit. Dublin Bay is in the foreground with the Dublin/Wicklow mountains in the background from left to right. Coastal regions appear rather sunny and free of cumulus development, whereas most inland regions are rather cloudy. The street itself seems to have an origin somewhere on the western ridge of the Dublin hills; perhaps some extra up-lift is produced on this windward side. Most noticeable however, is the increased development and darkness on it's leading edge located over Dublin city; perhaps the city's heat island is playing a role here? - although this is by no means certain.

-- Ed Graham (BA, MSc) Meteorologist for Cunningham Weathernet Ltd., 4th Floor, Kingsland House, 21 Hinton Road, Bournemouth BH5 2AQ. Tel: 01202-296396 Fax: 01202-316819 e-mail: Ed@weathernet.demon.co.uk

"We are all in the gutter, but some of us are looking at the stars" -Oscar Wilde

Irish Meteorological Society - 1996 Annual Outing to Céide Fields, Co. Mayo

Photo 1: Our journey started at 8.30 am when we left Dublin, picking up people at Glasnevin,Trinity College and also at Maynooth. We went directly to Bellacorrick where the wind farm is situated (25 miles past Ballina) After short refreshment we all boarded the bog train which consisted of a bog railway engine and a genuine West Clare Railway carriage as you see opposite.

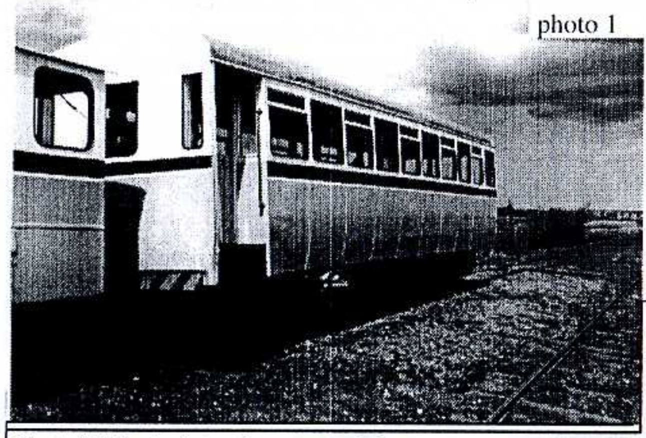


photo 1

Photo 2 The train took us around the bog and we were shown the 21 windmills. These windmills are almost maintenance-free with only one and a half persons needed to keep them going. The windmills are controlled from a centre in Denmark and will cut out automatically when the wind goes over a certain speed. They are very heavy and are secured by a very large block of concrete. They cost £8 million but this will be recovered in the first 5 years of operation. As it happened, the day we were there, the wind speed wasn't sufficient to generate much electricity. The photo shows a contrast of the old technology and the new as the wind farm is next to a peat-burning power station.

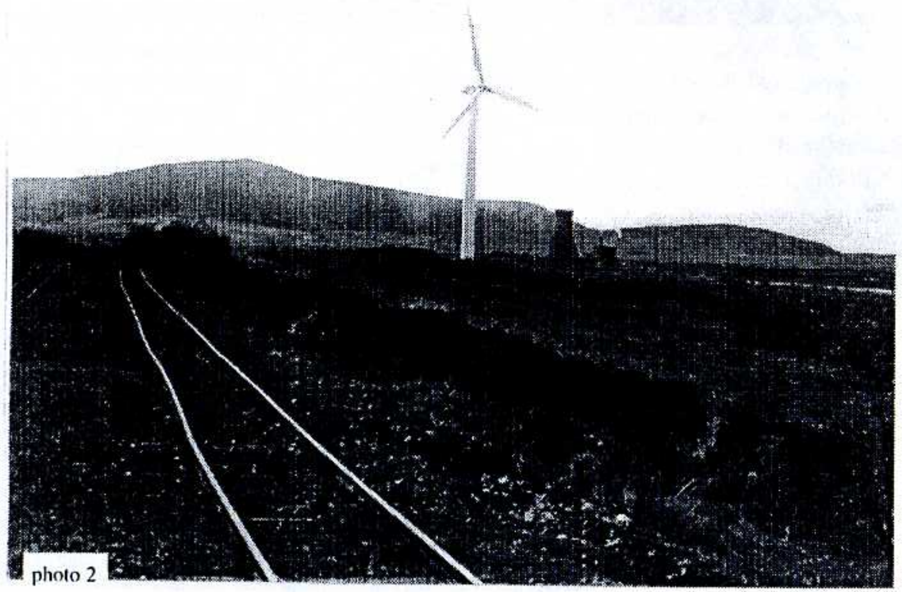


photo 2

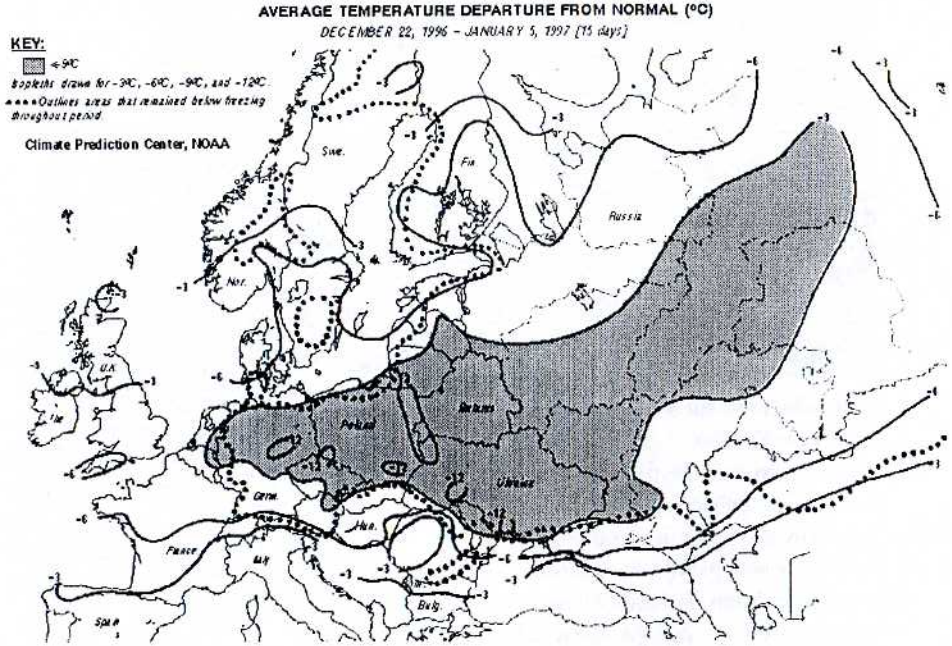
photo 3

Photo 3 shows the Céide Fields Interpretive Centre in the background. Its shape is somewhat familiar to those who know the Met Éireann building. The foreground shows some of the exposed walls of the ancient fields which have been discovered. There is a viewing platform at the top of the Centre and it can be accessed either by a stairs inside the building or by climbing up steps on the outside of the building. It has a spectacular view of the cliffs along the coastline. There was a purpose built video room in the centre and an indoor exhibition. We were very lucky with the weather that day as, while there was quite a lot of shower activity over the country, the Northwest escaped and there were blue skies all the way.

Photo 4 shows the group on the tour of the Céide fields with our very informative tour guide. She told us the story of how the fields were discovered and also how the walls are found under the bog. This is achieved by sticking a long metal rod down into the bog and measuring how far it will go down before it reaches either the ground or the stones of the walls. These heights are then plotted using sticks. We were even allowed to try this ourselves. The farm walls that have been found already are marked out on the bog and it is quite impressive to view these as they spread up the hillside. Our guide told us about the living arrangements of these farmers of 7000 years ago. There was a communal living area but each was responsible for their own field. They kept livestock too.

photo 4

Bitterly Cold Conditions Grip Most of Europe and Central Russia - *Climate Prediction Center, NOAA*



While much of the United States experienced unseasonably mild conditions,bitterly cold air settled into most of Europe and central Russia since late December. Most areas across central and northern continental Europe, western Russia, southern and eastern Scandinavia, and southwestern England averaged at least 6 degrees Celsius below normal for the 15-day period, with departures reaching -15 degrees Celsius in the southwestern Ukraine. Lows plummeted to -40 degrees Celsius in part of northwestern Russia, to -25 degrees Celsius as far south as northeastern Romania, and to -10 degrees Celsius in western Macedonia near Albania. In addition, a large section of Europe and western Russia from Germany eastward remained below freezing throughout the period. According to media sources, the prolonged cold snap, accompanied by periodic snowfall in some areas, took nearly 10 dozen lives, disrupted air and surface transportation, caused localized power outages, and froze Netherland's canals solid for only the 15th time in the last 100 years.

Met Soc. Annual Dinner

Saturday 22nd February 1997 8pm

The Old Dublin Restaurant, Francis St., Dublin 8.

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Dinner Menu

Galantine of Game
Home Pickled Beet and Pear Chutney

Baked Tomato Galette, Pesto Sauce
With Spicy Polenta, Boifie and Mushroom Cup

Dressed Kilmore Crab and Lime Cured Salmon
Served with Avocado and Crème Fraiche

Pan Fried Terrine of Pressed Duck Liver
With Potato and Sage

Freshly prepared Soup of the Day

Duo of Melon
With Assorted Fruits

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Chargrilled Rib Eye of Beef
Portobello Mushroom and Pommerol Butter

Roast Haunch of Venison, Orange and Juniper Berry Jus
Served with Glazed Chestnuts and game Chips

Seared Fillet of Salmon with Wilted Greens
With Sweet Confit of Carrot

Pot Roast Stuffed Breast of Pheasant
Wrapped in Pancetta, with Wild Cranberry Jus

Loin of Errigal Lamb
With Aromatic Herb and Oyster Mushrooms

Selection of Fresh Vegetables

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Choice of Dessert

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Tea/Coffee

Price: IR£20.00 **including service charge**