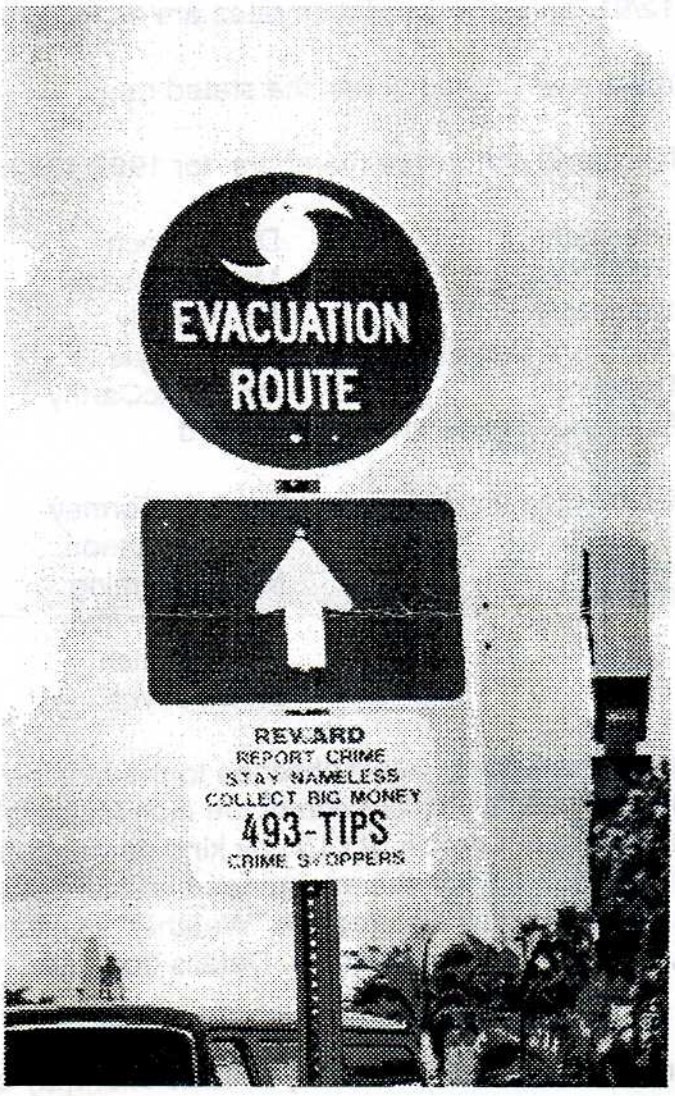
Irish Meteorological Society

Newsletter

Number 34 **Sept. 1992**



A familiar sight to the couple of million people from Florida and Louisiana who followed the hurricane evacuation route northwards, to avoid the chaos and destruction caused by Hurricane Andrew in August.

Contents:

President: P. Lynch *Secretary: A. Kelly*

Irish Meteorological Society

The Irish Meteorological Society was founded in 1981 with the object of promoting an interest in meteorology in Ireland and disseminating meteorological knowledge, pure and applied. Membership is welcomed from those with an interest in meteorology, climate and the environment. The Society organises lectures, seminars, outings and an annual dinner for members and guests. An A.G.M. takes place, usually in April each year to coincide with the annual one-day seminar.

Summaries of lectures and other articles of meteorological interest are published in the Society's Newsletter. Articles and comments on articles are welcomed from members for publication.

The address of the Society is : Irish Meteorological Society,
c/o Meteorological Service,
Glasnevin Hill,
Dublin 9

As of 12/91, annual subscription rates are as follows: Greater Dublin Area £12,
elsewhere £8.
Students are welcomed at half the stated rates.

The officers and committee members for 1992/1993 are as follows:

President	Dr. P. Lynch
Vice-President	Ms. E. Cusack
Secretary	Mr. A. Kelly
Assistant-Secretary	Mr. J. Doyle
Treasurer	Mr. S. McCarthy
Assistant-Treasurer	unfilled
Committee members:	Capt. K. Tormey
	Dr. P. Shannon
	Mr. G. Fleming
	Mr. K. Commins
	Mr. S. Walsh
	Dr. M. Joyce

Members of the Society may subscribe to the Monthly Weather Bulletin published by the Climate and Applications Division of the Irish Meteorological Service at the preferential (as of 12/91) annual subscription of £15 , by kind permission of the Meteorological Service. The Society gratefully acknowledges the assistance and facilities which it enjoys from the Meteorological Service.Members may also receive "Weather" magazine, published by the Royal Meteorological Society, again at preferential rates. Details from the Treasurer at the above address.

Last April, Gerald Fleming stood before those assembled in the Tara Tower Hotel for the Society's One-Day meeting on "Weather Extremes" and delivered an illustrated lecture on Hurricanes and Tornadoes. It was difficult then to image the awesome power and energy of destruction contained in a Category 4 hurricane. During August most of us will have seen, through the media, the effects of "Andrew" as it passed through the Carribbean, devastating the Bahamas, Florida and Louisiana. The National Hurricane Centre in Miami reported (before it's monitoring equipment was blown away) a sustained wind of 130mph and a gust of 164mph.
The TAFs (terminal area forecasts issued for airports) for Miami International Airport, in anticipation of Andrew's arrival ,contained forecast winds of 70kts, gusting to 120kts. In the Bahamas, Nassau's TAF simply began "variable 130kt!"

HURRICANE!

As we go through the summer, the waters around our coasts gradually warm up, with the surface layers reaching 18 or 19C at most off the Southern and Southwestern shores. Away to the South, at latitudes of 15 to 20 degrees North of the equator, the surface layers of the oceans are warming too, and by mid to late summer will reach 27 or 28C. At these temperatures, heat energy steams off the sea surface, driving intense convective clouds high into the atmosphere, and every so often these clouds get whipped into a tight spiral of accelerating air - a HURRICANE.

How do these hurricanes begin? We can set down a number of conditions that appear to be neccessary for hurricane development. The first is location. Hurricanes have their greatest genesis between latitudes 5 and 25 degrees North and South of the equator. Warm seas are required, a surface temperatures of 26.5C or greater, and this warm surface layer must also be sufficiently deep. There must be high convective instability, that is , a high lapse rate, or to put it another way - a temperature that decreases rapidly as we ascend through the atmosphere. There must also be high humidities right through the troposphere.

Another neccessary condition is that there be small values of vertical wind shear. The energy of hurricanes is mediated by vigorous convective clouds and such clouds cannot develop in conditions of high wind shear, as the tops of the clouds get shorn away from the bases and the vertical convective cells never really get a chance to get going. The final condition is the requirement for positive vorticity at low levels; this provides the initial kick to get the convective clouds organised into a circulation. Once circulation and it's associated vertical motion begins, the dynamics of the hurricane itself provide the impetus for deepening and development.

It is approcriate at this stage to note that what we call hurricanes have the generic title "Tropical Cyclones". In the Pacific they are known as Typhoons; while in the Phillipines they go under the name of "Bagiuos", recalling the name of a town destroyed by a tropical cyclone in the last century.

Coming back to the Atlantic, where are the favourite places for hurricane development? It is noteworthy that hurricanes do not develop south of the equator in Atlantic waters; sea surface temperatures are just not high enough. In the North Atlantic we have the great anti-cyclonic swirl of air known to us as the Azores High, and on it's southern flanks the Easterly trade winds that carried Colombus and his successors frm the Old World to the new. Within this easterly flow, troughs of low pressure known as easterly waves form over West Africa and are carried by the trade winds out over the ocean. About 100 of these easterly waves cross the Atlantic each year and one in five or thereabouts encounters sufficient oceanic heating to develop into a tropical disturbance, with a central pressure close to 1000hPa. These tropical disturbances are not like our familiar mid-latitude depressions, in that they do not entrain sectors of warm and cold air and are not associated with frontal boundries as such. Rather, they are loose circulations of convective clouds, swirls of thundery showers with winds reaching up to gale force.

Of these 20 or so tropical disturbances that cross the Atlantic every year, 6 or 7 go on to the next stage of development; they form what is one of the strangest meteorological phenomena known, the EYE; they become hurricanes.

A simple plan view of a hurricane is presented in Fig. 1. At the centre is the eye, typically 20Km in diameter, a zone of descending air promoting clear skies and light winds. Surrounding this is the eye wall, an area of intense convection 10 to 20Km thick. Within the wall, updraughts of 2-4 metres/sec. are to be found, driving convection up to 60,000 feet in altitude and generating rainfall rates of 30-50mm/day.
This is also the zone of strongest winds, with speeds of 100mph and greater.
Around the eye wall, out to a diameter of 200Km or thereabouts, are the hurricane rain bands, spiral arms of convective cloud that reach from the eye wall out to the periph--ary of the hurricane itself. That hurricane rainfall was organised into such bands was not suspected until the 1960's when the early weather satellites first revealed the structure of the circulation. Beyond these rain bands, an area of divergent surface winds and gently descending air occurs, in which normal tropical cloudiness is suppressed. Knowledge of this phenomenon is much older; it is recorded that Christopher Colombus refused to put to sea on one occasion when ordered to do so by the Governor of Hispaniola, as he recognised this sign of an impending hurricane. The Governor's fleet put to sea and the great majority of his ships were lost next day.

FIG. 1

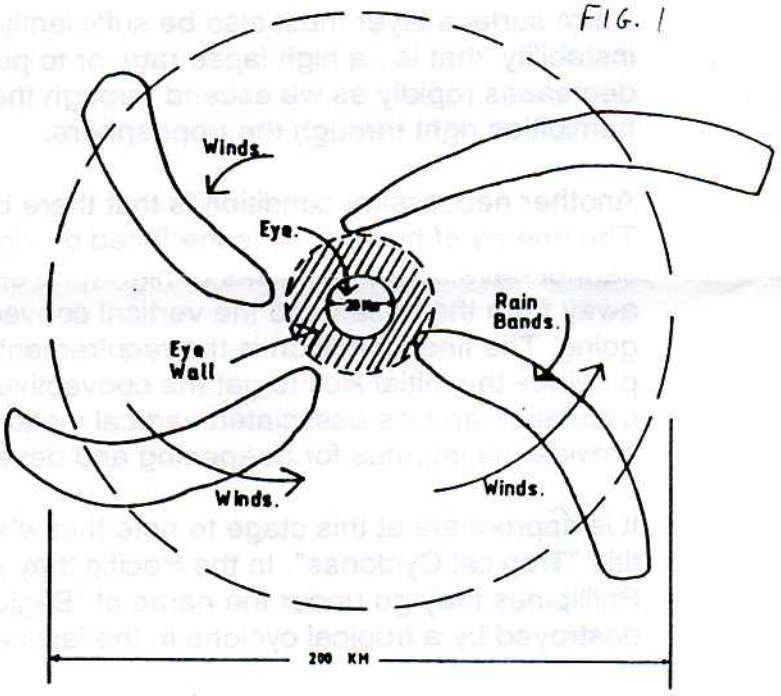
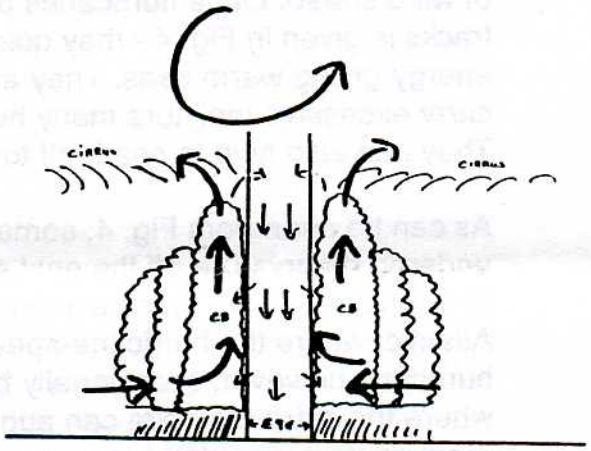


Fig. 2 gives a simplified cross-sectional view of the wind flow in a mature hurricane. The sizes of the arrows give some idea of the strength of the windflows. Within the eye we have subsiding air, and because of this subsidence the air in the eye is warmer than the ascending air in the eye wall - a temperature difference that can be as high as 10C. Such temperature differences occuring over horizontal distances of 20 or 30Km are otherwise unknown in the free atmosphere. Because this air is warmed to such an extent it is also less dense than the surrounding air, and this low density contributes in turn to exceedingly low surface pressure values at the base of the eye. The lowest surface pressure measurements recorded were during tropical cyclones; 870hPa in Typhoon Tip near the Phillipines in 1979, and in the Atlantic 888hPa in Hurricane Gilbert just west of Cuba in 1988. This latter value was extrapolated from pressure readings taken at an altitude of 10,000ft by a NOAA reconnaissance aircraft flying through the centre of the storm.



WIND FLOW IN A MATURE HURRICANE

Fig 2

The strength of a hurricane is measured on the Saffir/Simpson scale, shown in Fig. 3. This scale starts where the Beaufort scale leaves off, with a hurricane being defined by Beaufort as Force 12, with winds of 73mph (64kts) or greater.

SAFFIR/SIMPSON HURRICANE SCALE

CATEGORY	CENTRAL PRESSURE	WINDS (MPH)	STORM SURGE (FEET)
1	>980	73-95	4-5
2	965-979	96-110	6-8
3	945-964	111-130	9-12
4	920-944	131-155	13-18
5	<920	>155	>18

MAJOR HURRICANE: CATEGORY 3 OR GREATER.

Fig 3.

The three related criteria for assessing the strength of hurricanes are the central pressure, sustained wind speed and the height of the related storm surge.

It is the storm surge that is the cause of the greatest damage inflicted by hurricanes on coastal regions - it has been estimated that 90% of all property damage due to hurricanes in the U.S.A. is due to this effect. This storm surge results from:

1. The water driven onshore by the strong winds, and
2. The rise in sea level associated with the fall in central pressure.

It was such a storm surge associated with a Pacific typhoon in the Bay of Bengal, making landfall just at the time ofhigh tide, which caused the flooding in Bangladesh in 1970 which left between 200,000 and 300,000 people dead. In the U.S.A., where there has not been major loss of life due to hurricanes for some decades now, Bob Sheets, the Director of the National Hurricane Centre in Florida has pointed out that inadequate planning control has allowed an explosion in

the population of the coastal regions of the southeastern U.S. The percentage yearly increase in population is greater than the percentage yearly improvement in forecast accuracy at the Centre, which suggests that the risk of major hurricane--related loss of life in the U.S. is growing each year.

Next to storm surge, wind is the biggest threat from a hurricane, and it has been estimated that wind damage, in monetary terms, is proportional to the third power of wind speed. Once hurricanes pass inland - and an indication of typical hurricane tracks is given in Fig. 4 - they quickly lose their intensity, cut off as they are from the energy-giving warm seas. They are far from being harmless however, as they can carry excessive moisture many hundreds of miles inland, resulting in serious flooding. They can also help to spark off tornadoes.

As can be seen from Fig. 4, some North Atlantic hurricanes never make landfall and undergo recurvature off the east coast of the U.S., steering around the western edge of the Azores High. This track brings them over the colder waters of the North Atlantic, where the hurricane-speed winds quickly subside. The remnants of the hurricane however, occasionally become entangled in mid-latitute depressions, where the extra moisture can augment the moisture already in the depression to produce heavy rainfall over our part of the world. It was precisely this mechanism which resulted in record 24hr rainfalls over Ireland in the storm of 25/26th August 1986, when over 200mm was recorded in Kippure Co. Wicklow. It is ironic that this storm - -known as Hurricane Charley - was probably the best known "hurricane" of all in Ireland, when in meteorological terms it was'nt really a hurricane at all!

Satellite Meteorology was instrumental in monitoring Andrew's development and progress from its it's initial detection as a disturbance over West Africa on Aug. 12th, some 12 days before making landfall in Florida. Data from Meteosat images enabled the National Hurricane Center(sic) to issue accurate warnings and advisories well in advance of Andrew's arrival. The first Tropical Depression Advisory was issued at 17.0300UTC; Andrew was upgraded to aTropical Storm at 17.1500UTC and to hurricane status at 22.0900UTC. Andrew produced sustained winds of at least 130kts and a minimum central pressure of 922hPa.

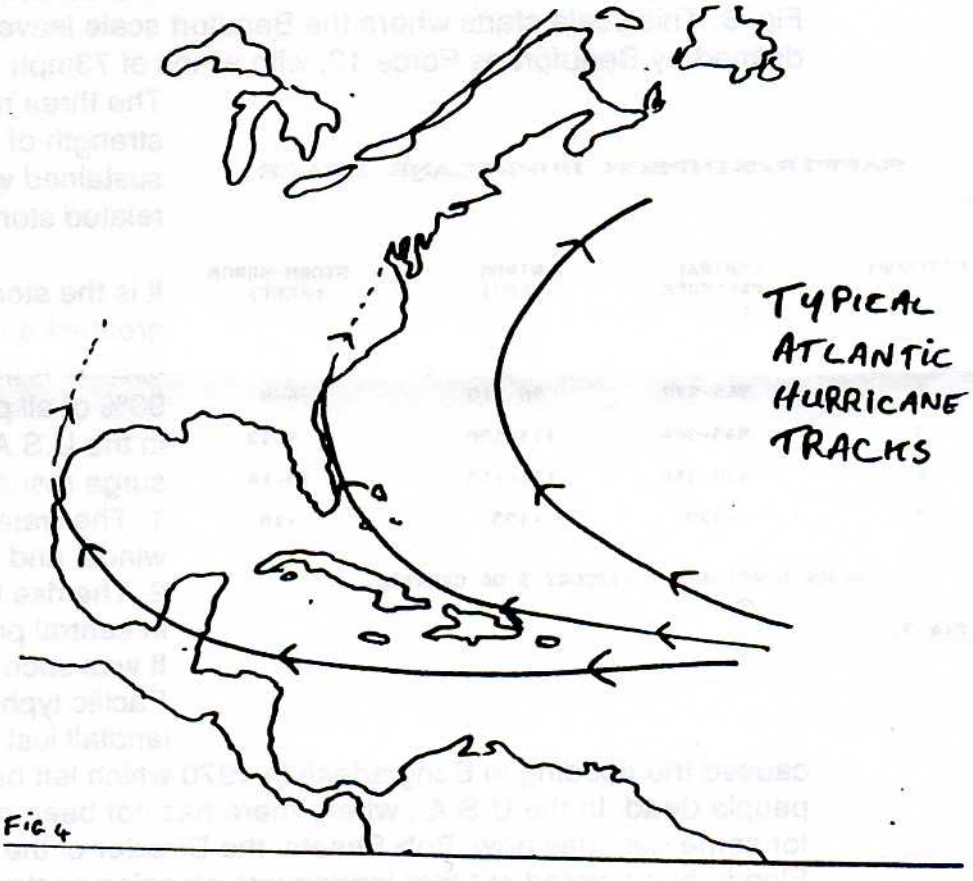


Fig 4

Happenings

European

A European Conference on Applied Meteorology will be taking place in England in 1993. More details as they become available.

National

Valentia Observatory in Cahirciveen, and *environs*, went into celebratory mood fromSeptember 4th to 11th to mark the 100th anniversary of the Observatory's opening.

The National Ploughing Championships took place this year in Carrigtwohill, Co. Cork from Sept. 29th to Oct. 1st incl. As usual, AGMET-man Tom Keane was in attendance at the Meteorological Service's stand, shared with the Farming Independent.

Recent retirements from the Service have been P.A. Lyons (Head, Aviation Division) and Andy McManus (P.M.O., Instruments and Observations).Sadly, Frank McCaffrey (S.M.O., Instruments and Observations) passed away in early October, having been unwell for some time.

oooOOOooo

From 0600 on September 15th there will be a new series of telephone numbers to dial for weather forecasts (including a Sea Area forecast for all Irish coastal waters and the Irish Sea) issued by the Irish Meteorological Service.

Dial **1550-123** and add one of the following; for **Munster-850, Leinster-851, Connacht-852, Ulster-853, Dublin Area-854.** The **Sea Area Forecast** is available on **1550-123-855**. Calls cost 48/36/24 pence per min. peak/off peak/economy.

The first lecture of the season is scheduled for October 16th and will deal with the relevance of weather to the the Air/Sea rescue services operated by the Irish Aer Corps.

Social

Christmas - and 1993 - must be approaching - the Royal Meteorological Society's calendar for 1993 is now available at a price in sterling of £4.10 per copy (including post and packing) or if you plan to use them as Christmas stocking fillers, 5 copies can be had for £18(incl. p/p). Remittances, in sterling, to the Executive Secretary, Royal Meteorological Society, 104 Oxford Road, Reading, Berkshire, RG1 7LJ. Buy now at favourable exchange rates!

Our Annual Dinner will take place in the Central Hotel, Exchequer Street, Dublin 2 in January. Details are being finalised and will issue to all members soon.

THE PROSPECTS FOR AUTUMN 1992. (England, Wales and Ireland).

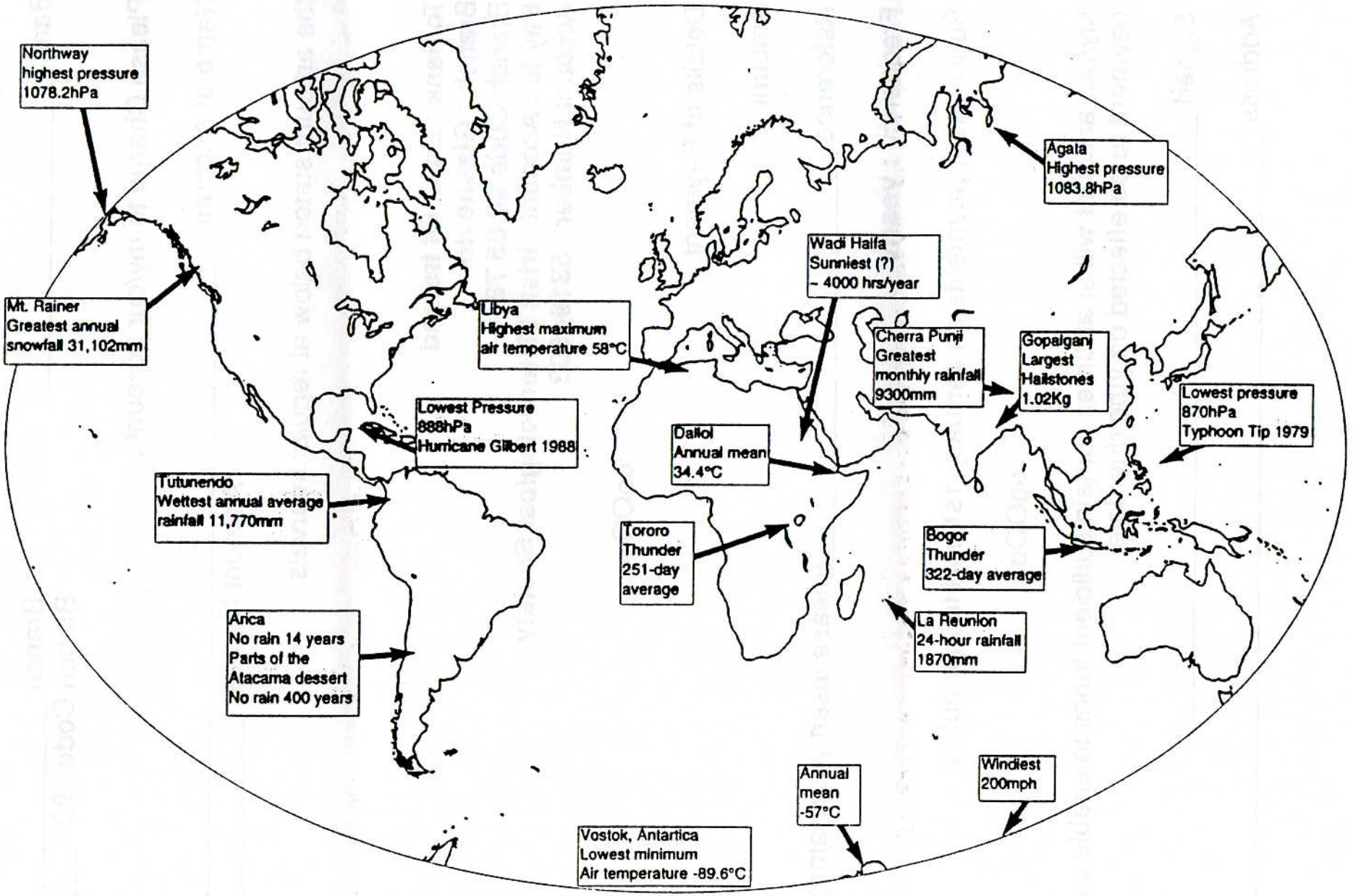
Thanks mainly to the warmest and driest June since 1976, the summer mean temperature was slightly higher than normal and the rainfall below, here at least, in spite of the wet July. But the summer was not as good as expected in the forecast at the end of May, and not as good as predicted by Ratcliffe in the June 1992 issue of Weather (Vol 47, No. 6, p228), although he was right about the prevailence of Southwesterlies. The hoped for anticyclones eluded us after June. All this in spite of a very good statistical probabilty in favour of a good summer

We might have expected the best marker for our autumn weather this year to be the good spring, which as far as central England was concerned, was the third warmest this century, with the warmest May since 1833. However, when we look through the record and see what sort of autumns follow on very warm springs, we find a equal numbers of mild and cool autumns with rainfall fairly close to or a little below normal. However, as we have noted, June 1992 was warm and dry. When we look at the autumns that follow on very warm and dry Junes, we find a marked tendency towards cold and wet autumns. Furthermore when we take the May-June period, which was very warm and dry, and look at the 13 similar examples in the 300 year record, we only find 4 dry autumns as against 7 wet and 2 with normal rainfall. And we find only 2 of the subsequent autumns were mild, 7 were cool and 4 had normal temperatures. If we narrow it down still further and extract the 8 examples of where the May-June weather was very good, but where the summer as a whole for these years was close to normal, we find only one of the following autumns was mild and dry, as against 6 wet and 5 cold.

We might conclude from the above analysis that this autumn will go against the recent trend for mild and dry autumnal weather. Rainfall is likely to be above average, while the mean temperature will be normal or slightly below. A lack of blocking anticyclones during July and August is quite often made up for in September. So we might expect a good spell of quieter anticylonic weather during part of September.

Rob Weatherill. (Based on Manley's CET temperature series and EWR figures. These data go back over 300 years) 1.9.92

World Weather Records



Request For Standing Order

To the Manager

Bank _____ Branch _____

Branch Code 90 _ _ _ _

Please Charge to my/our account :

Name of Account _____

Account Number : _____

the amount stated below at regular intervals.

ooOOoo

To bank : **Bank Of Ireland**
Branch : **Glasnevin**
Branch Code **90 05 78**
Pay to : Account : **Irish Meteorological Society**
Account Number : **53194603**

ooOOoo

Details of Payment

Amount £

Reference _____ (please insert your name)

Frequency : **yearly**
First payment : **19**
Subsequent payments on **January 1st** until further notice.

ooOOoo

My/our account will at all times contain sufficient funds to enable each payment to be effected on ythe due date :

Signed _____

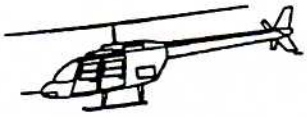
Address _____

Irish Meteorological Society

presents

"Crashing Winds and Lashing Seas"

-the significance of Weather to the Irish Aer Corps-



All aspects of aviation are weather-dependant; whether on V.I.P., Security or Search and Rescue missions, the weather plays a very significant part for those involved in the Irish Aer Corps. The relevance of meteorology toHelicopter operations will be dealt with

by

Captain Andy McIntire (Aer Corps)

and

Commandant Jurgen Whyte (Aer Corps)

in

Lecture Theatre G33

Earlsfort Terrace / U.C.D.,

at

8.00pm

on

Friday October 16th 1992

Open to the Public

Admission Free