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# JOURNAL OF METEOROLOGY

An international journal for everyone interested in climate and weather, and in their influence on man."

Editor: Dr. G. T. Meaden

Vol. 15, no. 146, February 1990

## THE CAIRO COMPACT: TOWARD A CONCERTED WORLD-WIDE RESPONSE TO THE CLIMATE CRISIS

*Cairo Climate Conference Produces 'Compact' outlining the Required  
World-Wide Response to the Climate Crisis.*

The World Conference on Preparing for Climate Change, after five days of discussion in Cairo, Egypt, among the over 400 participants from six continents, adopted on December 21, 1989, the following statement of shared understanding, purpose, and resolve.

Humanity faces threats, real and growing, to the world we live in and even to life itself: global warming and the depletion of the ozone layer. The scale and the magnitude of these problems do not lend themselves to treatment issue-by-issue or by one nation or even a group of nations, acting alone. All nations – North and South, East and West – will have to co-operate on an unprecedented scale. They will have to make difficult commitments without delay to address this crisis.

All poorer nations, and the vulnerable segments of various populations, will be hit by climate change: by rises in sea level that jeopardize coastal areas, by changing weather patterns, by decreased availability of fresh water, by induced heat stress, by increased ultraviolet radiation, and by the spread of pests and disease. All this will devastate food and agricultural production and adversely affect human health, welfare and cultural heritage. To date, the emissions that contribute to these problems have come primarily from industrialized nations, but projections of population growth, land use, and energy consumption indicate that emissions from industrializing countries are likely to increase rapidly.

The capacity of poorer nations to adapt to coming climate change, and minimize their own contributions to it, is sharply constrained by their limited resources, by their debt problems, and by the need to develop their economies on a sustainable and more equitable basis. Affluent nations, in recognition that climate change is a grave problem that humanity shares and has to solve in concert, need to make available to poorer nations significant additional financial and technological resources. We welcome the easing of international tensions and urge that part of the resources now used for military security be deployed in the pursuit of environmental security instead.

The challenge posed by climate change cannot be met by national



governments alone. They need to be joined, and supported, in their efforts by multilateral organizations, the industrial, business and financial community, scientific and educational institutions, foundations, environmental groups, and concerned people everywhere, with a special emphasis on the role of women and youth. The participants in the Cairo conference, drawn from all of these groups, urge that actions be taken – and taken now – to reduce, and blunt, the impacts of climate change. These actions should not await the resolution of remaining scientific uncertainties; the situation demands a global insurance policy to protect our future.

Here are the items that should be at the top of the world's agenda:

A framework climate convention should be completed at the earliest possible date, but in any case before the 1992 United Nations Conference on Environment and Development. It should include as much as can be negotiated within this time frame. The convention should build on concepts already agreed to in principle, including those embodied in the Noordwijk Declaration on Climate Change of November 1989, and relevant UN General Assembly resolutions at its current session. The convention should, *inter alia*, establish general targets for reduction in greenhouse gas emissions and for reforestation, and should promote energy efficiency. These measures help deal with climate change, and themselves produce other economic and environmental benefits.

Work should be also initiated on protocols that would contain more specific commitments.

To ensure success in these negotiations, governments should give strong support to the vital work of the Intergovernmental Panel on Climate Change. Urgent measures should be undertaken to ensure wider participation by developing countries.

While participating in the multilateral processes toward the convention, nations should start immediately to undertake measures on their own, or on a regional basis, to reduce greenhouse gas emissions and to promote reforestation. These measures could later be taken into account in determining international treaty obligations.

Affluent nations should develop, bilaterally and multilaterally, funding mechanisms for the transfer of additional financial and technological resources to poorer nations to enable them to restrain greenhouse gas emissions and to adapt to climate change.

The United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) should be strengthened and given more resources. Other relevant United Nations bodies also need more support.

The ongoing international process for protection of the stratospheric ozone layer should be strengthened through participation by all nations in the Montreal Protocol; agreement on an early phase-out of substances that deplete the ozone layer; and industry-government collaboration on the development

of alternative technologies, and on arrangements to transfer ozone-safe technologies to countries in need.

Historically unprecedented population growth in many areas of the world is a driving force behind the rise of greenhouse emissions. Governments, international agencies, and non-governmental organizations should provide significantly increased assistance in family planning, education, and maternal and child health, in a major effort to reduce population growth rates.

In addition to adopting programs to curb deforestation, nations should launch large-scale reforestation efforts.

Government agencies and agricultural research institutions should launch intensive efforts to evaluate and improve certain agricultural practices that contribute significantly to emissions of methane and other greenhouse gases.

Governments and other energy suppliers should invest in those resources that provide energy at least financial and environmental cost.

Major energy savings should be achieved through more efficient industrial processes, mass transport, more efficient vehicles, and better urban planning and building design.

Strong emphasis should be placed on development and use of new and renewable sources of energy. Such alternatives are universally desirable, but are especially needed in many African nations, where reductions in availability of water would reduce the amount of biomass, which is their main source of energy.

Water management schemes, including irrigation and hydroelectric projects, should be designed to take into account the possible impacts of prospective climate change.

The resilience of agriculture to climate change should be increased through greater diversity of farming systems (e.g., mixed crops and agroforestry); improved plant breeding; and long-term adjustments of agricultural infrastructure (e.g., irrigation systems, terracing and other methods of preventing soil erosion).

All coastal and island governments should ensure that prospective sea level rise and related climate changes are taken into account in long-range planning, in particular in decisions about proposed coastal development and settlement.

Climate changes are likely to cause major displacements of human population. Work is urgently necessary to consider the national and international implications of environmental refugees and to set in place sufficient means for coping with the problem. We invite the United Nations High Commissioner for Refugees to consider preparing a report on this subject.

Nations should consider establishing World Cultural Zones to safeguard priceless elements of mankind's cultural heritage – historically significant buildings and other antiques – which are being damaged by atmospheric pollution. The Nile Valley in Egypt, which is home to many historically unique structures, would be an appropriate area in which to establish the first such zone. In addition, research programs should be initiated to monitor



localized climate changes that may imperil antiquities and to detect climate induced damage in its incipency.

International scientific and technological co-operation, research, and training of scientists should be strengthened, with particular emphasis on monitoring greenhouse gas concentrations, regional climate modeling, health effects, alternative energy technologies, adaptation strategies, marine resources, agriculture, and forests.

Governments and intergovernmental organizations should work with non-governmental organizations, citizen groups, women's organizations and private industry, business and financial institutions to increase public understanding of climate change and its implications, and to involve them in the implementation of programs dealing with the problem.

The actions of individuals can make a critical difference, through their way of life, their consumption patterns, and their participation in the processes of decision-making. Individuals should contribute their share of the costs of correcting the damages they inflict on the atmosphere.

In conclusion, we underline that we have joined in this Cairo Compact out of a real sense of urgency. For the sake of our planet and the lives of our children and generations to come, we must act now.

We are grateful to the Government of Egypt for jointly convening, with UNEP and the Climate Institute, this conference, and for the participation of many of its most senior officials. It is fitting that this country, with its extraordinary sense of history, is so keen to preserve its past and safeguard its future. That is wisdom borne of experience; we hope that other countries will take notice, and will join with Egypt, and with those of us who met here, in common cause. (Address for further information: Climate Institute, 316 Pennsylvania Avenue, S.E., Suite 403, Washington D.C. 20003, U.S.A.).

## THE CIRCLES EFFECT: NEW TYPES IN 1988, Part 2 A MAIN CIRCLE WITH TRIPLE SATELLITES 'EQUIANGULARLY DISPOSED' TWO CASES OF 'EQUIANGULAR' TRIPLETS & THE SO-CALLED CELTIC CROSS FORMATION

By G. T. MEADEN

*Circles Effect Research Group, CERES, Bradford-on-Avon*

**Abstract:** Descriptions are provided of some rare cropfield-circle formations which further demonstrate the subtleties that are possessed of the circles-effect vortices responsible for creating them. The first part of this article appeared in *J. Meteorology*, vol. 14, number 138, pp. 126-127, 1989.

### CIRCLE COMPLEX AT OADBY, LEICESTERSHIRE

Between the small town of Oadby and the village of Stoughton a couple of kilometres south-east of the City of Leicester, farm manager Mr David Watson was crop-spraying a field of spring wheat when he found a circle

complex no example of which we had previously seen or heard of. As the date was 20th or 21st June, and it was Mr Watson's opinion that the circles were no more than two or three days old, a formation date of 18th June was considered most likely, the wind having been from north-east to east for much of the month (cf the paper in *J. Meteorology*, vol. 13, no. 132, pp. 305-311, 1988 which reported Roy Lucas's observations of spinning mist-forms near Avebury, Wiltshire, on 16th June 1988 in a north-east windflow).

The immediate area of the field was flat but three kilometres east-north-east of the site lies Houghton-on-the-hill a village whose name says much about the nature of the topography, and there are other hills a little further to the east. (We shall demonstrate on another occasion that circles, and therefore their generative vortices, have been known to occur as far as six or seven kilometres, at least, downwind of the creator hill).

A few days later (29th June) aerial archaeologist James Pickering from Hinckley spotted the circles and alerted his flying colleagues. David Buttress's photographs, taken on 1st July, led to immediate press and television coverage of the event. I met James Pickering on site soon afterwards and undertook a comprehensive survey (cf Figure 1, in which only some of the survey results are given).

The complex is centred on a circle ringed by an annulus flattened monotonically clockwise. The bed of the main circle had been subjected to such a blast that the straws were lying radially, with, at best, a slight but telling suggestion of an anti-clockwise tendency towards the eastern perimeter. The three satellites, all directed anti-clockwise, were small – less than two metres

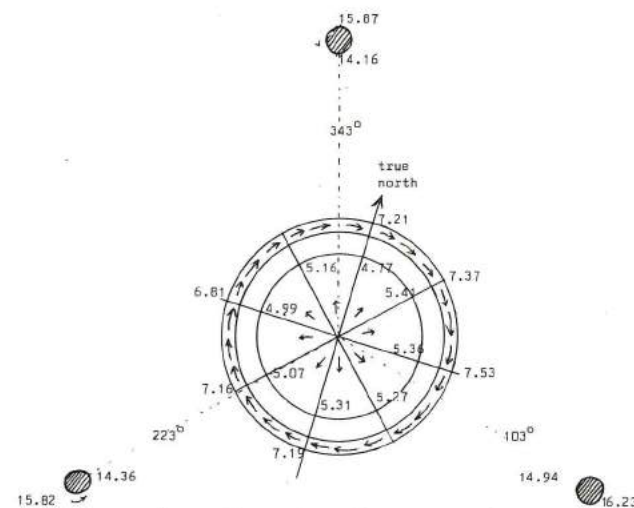


Fig.1: Survey of a rare four-circle set from Leicestershire, June 1988, (not to scale). An aerial photograph of this circle system may be found in *The circles effect and its mysteries*, p.63.



across – and practically equidistant, as though spaced around an invisible ring 32 metres in diameter.

The occurrence of this event at a site in the East Midlands, two hundred kilometres north of the now-famous south-of-England sites in Wiltshire and Hampshire, should further stimulate observers in other areas to watch out for circles wherever they may go. A trace similar to this one, but dated to 1982, has recently been reported from the Blue Mountains in New South Wales, Australia.

### TRIPLE CIRCLES AT CORHAMPTON AND CHEESEFOOT

The first of the triple combinations formed overnight in Cheesefoot Bottom, a punchbowl concavity on the chalk downs south-east of Winchester, Hampshire. It was sighted early on Saturday morning 4th June. The second triple, from Corhampton 10km to the south-east, was reported by the farmer Mr Charles Hall on 8th June. Its formation date is unknown but 4th June seems an obvious possibility. All six circles had similar diameters of 10 metres, each centred on the points of an equilateral triangle (Figure 2). Because a similar 'triangular' triple-formation happened at Bratton, Wiltshire, in July 1982, the triple circles of 1988 cannot be claimed to be a 'new' formation and the consequence of a species of 'evolving complexity or intelligence', as some superficial observers and publicity-seekers carelessly wish it. Indeed, as time goes on we are finding antecedents for more and more of the so-called 'new' formations of the late 1980's.

### THE CELTIC CROSS ON CHARITY DOWN, NEAR LECKFORD, HAMPSHIRE

This marvellous set of five circles with a ring interlinking four of them was found by farmer Geoffrey Smith on 10th September 1988 which was harvesting day. Within hours the evidence had been destroyed but not before

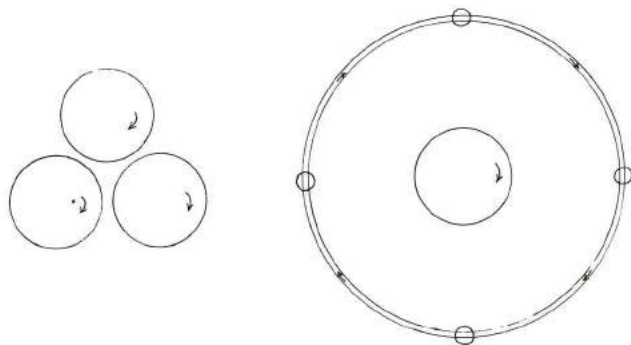


Fig.2: Sketches of triple circles, as seen at Corhampton and Cheesefoot in Hampshire, and the Celtic quintuplet from Charity Down, Hampshire.

pilot Mr F. C. Taylor and Mr C. Andrews had taken aerial and surface photographs (Figure 2).

The clockwise main circle measured 10 metres and each satellite four metres across. The great ring enjoining the satellites had a diameter of around 41 metres and a circumferential length of 125 metres. The breadth of this clockwise ring was 1½ metres. Faint rings joining satellites had been seen on earlier occasions. Two are mentioned elsewhere, one with a photograph (at Bratton in July 1983, cf Figure 33, p.65, *The circles effect and its mysteries*). One of the other occasions was in 1985, at a site south of Goodworth Clatford only a kilometre or so from the Charity Down event of September 1988.

## THUNDER AT CARDINGTON, BEDFORDSHIRE

By HARRY MARCHANT

120 Station Road, Hailsham, East Sussex

*Abstract:* This study analyses the diurnal, monthly, seasonal and annual variation, and duration of thunder heard at Cardington, Bedfordshire, England for the period January 1956 to December 1979. A day of thunder heard is defined as a 24-hour period from midnight to midnight during which thunder is heard at least once. All times are in Greenwich Mean Time. Original Meteorological Office records were consulted.

### INTRODUCTION

Before it was closed in 1980 Cardington Met. Office (latitude 52 degrees 06 minutes N, longitude 00 degrees 25 minutes W, at 29m A.M.S.L.) was located 1.75km S.E. from the edge of Bedford and about 1.5km S.W. of Cardington village. The land rises markedly a few kilometres to the S.E. The station was about 90km from the Wash, the nearest coast.

### DIURNAL VARIATION

As Figure 1 shows, the peak time for thunder was from 15-17h G.M.T. with a secondary maximum from 02-04h and the minimum from 08-09h.

Figure 2 shows the diurnal variation in each month of the year. The morning incidence was higher in July than in any other month but there was not much difference in the afternoon and evening peak hours between June, July and August, the three most thundery months. However in June there were over 20 occasions in a greater number of hours. In July and August it peaked from 15-18h, in June there was a less definite maximum from 16-17h.

The peak hours occurred earlier in the day in October and November than in any other month except December which was the only month to show no definite afternoon or early evening peak. In March and November no thunder was heard before 1000h or after 1900h.

### MONTHLY VARIATION

Figure 3 shows the annual average number of hours and Figure 4 the annual average number of days in each month of the year. Figures 3 and 4 were derived from Table 1.

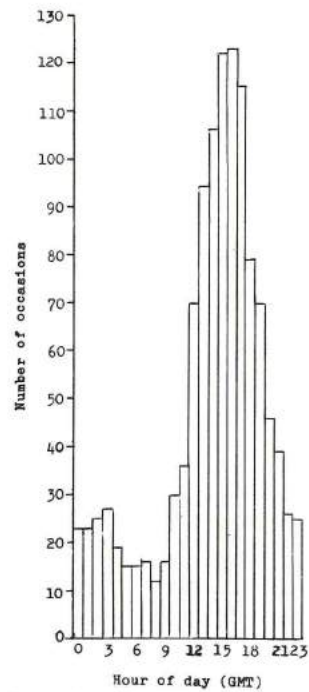


Fig.1: Diurnal variation of thunder.

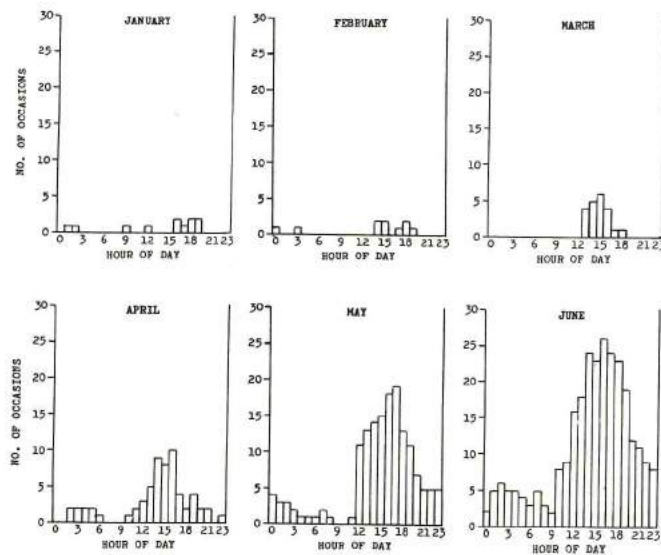


Fig.2a: Diurnal variation of thunder in each month: January to June.

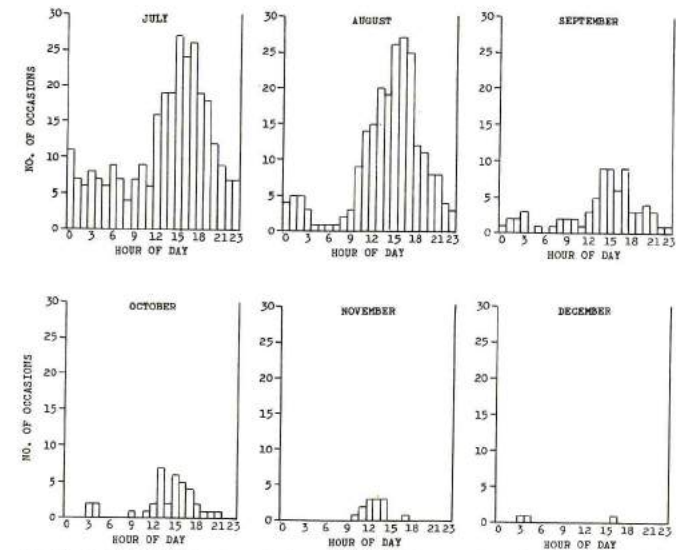


Fig.2b: Diurnal variation of thunder in each month: July to December.

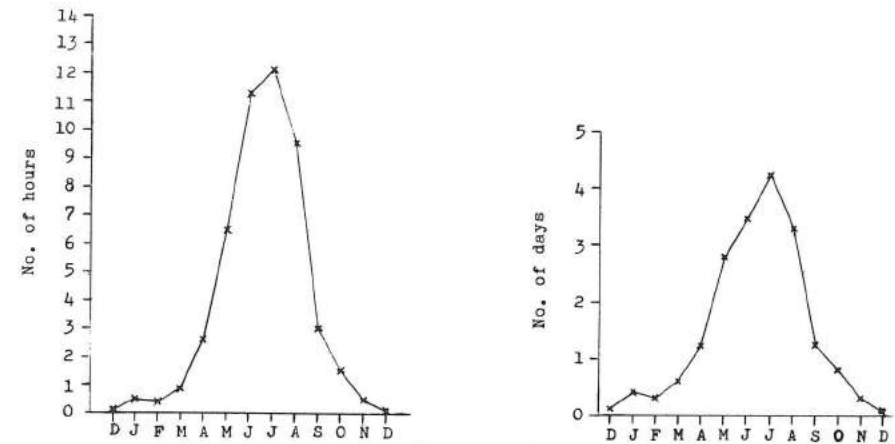


Fig.3: Average number of hours in each month of the year.

Fig.4: Average number of days in each month of the year.

Both the average number of hours and days started to rise in March, reaching a peak in July, and dropping to a minimum in December. The changes were often large between successive months but the drop between August and September was especially substantial. The September number of hours was less than a third that of August.

It can be seen that June's averages in both graphs were higher than those of August although August is regarded as being more thundery in Britain



generally. With Cardington being so far away from any sea, the importance of strong solar surface heating over land earlier in summer is more marked than high sea temperatures later in the year relative to most other parts of Britain. However it was seen in the section on diurnal variation that there is not much difference in the afternoon peak hours between these two months.

TABLE 1: Number of thunder hours in each month and annual average number of hours and days in each month of the year

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
1956	1					9	21	14	2	3			50
1957		1	1		8	24	21	6					61
1958			1	1	5	12	12	27	8	7			73
1959			3	2	4	6	21	9					45
1960	2	1			2	33	25	17		3	5		88
1961	1			9		5	4	8	4				31
1962			3		17	2	18	2	5		4		51
1963				1	3	15	7	5	7		1		39
1964				7	1	18	8	2		7			43
1965	1			7	4		31	3	5				51
1966		3		3	5	11	9	11		2			44
1967		1	1		22	7	11	12	2	2			58
1968			4	17	2	16	16	9	3				67
1969	1			1	24	5	2	7			2		42
1970		1			5	15	7	11					39
1971					2	3	9	24	6	1			45
1972	2			4	6	5	11	1					29
1973					13	13	9	9	4	3	1		52
1974	2			1	5	23	5	15	8	2		2	63
1975			2	1	4	13	15	14	2	2			53
1976					6		18		10			1	35
1977		2	1	4	4	17		5	2	1			36
1978	1		2		5	11	5	11	1				36
1979		1	3	4	8	12	4	9					41
Total Hours	11	10	21	62	155	270	290	227	73	37	13	3	1172
Average	0.5	0.4	0.9	2.6	6.5	11.25	12.1	9.5	3.0	1.5	0.5	0.1	48.8
%	0.9	0.9	1.8	5.3	13.2	23.0	24.7	19.4	6.2	3.2	1.1	0.3	100
Total Days	9	8	14	30	67	85	102	80	30	19	7	2	453
Average	0.4	0.3	0.6	1.25	2.8	3.5	4.25	3.3	1.25	0.8	0.3	0.1	18.9
%	2.0	1.8	3.1	6.6	14.8	18.8	22.5	17.7	6.6	4.2	1.5	0.4	100
Hours/Day	1.22	1.25	1.50	2.07	2.31	3.18	2.84	2.84	2.43	1.95	1.86	1.50	2.59

May also had a fairly high incidence of thunder and it can be notably thundery as in 1967 and 1969.

As can be seen in Table 1 June had the highest ratio of thunder hours to thunder days and January the lowest.

### SEASONAL VARIATION

Table 2 shows the seasonal variation of thunder at Cardington. Two-thirds of all thunder hours occurred in summer and only 25% in winter. Most of the hours and days of thunder heard outside summer were in the spring, mainly because of May's high total.

TABLE 2: Seasonal variation of thunder.

Season	Thunder Hours		Thunder Days		Mean Hours
	Annual Average	Percent of Annual Total	Annual Average	Percent of Annual Total	Per Day
Spring (Mar-May)	9.9	20.3	4.6	24.5	2.14
Summer (Jun-Aug)	32.8	67.2	11.1	58.9	2.95
Autumn (Sep-Nov)	5.1	10.5	2.3	12.4	2.20
Winter (Dec-Feb)	1.0	2.0	0.8	4.2	1.26
Year	48.8	100	18.9	100	2.59

### ANNUAL VARIATION

Figure 5 shows the total number of hours and Figure 6 the total number of days of thunder heard in each year.

The highest number of hours was 88 and the highest number of days was 30, both in 1960. The lowest number of hours was 29 in 1972, but it was 1976 which had the lowest number of days at 13. 1960 had a wet summer whilst those of 1972 and 1976 were dry.

### DURATION

Table 3 shows the number of occasions of specified numbers of consecutive hours of thunder heard in each month of the year. Most thunderstorms lasted less than two hours, and activity of over seven consecutive hours occurred exclusively in the months May to July. The longest period of activity started between 1400 and 1500 on 30th June and ended within an hour after midnight on 1st July in 1957.

Many of the storms are short-lived ones in unstable polar airstreams but occasionally widespread prolonged ones in warm or hot continental air affect Cardington.

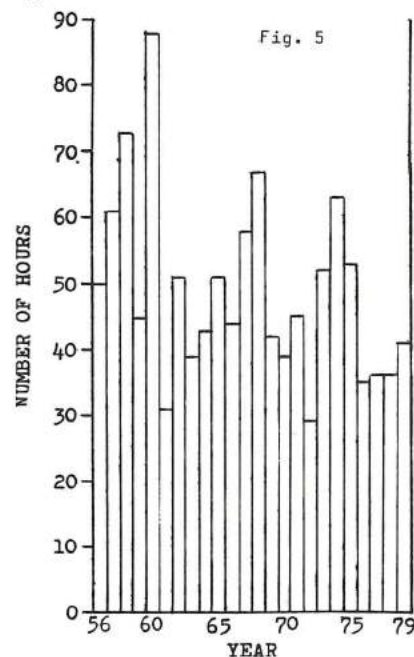


Fig.5: Total number of hours in each year.

Fig.6: Total number of days in each year (0001-2400h).

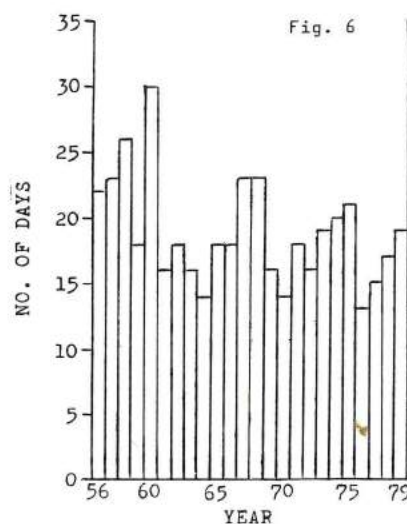


TABLE 3: Number of occasions of specific numbers of consecutive hours of thunder heard in each month of the year.

Consecutive hrs. of thunder	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1	7	6	9	15	27	33	39	26	11	10	4	1	188
2	2	2	3	11	26	39	44	31	13	7	3	1	182
3			2	5	10	10	19	15	3	3	1		68
4				1	3	12	9	13	4	1			43
5					2	4	6	3	1				16
6				1		4	1	1	1				8
7					1		2	3					6
8					1	1							2
9					1	1	1						3
10						1	1						2
11						1							1
Total	9	8	14	33	71	106	122	92	33	21	8	2	519

## CONCLUSION

With Cardington well inland, strong solar surface heating over land in late spring and summer is of extreme importance in occurrence of thundery activity, whereas relatively high sea-temperatures later in the year are a much less important factor. Summer was by far the most thundery season of the year with a fairly high incidence in May. Although August was less thundery than the two previous months, a very large drop occurred between it and September.

Most thunder occurred in the third quarter of the day and thunderstorms frequently lasted less than two hours.

## HUNTING SCENT AS AFFECTED BY METEOROLOGICAL CONDITIONS

By PAUL C. SPINK

*Thornton Hall, Ulceby, South Humberside*

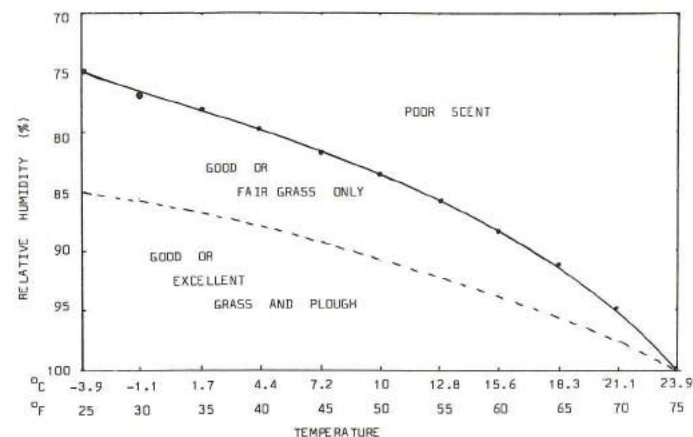
**Abstract:** This is a survey of the meteorological factors which govern the scenting conditions during a day's hunting. Scenting conditions are many and can be responsible for a good or poor day's hunting. A hound's nose is a most delicate and responsive detector of a quarry's scent and it is not generally appreciated that the number of factors which influence scenting conditions can be more than a score, most of which can be favourable or unfavourable, depending upon the interaction of those operative at any given time. The following article sets out the main factors and explains why scent is often so unpredictable.

I have enjoyed hunting with beagles since 1935. Prior to the war, I found watching hounds follow the scent line the most interesting part of hunting. Up to then I had not given much thought to the properties of scent. During the war, thanks to a meteorological course at Greenwich, my knowledge of meteorology increased and I then felt it could be applied to the subject of scent. Feeling rather homesick for the English countryside one particularly sticky hot January afternoon in Mombasa, I began to think of those hunts in Kent, Surrey and Sussex in the pre-war era. Pushing aside the current Indian Ocean weather chart, I began to work out a simple forecasting scent chart which I could use once the war was over and the sweet sound of the horn could be heard again over England's pleasant countryside. The chart shown was the result (Figure 1). It first appeared in 'the Field' and more recently in 'Horse and Hound' and the 'Shooting Times'. The only equipment needed is a wet and dry bulb thermometer and relative humidity tables. The rest is simple. I have found it 90 percent accurate and very much more accurate than my predictions without its use.

The number of permutations possible resulting from the interreaction of twenty or more factors is potentially very large. The main factors can conveniently be grouped as follows:

1. Those arising from the quarry scent sources.
2. Those due to the environment including weather factors.





3. Those due to the detector (hounds nose).
4. Those resulting from the skill of the huntsman.
5. Those resulting from anti-scents.

### QUARRY SCENT

Many visualise the 'line' as caused by the smelly feet of the quarry. A 'line' has been defined as a series of scent sources deposited on an unlimited surface by the passage of a quarry. The scent source is given off as particles by body contact when brushing through long grass and undergrowth. The body scent is also directly airborne where it combines with the quarry's exhaled breath to produce a strong scent source easily disposed by the wind often being blown many yards down wind of the pad tracks, or from the way the followers saw him go. This is called 'breast high' scent and is not very persistent since it is soon dispersed by the wind. The scent particles are given off by the scent source and pass through an air gap to the hounds nose – the detector. The shorter the time and distance they have to travel the greater the concentration and the stronger their impact on the nose and so the better the scenting conditions.

Pad tracks may leave some body scent on hard surfaces but pads soon become covered with a film of dust or mud which limits their contact with the ground and so the scent left behind. Pad pressure and nails cause bruised herbage releasing the sap as well as breaking soil skins caused by surface drying, or when excess moisture is on the surface they stir up the mud so that there is a different scent for the disturbed ground compared with the undisturbed surface surrounding each pad fall. By herbage is meant any live plants which have sap in their stems or leaves, e.g. grass, weeds and arable crops. The leaves can be bruised by even a light weight such as pressure of a pad. The sap has an odour which can be detected by a nose under the right

conditions. Regarding the soil skins, normally soil loses moisture to the air and the surface becomes drier than soil below and a skin forms with the reduced evaporation from below. Pad pressure breaks the skin and allows more evaporation from below which carries the soil scent. Other sources which occasionally produce a strong quarry scent are – anal gland discharge, accidental contamination due to urine splashes, blood from scratches and drops of saliva. Of all the different scent sources it is suggested that bruised herbage and broken soil skins make the main contribution, the other incidental sources helping to maintain the identity of the quarry.

### WEATHER AND THE ENVIRONMENT

The main factors are temperature, pressure, relative humidity, frosts, inversions, wind and turbulence, nature of the ground, its surface, contours and soil.

Perhaps the most potent factors affecting scent are direction of wind, its speed and air turbulence. Particles from scent sources will be blown down wind. The airborne body and exhaled air scent will lie above or very close to the pad track. A strong wind will quickly disperse the particles but when running down or up wind the pad track scent and the airborne scent will reinforce each other. Under these conditions the pack will fan out and run with a good head, nose held high, some following the pad track, others the airborne scent. A light wind improves conditions, thus diffusing or spreading the scent and thus giving hounds a bigger area over which to work.

Turbulence plays a very significant part in determining scent conditions. This is a churning of the atmosphere, quite apart from wind. It may be compared with the eddies in a swiftly moving stream and is caused by irregularities and obstacles on the earth's surface such as hedges, trees, buildings etc. Turbulence is magnified or diminished by the difference in temperature between the air in contact with the earth's surface and air at a higher level.

(a) Low Turbulence: In this case the ground is cool and the layer of air in contact with the surface cools below the temperature of the air at higher levels (Inversion of Temperature). Since the warm air is now on a higher level the churning process does not take place and turbulence caused by obstacles is reduced. Low turbulence is most pronounced during the late evening, night and early morning when skies are free of cloud and there is little or no wind. Members of hunts must recall occasions during a winter anticyclone or after the passage of a cold front when an overcast sky clears in the late afternoon after a day of indifferent scent, an inversion of temperature occurs, a front sets in, the grass begins to crackle and scent improves enormously – hounds begin to hunt with a great cry just when the light begins to fade and tired members are looking for the welcome 'blow for home'.

(b) High Turbulence: The sun heats the earth's surface and therefore the air in contact with the ground becomes warm. The warm air rises and is replaced by a layer of cool air from above; existing turbulence is thereby increased. The



extent to which the earth's surface is heated and therefore the amount of turbulence depends upon the amount of sunshine, the season and cloud cover. The effect of high turbulence on scent is to disperse it upwards and sideways.

(c) Moderate Temperature: is brought about by strong winds which mix the lower air so thoroughly that the temperature is about the same at all levels, also by the amount of cloud cover such as a thick cloud layer which prevents the heating of the ground by day and cooling by night. The degree of turbulence could explain that old saying "Good scent when fences and hedges look sharp and black, poor scent when there is a blue haze". Low turbulence does not dull the outlines of hedges while high temperature produces the 'blue haze effect'.

A simple picture of what happens to the stream of small molecules (or particles) leaving a scent source such as a pad mark is to envisage a small smoking bonfire where the smoke represents the stream of small particles. On warm windless days the smoke will rise as a vertical column, on still damp days it will hang about as a cloud about the fire. With a gentle wind the scent particles, like the smoke, travel down wind close to the ground in a narrow but ever widening band. Strong winds produce turbulence which rapidly disperses the smoke because the wind near the ground is being continually slowed down by surface obstructions whilst a metre high the fast moving wind is continually stirring up the slower ground wind. The persistence of scent can be related to the degree of turbulence which can be found by measuring the wind speed one metre above it. If there is a turbulent wind blowing over or about the mass, the escaped molecules are blown away and more escape to take their place until none are left. An analogy to this process is not unlike wet clothes drying on a line on a windy day, the rate of drying being dependent on the temperature and humidity of the surrounding air.

#### RAIN

Water in its three states of solid, liquid and vapour plays a key role in all matters concerning scent. Rain itself in sudden storms blots out and washes away scent sources, and as such cleans up soiled ground. But water carries scent as the otter well knows. This is likely to be body scent floating to the surface above. Rain, or lack of it, frost and snow have the most direct influence on the hunter and his sport.

#### SUN

The sun exerts its major influence here too because, in addition, sunlight destroys by burning off certain scent sources by chemical action, especially those associated with bruised herbage. Not only does it cause the decomposition of the mixture producing scent but dries it up and the hot rising air from hot ground carries the scent above the range of the hound or gun dogs nose.

#### HUMIDITY

The amount of moisture in the air has the greatest influence upon scenting conditions. This amount depends on the air temperature and origin of the air

mass covering the hunting area. A keen hunter should acquire an elementary meteorological knowledge of weather and its processes, the meaning of 'fronts', the law of winds and an ability to read a simple weather map such as supplied by a good daily paper which can be an aid to the hunter on the morning of the meet. Warm air holds more moisture than cold. As warm air cools there comes a point (the dew point) when the air becomes saturated, i.e., it will hold no more moisture and the excess water appears as mist or fog or condenses on cold surfaces, for example on grass as dew. The amount of moisture in the air at any given time is known as its relative humidity and is expressed as a percentage of a given volume of water to the amount which would be present were the air saturated at the same temperature.

#### THE HUNTSMAN'S SKILL AND THE HOUND'S NOSE (DETECTOR)

The hound's nose can be highly trained, particularly with the right breeding inheritance, education and pack discipline but it needs to be turned on and directed in range of the line (or spoor) by the skill of the huntsman and the role he has to play. His part will be difficult if he has a large riding field behind him who must always press on, to that of being a lone figure on a Lakeland Fell, hunting on foot.

No matter how good the scent may be it is of no value unless he gets his hounds heads down and their detectors turned on. How often do we see a fox go away on what should be a good scenting day and a noisy huntsman blowing his hounds away with their heads in the air galloping over the line without a single hound 'owning it'. Indeed no matter how good our hounds noses or how strong the line may be, unless they are thought reasonably adjacent and unless he gets his hounds heads down, most of the field will think it is a poor scenting day.

THE ANTI-SCENTS are tobacco smoke, car exhausts, fertilisers, muck spread on soiled ground. Female quarries and the very young have an ability to leave none, or a very faint scent. Certain household products are sold to make you believe they have destroyed unpleasant smells. In fact all they have done is to stun your own sense of smell, the odour itself being unchanged. It seems likely that pregnant animals and sitting birds have an ability to exude similar types of substance which knocks out temporarily a hound's or gun dog's nose.

It is well known that a fox often knows whether scent is good or bad and runs through soiled ground, flocks of sheep, rolls in muck, in order to counter his own scent. I was informed recently that a reason blood hounds have such large ears is that during the process of their rather leisurely and painstaking methods they linger over a suspect line breathing hard, their warm breath under their ear coverage enhancing the scent molecules, much as a diner having a balloon of brandy after a good meal cups his warm hands around the glass in order to sniff better the enhanced bouquet or aroma.



### THE SCENT CHART. Fig.1.

On days when the prediction is for good scent over grass but poor over plough it is fascinating to note how hounds can hunt a hare with a beautiful cry over grass, (or stubble sown with clover) then on reaching plough, the cry dies away, they check and after casting around for a short time the best of the leaders give tongue in a clear, bell like note and the pack slowly hunts to the end of the plough before reaching grass again when there is a burst of music as they give tongue on a strong line. On a recent hunt we had a splendid overcast day when hounds hunted over both grass and plough on a 'screaming scent'. A week later, with similar conditions of temperature and relative humidity but with a brilliant sun, scent progressively deteriorated until by mid afternoon, it was poor – a good example of sun burning off the scent.

I have found that quite often when the point lies between the two curves of the chart the scent can be excellent over grass but poor over plough. It must be remembered that in wet conditions over plough the fox or hare gets its pads well covered with mud, thus insulating a direct contact of body scent with the ground. This is when the important scent factor of bruised herbage does not operate to help hounds. Conversely I have found much evidence of good scent over dry arable land. I recollect a March meet when the drilled seed beds were bone dry and there was no moisture to retain the volatility of scent.

The wind factor also has an important bearing upon the success of a hunt. Generally speaking scent does not lie well with a northerly or easterly wind though I can remember occasions when humidity was unusually high producing a good scent. Southerly and westerly directions are the most favourable, in other words the more humid conditions are best.

The foregoing facts can contribute to the joy of being out with hounds on foot and watching them work the line, particularly when the hunt is slow and one can keep up in the rear of the pack.

Also one remembers those memorable occasions when one stands on a point of vantage such as a hill in wold country watching hounds working far away below. Then one sees them put up a hare and accompanied by a burst of music from the leading hounds, we watch the quarry's progress and with luck it comes up the hill towards where we crouch. Then one sees hounds working the line up the hill which the hare took and gradually their music gets louder as they ascend and follow on. This to me is the joy of hunting. I am conscious that among townfolk who have little knowledge of country matters hunting is a dirty word. These gentry forget that the good Lord gave hounds scenting noses to hunt with and that many of us humans would be much happier and healthier – not to mention with better figures – if we had to hunt on foot occasionally for our dinner.

"Better to hunt in fields for health unbought. Than fee the doctor for a nauseous draught".

Remember too, that Nimrod was a mighty hunter 'before the Lord'. Mr John Jorrocks, M.F.H. called hunting the 'Sport of Kings' and I feel I must end with the following lines.

With nostrils opening wide, o'er hill, o'er dale. The vig'rous hounds pursue, with very breath, . . . and in triumphant melody confess. The titillating joy. Thus on the scent depend the hunters hopes. Somerville (18th Century)

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 SPINK, P. C., (1973): Hunting Scent Prospects by Degrees *Weather* 28 pp, 212-213.  
 SPINK, P. C., (1975): *Shooting Times*, June 12-18 pp 24-25.  
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\* The late Colonel Bedford of Market Stainton, Lincolnshire, was a former Master of the Fox Hounds who had studied scent as a professional chemist. I was to have collaborated with him on a joint-paper on scent and meteorology but an untimely fall in the hunting field caused his death. His widow kindly gave me his notes to study. Many of his findings are contained in the foregoing article.

## EXTREMELY HIGH NOVEMBER TEMPERATURES IN THE HILLS OF SOUTH WALES IN 1989

Picking mushrooms in the hills of South Wales in November just about sums up this very warm year of 1989. Even if temperatures are well below average in December, the 1989 annual temperatures for Cardiff-Wales Airport at Rhoose (which is situated about 15km to the SW of the city of Cardiff) will be their highest since records began there in 1955, exceeding the previous highest recorded in 1959.

On Tuesday 14th November this year Cwmbargoed, near Merthyr Tydfil, 1220ft AMSL, enjoyed a most glorious warm sunny day when the afternoon temperature rose to a maximum of 17.7°C, from a 0900 temperature of 13.0°C, which was in the record-breaking category especially seeing that Cwmbargoed is situated amongst the higher hills of South Wales with the Brecon Beacons not very far away to the north nearly 3000ft AMSL. From the figures below, 17.7°C just exceeds the previous highest British temperature of 17.6°C for the 14th November from 1874 to 1985, although on this same afternoon parts of southern Ireland reached a temperature of 20°C, whilst in many parts of England the temperature never reached 10°C in the cloud and fog. The coastal areas around Cardiff which are usually 2 or 3°C warmer than Cwmbargoed, only reached around 11°C on this Tuesday afternoon. The observer at Cwmbargoed weather station, Mr Josh Powell makes these comments, "November 14th 1989 was an observer's dream come true. It was very calm, the mountain ponds were like mirrors and there was a faint layer of smog in the Taf Valley. It was the perfect day for Cwmbargoed to become the warmest weather station in the country, 3.7°C above their 1983 November record of 14.0°C. In Cilsanws Jack Evans, a keen naturalist, sat in the garden watching his bees working among the ivy blossoms and gossamer spiders floating in the calm air. During the morning Arthur Williams picked mushrooms on the mountainside near Cwmbargoed".

It would seem that this very warm November air could only have come from the inversion in the high-pressure area which had settled over or near the



TABLE 1:

November 1989	**	Cwmbargoed		Cardiff (Rhoose)			Cardiff (Llandaff)	
		Max	Min	G.M.	Max	Min	Max	Min
12 Sunday	19.4	13.0	9.2	6.7	13.9	10.0	14.0	11.0
13 Monday	18.3	15.5	6.2	0.4	12.0	6.4	12.5	7.0
14 Tuesday	17.6	17.7	6.9	1.0	10.7	5.3	11.0	5.5
15 Wednesday	16.7	7.2	5.1	5.0	9.8	7.1	10.0	8.0

\*\* From a table of Britain's highest temperatures for each date of the year from 1874 to 1984 which was published in *J. Meteorology, UK*, Vol. 9, 169-175 (1984).

TABLE 2: Long-Term Highest November Maxima.

Cwmbargoed and Tredegar	Cardiff (Rhoose)	Cardiff (City)
14.6 Tredegar †	16.8*	16.6**
14.0 Cwmbargoed ††		18.3***
† 1950-1972	*1955-1989	**1904-1937
†† 1967-1988		***1931-1960

TABLE 3: November Maximum temperatures at Tredegar and Cwmbargoed are as follows.

Tredegar: 1950 11.1, 1951 12.2, 1952 11.7, 1953 12.2, 1954 12.2, 1955 12.8, 1956 13.4, 1957 10.0, 1958 13.9, 1959 14.5, 1960 12.8, 1961 12.2, 1962 11.1, 1963 12.8, 1964 12.2, 1965 12.2, 1966 11.7, 1967 10.6, 1968 12.2, 1969 14.4, 1970 14.4, 1971 14.6, 1972 12.5,
Cwmbargoed 1967 10.0, 1968 11.2, 1969 13.7, 1970 12.9, 1971 13.0, 1972 11.8, 1973 12.8, 1974 11.0, 1975 12.4, 1976 10.1, 1977 13.0, 1978 13.6, 1979 12.5, 1980 12.2, 1981 11.7, 1982 13.2, 1983 14.0, 1984 12.5, 1985 12.5, 1986 11.7, 1987 12.4, 1988 11.8, 1989 17.7.

British Isles for the last few days, but the next day the maximum at Cwmbargoed was only 7.2°C because a cold front had brought colder air across.

The tables above show how remarkable this day maximum of 17.7°C really was. Taking the nearby records at Tredegar (1028ft AMSL) going back to 1950, which over the years has had similar temperatures to those of Cwmbargoed, the highest November maximum has only been 14.6°C, until this year of 1989. The year of 1976 is most interesting, for in July there was a maximum of 30.1°C, but in November the highest maximum was only 10.1°C.

75 Nicholson Webb Close,  
Danescourt, Llandaff, Cardiff.

JOHN C. H. TRENCHARD

## INCREASING RAINFALL IN SOUTH WALES

I was interested to read the article on 'increasing rainfall in South Wales' in the November 1989 issue of *J. Meteorology*. I am inclined to think that 'the continuation of higher rainfall in the west from 1950 to the present' which

'has occurred despite the emphatic decrease in the frequency of westerlies' is due chiefly to the remarkable increase in the *southerly* type which has occurred during this period and also during 1900-1930, reflected in Dr Mayes's rainfall trend (his Figure 1).

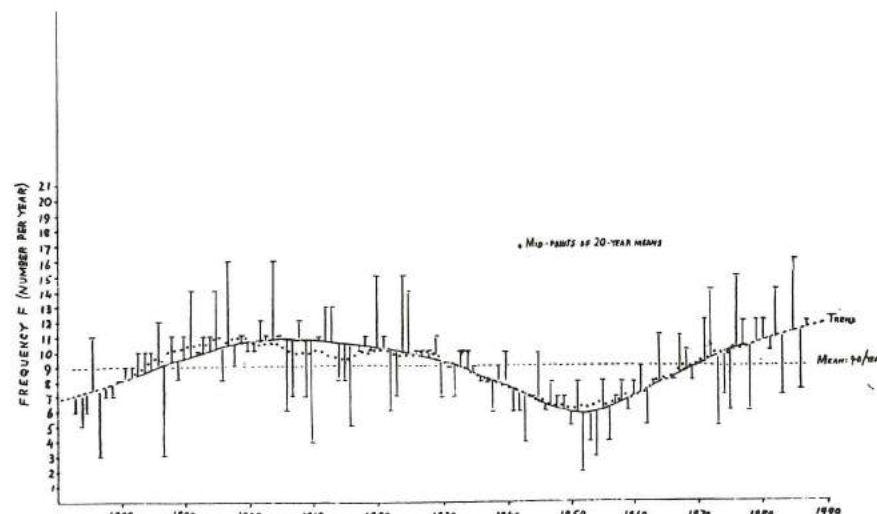


Fig.1: Southerly type, Scotland. (A) Frequency of spells.

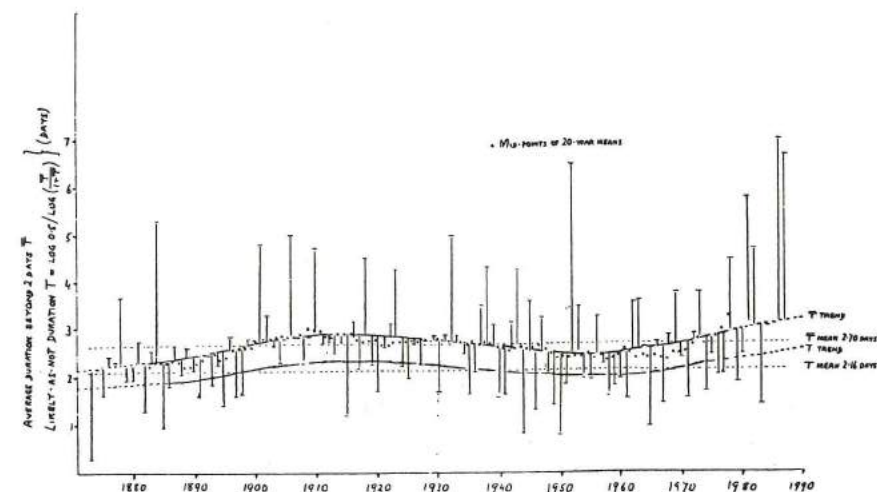


Fig.2: Southerly type, Scotland. (B) Average duration of spells after the two days needed to become established with (below) the likely-as-not duration which in successive stages can theoretically extend to infinity. (The longest spell during this period was 24 days).



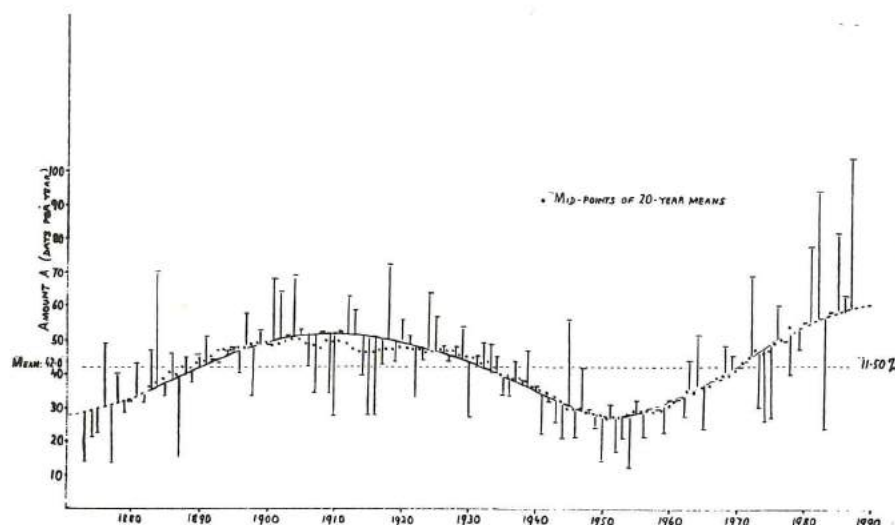


Fig.3: Southerly type, Scotland. (C) Amount (product of frequency and average duration, which in this instance is positively correlated).

Note also that (p.375) Upper Lliw reservoir, West Glamorgan, is 'surrounded by south-facing slopes . . . '.

In addition, observe the distinction that I have made (and which is not always made) between 'frequency' (of spells) and 'amount' (of the type), and the connection between frequency, amount, and 'average duration beyond two days', formal definitions of which are given in my recently completed, unpublished research paper "Long-term trends of the six weather types in Scotland" from which these three diagrams are taken (my Figures 1, 2 and 3).

The trend for Ireland is similar, so the one for 'England S.W.', which includes South Wales, can be expected to be too.

Whitewater House, Budleigh Salterton, Devon

R. B. M. LEVICK

## LITERATURE REVIEWS AND LISTINGS

### Book Reviews

**WEATHER, CLIMATE AND HUMAN AFFAIRS.** By Hubert H. Lamb. Routledge 1988. xiv + 364pp., £60.00.

Very occasionally a book appears that sets a standard by which everything else in its field can be judged. This is such a book, for it is a work of great scholarship and demonstrates what can be achieved in less than a lifetime's study. It is full of interesting and useful facts and provides much helpful advice on how to treat and interpret climatic data. Even the reference lists at the end

of each chapter are for the most part valuable, in spite of some duplication. They moreover show the author to have a quality rare among British climatologists, viz. the ability to read and incorporate data published in several languages.

The book contains 18 chapters, 6 of which have not been published before. Having originally appeared in various sources, the remaining chapters are here brought together for the first time. They have therefore been revised and updated especially for this book, though some of the examples of this mentioned on the dust cover are not as substantial as one might have expected (e.g. those relating to the stratospheric ozone problem and the Chernobyl disaster). Of the three parts into which the book has been divided, the first is by far the longest. It also displays a satisfying coherence in its discussion of selected aspects of 'climatic history and its effects on human affairs and environment'. The author believes that its chapters "will be the easiest for interested people who are not scientists to read". Following a wide-ranging, scene-setting chapter ('The Earth's restless climate') and an account of 'Climate and history in northern Europe and elsewhere in the last thousand years', there is a series of chapters in chronological order spanning climate and life of the Medieval period, problems of the Little Ice Age, the Great Irish Potato Famine and drought in modern Africa.

Part II deals with causes and mechanisms of climate and weather change and though not as long, it still exceeds 100 pages. Among the topics discussed are: causes and time-scales of climatic change, Christmas to New Year weather, and volcanoes and climate. Part III consists of a single, but thought-provoking chapter entitled 'The future of the Earth: greenhouse or refrigerator?'

As this book is the work of one man, it is perhaps not surprising that the range of topics covered is somewhat limited (e.g. there is a heavy bias towards the West European/North Atlantic region). Equally, at the more detailed level, one can point to omissions and shortcomings (e.g. there is no mention in chapter 4 of the work by Barbara Harries on Alpine passes; likewise, Figure 6.6 purports to show changes of world temperature over the last 100 years, but gives no details about the 1980s). To mention such things is, however, rather churlish, for it is the massive achievements of this book that are important and they are what will probably make it a classic in the field of climatic history.

### RECENT CLIMATIC CHANGE: A REGIONAL APPROACH.

Edited by S. Gregory. Belhaven Press, 25 Floral Street, Covent Garden, London WC2E 9DS, 1988, xvi + 326pp., £33.00.

As with Lamb's book, this is essentially a collection of papers on a theme. There, however, the similarity largely ends. Being the product of one mind developed over many years, Lamb's text exhibits a high degree of cohesion. The book Gregory has edited is the outcome of many minds enunciating their views within a very short time during a symposium at Sheffield University in 1987. Given that Lamb offers only 18 papers in over 360 pages while



Gregory's team has 27 papers in less than 330 pages, it is not surprising that on the whole Lamb achieves a more penetrating and substantial text. He also ranges more extensively in the time periods covered, though Gregory has put together a book which is of wider geographical scope (two of its four parts are not concerned with Europe).

In some ways these books are complementary. Thus, it is instructive to compare Lamb's 'Volcanoes and climate: an updated assessment' with Schönwiese's 'Volcanism and air temperature variations in recent centuries'. Equally, Lamb's 'Drought in Africa: the climatic background to a threatening problem of today's world' is neatly complemented by Gregory's own paper 'El Niño years and the spatial pattern of drought over India, 1901-70'. Both books are essential reading for those interested in climatic change and together they represent an important step forward in our understanding of that subject.

L.T.

## LETTERS TO THE EDITOR

### UNUSUAL MESOSCALE ROTATION ON 2 APRIL 1989

David Reynolds' observation of a mesoscale rotation (*J. Meteorology*, vol. 14, p. 390 1989) was interesting and informative in that it describes a phenomenon which appears to be associated with a 'col'.

A 'col' is a region of slack winds occurring near the 'saddle point' between systems. That is, it is the point of highest pressure between two depressions and, simultaneously, the place of lowest pressure between two anticyclones.

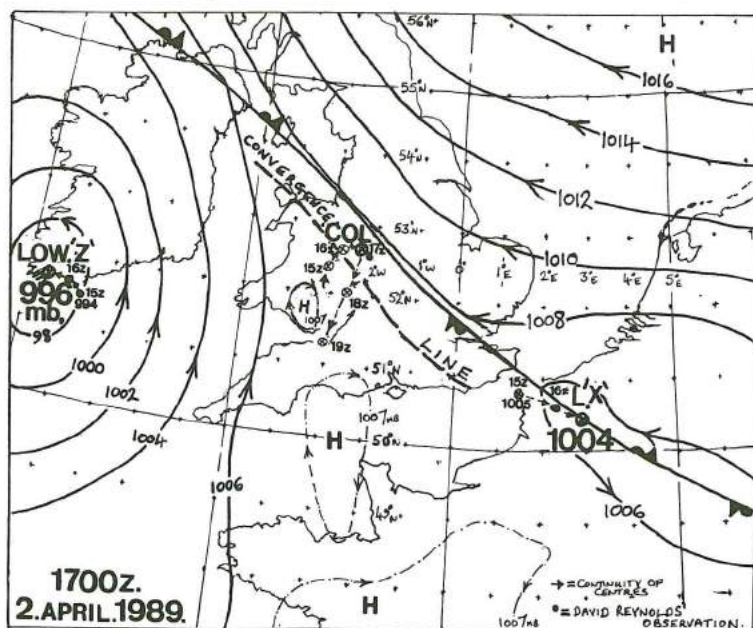


Figure 1 shows the movement of such a 'col' during the afternoon of 2nd April 1989 indicating that the mesoscale anticyclonic circulation could well have occurred just to the south of the col's position as it moved slowly south-south-westwards at the time.

On the larger scale, as well as the occlusion which Mr Reynolds mentions was located to the north-east, there was a convergence line (as indicated in Figure 1) further to the south-west with the 'col' (plus anticyclonic circulation) located between these two discontinuity lines.

Observations featuring a clear view of the sky near a 'col' are not that common, and Mr Reynolds is to be congratulated for making such careful notes of what he saw.

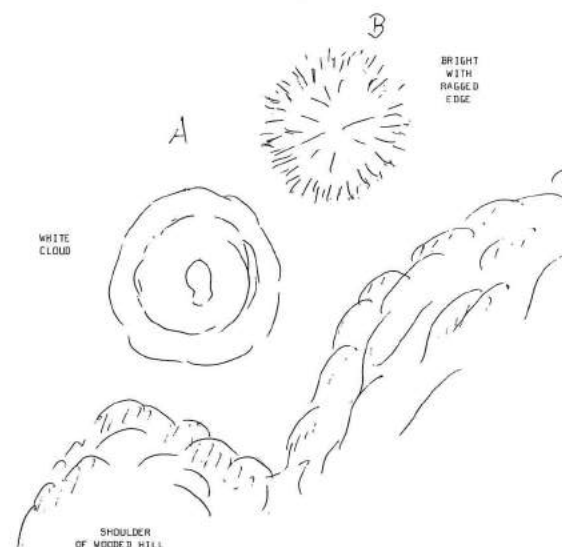
Woodland St Mary, Newbury, Berkshire

W. S. PIKE

## CLOUD CIRCLES AND RINGS

The attached sketch shows a manifestation observed by me here at 1630 GMT on 7th August 1989 (Figure 1); it is made from notes taken at the time.

Just above the shoulder of a wooded hill on a line-of-sight bearing about 280 degrees, having an elevation of about 30 degrees, and an apparent breadth of some 5 degrees of arc, a ring of white cloud (resembling a giant smoke ring) with a little wisp of white cloud in the middle could be seen (A in the sketch). When first sighted it was in a large patch of hazy blue sky. At about 2 o'clock above, there was a circular patch of brilliant cloud with ragged edges, brighter-coloured towards the edge and slightly iridescent and of much the same size (B in the sketch).



Gradually the ring of white cloud (A) became distorted and the bright patch (B) began to clear towards its outer edge, more and more resembling 'A'. At the moment when it had almost seemed to become a ring like 'A' the whole was engulfed in further thick cloud blowing up from westward. The entire event lasted about seven minutes.

I have never seen the like. Having read your recent most interesting paper on vortices and the circles effect (*J. Meteorology*, vol. 14, issue no. 139, 1989), I wonder whether a vortex can appear above ground with a horizontal axis as in the circumstances described.

Bradley Manor, Newton Abbott, Devon

A. H. WOOLNER



## TORRO TORNADO DIVISION REPORT: January to April 1989

During much of 1989 tornado activity in Britain has been at an even lower level than in the previous four years. At the time of writing (mid October) only five tornadoes have been reported, and only two of these can be considered definite cases. The main tornado-prone areas have had a remarkable frequency of anticyclonic conditions, and the longest unsettled spell, occupying much of the period from late February to the end of April, occurred at the time of year when tornado activity is normally at its lowest.

### WS1989February21. *Fair Isle, Shetland (HZ 2171)*

Mr. David Wheeler observed a waterspout hanging from the trailing edge of a cumulonimbus (COL, February 1989, p.16).

At 1200 GMT depressions were situated over the Norwegian Sea (990mbar) and to the west of Ireland (978mbar). Fair Isle lay in a westerly airstream at the surface and at 500mbar. The Northern Isles had showers of snow and hail throughout the day.

### tn1989March2. *Iford, Bournemouth, Dorset (SZ 134930-137933)*

At about 2230 GMT a "strong gust of wind" tore off tiles and ripped garden fences from the ground in Southwick Place. Mr. Bob Wingfield said: "There was a terrible thundery noise. It was very loud and lasted about one minute, rattling all the windows" (*Evening Echo*, Bournemouth, 3rd March, sent by Mr. Stuart Dapp). A colleague of Mr. Dapp's who lives in Ashford Road, about 400 metres N.E. of Southwick place, reported planks of wood strewn across his garden. He had heard "a sudden gust of wind about 10.45pm", during a very heavy shower of rain.

During the day a filling low moved across Eire and was centred over the Irish Sea, 990mbar, at midnight. At 500mbar there was a low just to the west of Ireland. The tornado occurred in the showery post-frontal air.

### EW1989March19. *Carn Liath, Highland (NN 471903)*

Mr. Reg Stuart observed snow whirling up into little cone shapes about 2-3 feet (60-90cm) high. This was at NN 471903, which is at about 990m altitude on Carn Liath, north of Loch Laggan. A short while later he saw similar whirlwinds at NN 469905, on the same mountain. The weather was windy, with thick mist. Mr. Stuart had seen eddy whirlwinds on many previous occasions.

At 1200 the area lay near the warm front of a depression (962mbar) centred well to the west of Scotland. At 500mbar there was a ridge over the North Sea.

### WS1989March20. *South-west England.*

Mr. Peter Matthews reported to TORRO that waterspouts were seen off S.W. England, according to the 6.30pm BBC1 weather forecast. Further information on these waterspouts would be most welcome.

The spouts were probably associated with a small, occluding secondary depression which moved along the English Channel during the day. At 500mbar a broad, shallow trough covered the country. There were showers or longer periods of rain in S.W. England.

### WS1989March21. *Magnus Platform, North Sea.*

At 0700 GMT a waterspout was observed forming below low cumulonimbus (base at about 900 feet (274m)). The spout, which lasted for about ten minutes, reached the sea surface, but the central section was invisible. The observers were Capt. R. Lanz and K. Saxon on the *TNT Sentinel* (report from Capt. M. L. M. Coombs).

At 0600 a very shallow secondary low (994mbar) lay over the northern North Sea, with a trough at 500mbar. The Northern Isles had showers of snow and hail for most of the day.

### FC1989April13. *Near Chedgrave, Norfolk (c TM 3699)*

A funnel cloud appeared at about 1345 GMT and was photographed by Mr. Paul C. Niuq at Chedgrave. He believed it to be over Bungay (TM 3389), but



Fig.1: Funnel cloud near Chedgrave, Norfolk, 13 April 1989  
(Photograph by Mrs. Cynthia Gibbling).



this would make it 10km away, which from the photograph is certainly an overestimate. There was no rain, hail or thunder at the time but there was "a very humid and heavy atmosphere". The funnel cloud reported from the area of Pulham St. Mary (TM 2085) in *COL*, April 1989, p.15, and the one in the Norwich area, mentioned by BBC local radio and by a local press reporter in a telephone call to Terence Meaden, are probably the same funnel. Two (of eight) photographs by Mrs. Cynthia Gibling of Chedgrave are reproduced in Figure 1 (thanks to Mr. Norman W. K. Brooks).

A shallow low, 998mbar, was centred near London at 1200. At 500mbar most of the country was covered by a trough. Thunderstorms broke out widely in the Midlands and East Anglia in the afternoon.

#### WW1989April16. *Near Ben Mór Coigach, Highland (c NC 0904)*

Mr. Reg Stuart was walking on Ben Mór Coigach when he saw a whirlwind at a considerable distance. (He thought it was over Enard Bay, NC 0414, but this would make it 11km away). The whirlwind was light in colour and cone shaped. There were few clouds at the time. This was most probably an eddy whirlwind, though conditions were not very typical.

Northern Scotland lay in a ridge, with light winds, and several stations reported 11 hours sunshine.

A tornado killed many people in the Manikganj district of Bangladesh on 26th April. Some press reports put the death toll as high as 1000, which if true would be a world record for a tornado; but it is likely that non-tornadic winds caused much of the damage and many of the deaths.

#### *Waterspouts worldwide*

The following waterspouts have been reported to TORRO by Capt. M. L. M. Coombs of the Meteorological Office.

#### WS1989January24.

6°20'N., 95°37'E., observers Capt. W. D. Boler and others.

#### WS1989February1.

38°12.5'N., 9°39.4'W, Capt. A. O'Niell and D. C. Selley. Height 150-200m, diameter 50-75m, rotation thought to be anticlockwise. Pressure was 1030.6mbar, but there was a trough at 500mbar.

#### WS1989February5.

36°16'N., 4°06'W, observer not stated. Pressure was 1030.2mbar, but there was a small low at 500mbar.

#### WS1989March4.

7°48'S., 49°39'E., observed by ship's company.

#### WS1989March14.

32°42'N., 73°38'W., Capt. G. S. Laird. The spout was estimated to be about 400m high and 50m wide.

#### WS1989April15.

21°00'N., 122°53'E, Capt. J. W. Welch and A. Dunkely.

#### WS1989April19.

2°30'N., 64°00'E., Capt. B. V. Chipperfield and others. Estimated height 500m; spray was raised 150m.

M. W. ROWE, G. T. MEADEN

## TORRO THUNDERSTORM REPORT: May 1989

By KEITH O. MORTIMORE

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May was a predominantly anticyclonic month and was, as a result, dry, very warm and exceptionally sunny. It was no surprise, therefore, that May also saw less than normal thunder activity. Most of the month's thunder occurred between 20th and 25th as thundery conditions spread progressively north-east across all parts of the U.K. and Ireland. Although some stations failed to hear any thunder during the month, these were few and far between, and generally across the country two or three days were quite widely reported. At Heywood (Greater Manchester) thunder was heard on five days.

Thunder-days in May 1989 were as follows: (Averages refer to the period 1951-1980).

May 1989	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Ave.
England												X	X						X	X	X	X	X	X						X	10	16.9	
Wales												X							X			X	X	X							5	8.6	
Scotland												X							X			X	X							X	5	9.1	
Ireland												X		X					X	X	X	X									6	8.0	
Total												X	X	X				X	X	X	X	X	X	X					X	11	18.7		
Netherlands												X	X	X	X											X					5	16.0	
Belgium									X	X	X	X	X						X	X						X		X	X		11		

A depression moved slowly east across Scotland on 11th and a series of frontal systems crossed all parts of the British Isles. Following a spell of warm sunshine thunderstorms broke out over parts of East Anglia in the afternoon and storms also developed in places near to a cold front as it crossed north Wales and northern England. In the evening scattered thundery outbreaks were also reported from Northern Ireland and eastern Scotland. Most parts of the British Isles had showers on 12th, hail fell in many places and thunder was reported over Yorkshire and in parts of eastern England, while early in the afternoon of 13th thunder was heard in the Dublin area of Eire. A ridge of high pressure covered the U.K. and Ireland on 19th, extending from an anticyclone centred between Scotland and Norway, and within this area of high pressure a decaying frontal system straddled the border region of England and Scotland. Heavy



showers developed on the southern side of this system with thunderstorms over the southern Pennines in the afternoon and parts of Merseyside in the evening. The most spectacular storms affected an area from Halifax through Huddersfield to Hebden Bridge where intense rainfall, particularly over the higher moorland, resulted in serious flash flooding. Houses were evacuated in the Halifax area as floodwater reached a depth of four metres in places and car drivers had to be rescued from their vehicles. At Luddenden the rear wall of a house was swept down a hillside and two cars were washed into a stream. The rain that in places fell for only two hours was sufficiently intense to scar the landscape in the vicinity of Walshaw Dean Reservoir where a rainfall total of 193.2mm was recorded.

Although there was an isolated outbreak of thunder in south-west Scotland around dawn on 20th it was in the south-west of England that activity began to appear late in the day as thunderstorms from France moved north-westwards across Cornwall and parts of southern Ireland. Activity continued to affect this area during the early hours of 21st, at the same time spreading to parts of Devon and Somerset, and in the afternoon there were a few further storms in mid Devon. In the evening there was thunder in the Channel Islands. During overnight storms in southern Ireland telephone services and power supplies were cut to parts of Co. Cork and Co. Limerick. At the Bord Gais/Marathon gas pumping facility at Inch, near Whitegate, Co. Cork, lightning set fire to purge gas being emitted from a vent stack. Lightning also struck power lines in parts of Cornwall blacking out thousands of homes in the Newquay, Penryn, Launceston and Wadebridge areas. Further thundery outbreaks spread across parts of southern England during early hours of 22nd, in association with patchy medium-level cloud, and some of the storms were electrically quite severe with heavy rain. There was also large hail from local areas of deeper convection and lightning damage was reported from some parts. On Moeltryfan mountain above Rhosgadfan (Gwynedd) a 26-year-old Southampton man received severe burns after being struck by lightning during an afternoon thunderstorm. His clothes were left in tatters and he was left with a scorch mark around his neck where he had been wearing a gold chain bearing a cross. In the evening thundery outbreaks returned to parts of southern Ireland, Dyfed and south-west England. Further thunderstorms moved north from France across southern Britain in early hours of 22nd, reaching northern England and parts of Scotland in the afternoon and evening. Heavy thunderstorms also developed over the east Midlands in the late afternoon and spread north in the evening. A number of lightning damage incidents were reported across the country during both major outbreaks and a 44-year-old man was killed by lightning in the village of Basingham (Lincolnshire). At Lychett Matravers (Dorset) two adjoining cottages were gutted by fire after being struck by lightning in the early hours and two police officers escaped injury near Okehampton (Devon) when their Land Rover was struck by lightning whilst travelling to rescue an 82-year-old woman trapped by flood-water. At Telford (Shropshire) wreckage was hurled 20 metres from the scene when a

house was struck by lightning. In Ireland Mallow Races in Co. Cork were called off after an hour-long thunderstorm flooded the track. A press report spoke of the storm being accompanied by 'fist-sized' hailstones. In the evening a cold front crossed north-west Scotland setting off further thunderstorms over the highlands. Part of central-southern England and the west country were affected by further thunderstorms during early hours of 24th but the most widespread developments took place later in the morning with many parts of the country affected by afternoon storms of considerable violence. There were numerous reports of severe flooding, lightning damage and hailstorms. At Ammanford (Dyfed) a 75-year-old retired miner was killed by lightning whilst walking near his home, at Ashstead (Surrey) a man was thrown to the ground after lightning struck a nearby tree, he was shocked but otherwise unhurt, and at Sheffield another man was struck. In the latter incident the man, an artist, was standing near the window of his studio when lightning struck the adjacent wall burning his arms, hands and feet. During a severe storm at Blagdon Hill, near Taunton (Somerset) hailstones between 40 and 50mm diameter caused a lot of damage to property and the ground was white for a time. As much as 12mm of hail was reported to have fallen on the hills around Shaftesbury (Dorset). By late afternoon thunderstorms were confined to North Yorkshire and most of these died out by midnight, although there was an isolated storm in north Norfolk in early hours of 25th. Finally, during the afternoon and evening of 31st, cold, showery conditions spread south across Scotland and northern England. Thunder accompanied some of the showers and hail fell in sufficient quantities to cover the ground in places, particularly over the higher parts of the northern Pennines. The summit of Cross Fell had a white covering on morning of 1 June following these evening hailstorms.

*Acknowledgements:* The Directors would like to thank all TORRO and TCO observers who have contributed to the compiling of this report. Sincere thanks are also offered to members of the Climatological Observers Link and also to the London Weather Centre for information in the Daily Weather Summary.

## WORLD WEATHER REVIEW: July 1989

**United States.** *Temperature:* mostly warm; +2degC locally from C. Arizona to N.W. Minnesota. Cold in Washington, Oregon, N. California, interior S. and much of N.E. coast; -2degC from S.W. Kansas to C. Arkansas. *Rainfall:* wet in S.E., as far W. and N. as E. Texas, E. Nebraska, S.E. Wisconsin and S. New Hampshire; also Hawaii, N.W. New Mexico, S.W. Colorado and N.W. Montana. Over 200% locally from S. Arkansas and S. Mississippi to New Jersey; Hawaii. Dry elsewhere; under 50% in S.W. Texas, S. New Mexico, California, W. Nevada, S. Oregon, E. Washington, S.W. Idaho, E. Wyoming, S.E. Colorado, E. Montana, W. Dakotas, C. Maine, N. Minnesota to W. New York.

**Canada and Arctic.** *Temperature:* mostly warm; +4degC from N.E. Alaska almost to Hudson Bay. Cold from Quebec and Maritime Provinces to most of Greenland, E. Canadian Arctic islands and S. Iceland; mainly -1degC. Franz Josef Land near normal. *Rainfall:* wet in most of Alaska and N. Canada; Gulf of St. Lawrence, N. and S. Greenland, Iceland. Over 200% in N.W. Alaska,



Ellesmere Island, Gulf of St. Lawrence. Dry in most of S. Canada (except much of S. British Columbia and S. Alberta); N.E. Alaska, C. Greenland. Under 50% in N.E. Alaska, N. British Columbia, S. Saskatchewan to S. and W. Quebec; W. Greenland.

**South and Central America.** *Temperature:* warm in N. Chile, N.W. Argentina, W. Indies, Bahamas, Bermuda; most of Mexico to Honduras; +2degC locally in N.W. Mexico. Cold generally in South America 15-40°S.; locally in S. Mexico; -2degC in S. Paraguay, N.E. Uruguay and extreme S. Brazil. *Rainfall:* wet in W. and S. Paraguay, Cuba; locally in S. Bolivia, E. Argentina and S. Brazil. Over 200% near Bolivia-Paraguay border; round São Paulo and Bahía Blanca. Dry in most of South America 15-40°S.; most of Mexico and West Indies; Bahamas, Bermuda. Under 50% in N. Chile, W. Bolivia, W. and N. Argentina, N. Uruguay, N.E. Paraguay, N.E. and N.W. Mexico, Bahamas, Bermuda; most of W. Indies; locally in S. Brazil.

**Europe.** *Temperature:* mostly warm; +3degC in S. Eire, S. England, N.W. France and much of Portugal; +4degC in S. Urals. Cold in Norway, Sweden (except extreme S.), N. Finland, Ukraine, Balkans, S.E. Italy; -2degC in Norway, N. Sweden. *Rainfall:* wet in most of European Russia and Finland; N. and W. Norway, N. Sweden, Faeroes, S. Germany, Austria, Italy, N. Switzerland, C. France, S. Yugoslavia, N. Greece, Azores; parts of C. and N. Spain. Over 200% in lower Volga basin, S. Yugoslavia; much of Italy; locally in C. and N. Spain and C. France. Dry elsewhere; under 50% in S. Urals, Low Countries, S. Sweden, N. and S. France, Portugal, S. and N.E. Spain, extreme N.W. Italy, S.E. Greece, E. Bulgaria, C. Czechoslovakia, S. Hungary; much of Ukraine, Romania, Poland and British Isles; locally in N. Germany. Provisional sunspot number 127.

**Africa.** *Temperature:* warm in Maderia, Canary Islands, coastal Morocco and Algeria, Botswana to Natal; +2degC in N.E. Morocco and parts of coastal Algeria. Cold from S.E. Morocco to Tunisia; most of Cape Province; -1degC in interior Algeria and Tunisia and W. Cape Province. *Rainfall:* wet in interior Morocco; coasts of Tunisia and (locally) Algeria (all over 200% in places); W. coast of Cape Province; S. Natal into Lesotho. Dry or rainless generally from Madeira and Canary Islands to Egypt; most of South Africa into Namibia, Botswana and Mozambique.

**Asian U.S.S.R..** *Temperature:* warm from Ob basin to Iran border; Pacific coast; +4degC in upper Ob basin. Cold elsewhere; -3degC W. of R. Lena. *Rainfall:* wet near N. and E. coasts (but under 50% in lower Kolyma basin and extreme S. Kamchatka) and E. of L. Balkhash and L. Baikal. Over 200% from Berling Strait to Sea of Okhotsk. Dry elsewhere; under 50% from Iran border through Ob basin to upper Lena basin.

**Asia (excluding U.S.S.R.).** *Temperature:* warm in most of Turkey and Middle East; N.C. India, N. Japan; Thailand to Philippines and Indonesia; +2degC in N. and W. Arabia, E. Malaya; locally in S. Thailand, Sumatra and N. Java. Cold in parts of coastal Turkey; Pakistan, China, N. Korea, S. Japan; parts of N. and coastal India and E. Arabia; -1degC at least locally in all these areas; widely in China. *Rainfall:* wet in parts of N. Turkey; Pakistan, S.E. and extreme N.W. India, S. Vietnam, S. Laos, E. Cambodia; most of Korea; parts of S., E. and N.E. China and N., E. and S. Thailand. Over 200% at least locally in all these areas except perhaps N. and S. Thailand. Dry in Middle East, Mongolia, S.E. and interior N. China, N.W. Korea, N. Vietnam, N. Laos, W. Cambodia; most of Turkey, India, Japan and Thailand. Under 50% at least locally in all these areas except perhaps N. Vietnam; widely except in Korea, Laos and Thailand. Malaysia, Indonesia and Philippines mixed, with few large anomalies.

**Australia.** *Temperature:* rather warm in N. third and locally in extreme S.E.; otherwise cold; -1degC from Perth to Brisbane; Adelaide area. *Rainfall:* wet in much of E. and S.E.; over 200% in E. Queensland and southern South Australia; otherwise mainly under 50%.

## WEATHER SUMMARY: October 1989

October was yet another in the continuing sequence of warm months over much of Great Britain with mean temperatures around two degrees Celsius above the normal in parts of the south and close to the seasonal average over

most of northern Scotland and the Islands. An incursion of southerly winds on 5th lifted temperatures over south-eastern Britain to their highest levels of the month with Kent being most favoured. At Herne Bay 22.3° was recorded and at Manston 22.1° was reached while a number of other stations in the south-east exceeded 21°C. In Scotland the temperature rose to 20° on the Moray Firth on 17th. The 17th was also the warmest night of the month over Scotland with minima of 14.3° at Edinburgh and 14.3° at Dyce airport (Aberdeen). In southern England there was a minimum of 15.6°C at Exeter on 21st. Lowest maximum temperatures included 5.3° at Fort William on 27th, 6.4° at Lerwick on 9th, 9.2° at High Bradfield (South Yorkshire) on 26th, 9.4° at Middleton (Derbyshire) on 14th and 10.5°C at Belfast on 25th. Screen temperatures below freezing occurred quite widely over Scotland on 2nd with -3.1° at Inverdrue (Highland), -2.6° at Tummel Bridge and -2.4°C at Rannoch School, Dall (Tayside). Over southern Britain the 3rd saw temperatures down to -0.5° at Gurney Slade (Somerset), -0.3° at Romsey (Hampshire) and -0.9° at St. Harmon (Powys). Throughout the rest of the month frost was an infrequent visitor and only on 15th were temperatures at all low when a minimum of -2.0° was recorded at both Glenlivet (Grampian) and Braemar (Highland). The months lowest grass minima were -7.1° at Inverdrue, -7.0° at Glenlee (Dumfries and Galloway), both on 2nd, -5.0° at south Farnborough (Hampshire) on 3rd and -4.0°C at Birmingham on 5th. Rainfall totals were mostly above average across the U.K. although eastern counties of both England and Scotland were rather dry and parts of east Norfolk recorded little more than 50 percent of the normal. Between 150 and 200 percent fell in western Scotland and in parts of south-east Wales and the lower Severn Valley. Daily totals were quite large on occasions. On 16th Fort William recorded 57.5mm and on 20th there was widespread heavy rain in the south-west of England and south Wales with 20-30mm over a large area and with 77.4mm at Cilfynydd (Mid Glamorgan) and 95.7mm at Ebbw Vale (Gwent). On 21st Fort William received a further 65.8mm. An area of persistent and heavy rain affected north-west Eire and parts of western Scotland on 27th with 94.7mm falling at Straide (Co. Mayo) and 53.5mm at Tiree. On 30th 64.0mm fell at Stornoway. Although sunshine totals approached or even exceeded the normal in some sheltered parts it was generally a rather dull month with less than 80 per cent in many western parts.

During the first three days an anticyclone drifted slowly east across the British Isles. The weather was generally dry and there was local frost over Scotland on 2nd and more widely over the U.K. on 3rd. Sunny weather spread north to most parts of Britain on 4th and with southerly winds affecting eastern areas sunshine lifted temperatures into the twenties on 5th. A spell of north-westerly winds covered all parts from 6th to 14th, with all parts getting a mixture of sunny spells and periods of mostly light rain or drizzle as weak frontal systems moved around the periphery of the anticyclone situated to the south-west of Ireland. By 15th the anticyclone had transferred eastwards into Europe and active frontal systems spread heavy rain across western Scotland



on 15th and 16th while southern Britain remained dry with some sunshine. The 17th and 18th saw further sunshine in many parts but fog developed widely at night and was slow to clear in places during the daytime. The weather turned much more unsettled on 19th as wet and windy weather spread north-east to all parts and there followed a spell of frequently disturbed weather with pressure persistently low to the north-west and with spells of often heavy rain and strong winds. The 20th and 21st were particularly stormy days in the south-west with gusts to 75 knots at Berry Head (Devon) on the former day and 82 knots at Pendennis Point (Cornwall) on the latter. Between 22nd and 27th it was generally unsettled with rain or showers in most parts and spells of sunshine. On 28th a very intense depression moved north-east right across the country. Rainfall was especially heavy in the west and near-to the low centre, and gale-force winds affected many parts (87 knots at Portland Bill in Dorset). There was further rain on 29th as fronts straddled the country but generally there was a quieter end to the month with sunshine in many places but still with some rain or showers, especially in the north and west.

K. O. M.

## TEMPERATURE AND RAINFALL: OCTOBER 1989

	Mean			Grass								
	Max	Min	Max	Min	Rain	%						
BELGIUM: Uccle	16.5	9.6	21.9(27)	4.8(16)	-1.0(4)	65.4	92	12.4(29)	16	-		
" Rochefort	16.2	6.1	21.4(27)	0.0(17)		87.6	125	20.4(29)	18	-		
DENMARK: Fanø	13.7	8.9	16.6(5)	3.8(3)		120.7	126	23.3(23)	20	1		
" Frederikssund	13.3	8.2	16.9(22)	3.4(1)	-0.6(1)	70.2	126	10.3(16)	19	1		
GERMANY: Berlin	15.4	7.2	21.8(22)	1.3(4)	0.1(4)	37.7	93	10.5(30)	15	0		
" Hamburg	14.5	7.8	20.2(22)	0.4(4)	-2.6(4)	46.5	82	10.5(13)	20	1		
" Frankfurt	16.3	7.0	22.7(22)	0.4(4)	-1.4(4)	46.8	96	13.3(29)	13	0		
" Munchen	16.1	4.8	24.5(28)	-0.9(5)	-4.1(5)	55.6	96	13.5(7)	16	2		
ITALY: Casalecchio	16.7	8.3	21.0(v)	5.0(v)	4.0(v)	4.6	5	3.5(7)	3	1		
MALTA: Luqa	22.9	17.3	25.8(1)	12.4(18)	7.5(18)	95.0		40.2(24)	12	6		
NETH'NDS: Ten Post	15.1	8.8	19.4(22)	3.1(4)	-1.7(4)	104.3	149	27.4(8)	22	0		
SWEDEN: Valla	11.2	4.4	16.0(5)	-2.3(12)	-6.5(12)	59.0		12.2(30)	18	0		
SWITZ'LAND: Basel	18.0	6.7	24.8(23)	-2.8(8)		47.2	77	18.6(28)	11	1		
EIRE: Straide	13.7	8.4	17.7(16)	2.3(23)	-3.5(30)	281.7	233	94.7(27)	28	1		
SHET'AND: Whalsay	10.5	6.7	12.7(17)	1.4(15)	-2.1(15)	117.9	78	20.4(21)	25	1		
" Fair Isle	10.6	8.0	13.0(17)	4.4(15)	-1.6(15)	124.7	119	18.4(20)	23	1		
SCOT'AND: Braemar	11.8	4.7	16.2(1)	-2.0(15)	-2.7(15)	72.8	91	13.3(27)	24	0		
" Inverduie	11.6	4.8	16.0(1)	-3.1(2)	-7.1(2)	85.4	98	8.9(27)	26	0		
" Rannoch	12.9	4.5	16.5(2)	-2.4(2)	-2.7(2)	148.2		16.3(31)	24	0		
WALES: Pembroke												
" Velindre	14.5	7.9	18.3(17)	0.4(3)	-2.5(18)	119.9	146	27.7(20)	21	0		
" Carmarthen	14.7	8.7	17.1(4)	4.1(18)	1.0(18)	176.5	136	34.6(19)	22	0		
" Gower	15.2	9.9	17.6(17)	7.6(3)	2.2(15)	163.0	122	27.8(20)	21	0		
GUERNSEY: Airport	16.5	12.0	19.0(22)	8.8(9)		42.1		10.2(19)	15	0		
ENGLAND:												
Denbury, Devon	15.3	9.7	19.0(1)	4.0(17)	2.1(17)	135.9	119	42.5(20)	13	0		
Gurney Slade, Somerset	15.3	7.3	19.5(4)	-0.5(3)		141.3	110	27.0(20)	19	0		
Yatton, Avon	16.2	8.8	19.8(17)	1.0(3)	-0.5(3)	97.3	94	22.1(28)	15	0		
Corsham, Wiltshire	15.5	8.3	19.6(17)	1.5(3)	-2.0(3)	101.9	146	20.5(20)	15	0		
Mortimer, Berkshire	15.7	8.1	19.2(17)	1.8(3)	-1.9(3)	72.8	117	17.7(20)	15	0		
Reading Univ., Berks	16.1	8.5	19.3(17)	2.7(3)	-3.2(5)	64.1	116	14.2(19)	15	0		
Sandhurst, Berkshire	16.3	7.6	19.4(5)	0.5(15)	-1.7(15)	70.5	108	16.5(19)	16	0		

	Mean		Max	Min	Grass	Rain	%	Wettest	RD	Th
	Max	Min			Min					
Romsey, Hampshire	16.3	7.7	20.5(17)	-0.3(3)	-2.5(15)	80.5	101	26.5(20)	15	0
Horsham, Sussex	16.3	9.1	20.5(5)	2.6(15)	-0.9(15)	70.3	98	13.0(20)	17	0
Brighton, Sussex	16.0	9.7	19.4(5)	5.1(5)	4.3(15)	86.7	74	16.5(30)	17	1
Hastings, Sussex	16.7	10.4	20.9(8)	5.8(15)	2.0(15)	97.5	109	19.1(21)	-	1
Dover, Kent	16.5	9.6	20.2(5)	4.1(18)		89.2		18.0(21)	17	1
East Malling, Kent	16.7	9.2	21.5(5)	3.4(15)	-1.7(15)	44.6	69	10.4(19)	15	0
Epsom Downs, Surrey	15.7	9.0	18.8(17)	1.7(15)	-2.0(15)	71.0	83	17.6(20)	17	0
Reigate, Surrey	15.9	8.4	20.2(5)	1.9(15)		64.7	65	14.2(20)	17	0
Guildford, Surrey	15.9	9.8	19.4(5)	4.9(3)	2.1(3)	63.9	89	14.8(20)	18	0
Sidcup, London	16.7	9.4	21.2(5)	3.4(15)	0.9(15)	46.2	86	8.6(19)	15	0
Hayes, London	16.3	8.6	20.0(5)	2.5(15)	0.8(15)	60.2	84	13.9(20)	16	0
Hampstead, London	16.1	9.7	19.8(5)	4.6(15)	-1.5(5)	53.7	91	10.1(20)	17	0
Royston, Hertfordshire	15.8	9.6	19.0(5)	5.6(15)	1.5(18)	41.9	85	11.4(19)	16	0
Loughton, Essex	16.1	8.9	20.0(5)	3.7(15)	-0.9(15)	54.0	80	15.8(19)	16	0
Buxton, Norfolk	16.0	8.8	21.1(5)	2.0(18)	0.4(15)	40.5	72	10.0(19)	15	0
Ely, Cambridgeshire	15.9	7.5	21.0(5)	2.9(15)	1.5(15)	39.1	74	11.1(19)	15	0
Luton, Bedfordshire	15.4	8.6	19.3(17)	2.3(15)	-1.7(5)	53.0	90	11.5(19)	17	0
Buckingham, Bucks'shire	15.7	7.8	20.0(17)	1.7(3)	-3.1(5)	57.7	91	16.4(20)	17	0
Oxford University	15.9	8.9	18.9(17)	3.5(3)	-2.0(3)	53.1	82	10.5(20)	17	0
Kettering, Northants	15.6	8.2	18.9(17)	1.3(18)	-1.5(5)	42.9	66	10.2(20)	16	0
Wolverhampton	14.3	7.9	17.8(17)	4.8(3)	-0.2(3)	96.3		14.1(20)	19	0
Louth, Lincolnshire	15.3	8.2	18.3(12)	3.4(15)		56.7		12.2(20)	20	0
Keyworth, Nott'shire	15.3	8.4	18.6(17)	3.2(3)	-1.0(3)	58.5		17.5(20)	15	0
Nottingham Nott'shire	15.9	7.8	19.5(4)	3.0(18)	1.4(18)	63.2	143	15.4(21)	16	0
Derby, Derbyshire	15.1	9.1	18.6(17)	3.7(18)	2.6(18)	77.9		17.1(20)	17	0
Middleton, Derbyshire	12.6	7.6	15.1(17)	4.4(15)		100.4	107	17.1(20)	18	0
Keele University, Staffs	13.9	7.9	16.6(4)	4.5(15)	0.4(15)	84.6	121	14.3(19)	20	0
Liverpool, Merseyside	15.3	9.3	18.2(17)	5.3(3)		99.4	134	20.3(28)	24	0
High Bradfield, S.Yorks	12.2	7.2	15.7(2)	3.3(15)		105.7		25.1(28)	20	-
Cottingham, Humb'side	15.4	8.2	19.7(12)	2.7(15)	-1.5(15)	42.0	80	8.1(20)	17	0
Carlton-in-Cleveland	14.2	8.0	17.2(12)	3.3(18)	-1.1(18)	61.8		18.3(19)	17	0
Durham University	14.7	6.9	19.1(17)	1.9(15)	-2.1(31)	48.5	75	12.1(18)	21	-
Sunderland, Tyne/Wear	14.7	8.9	18.2(17)	5.4(15)		41.1	88	14.0(19)	15	0
CANADA: Halifax NS	12.9	3.7	20.4(28)	-0.5(27)		137.1	113	60.6(11)	14	0
U.S.: Bergenfield, NJ	20.0	7.6	26.1(13)	0.6(10)	-0.6(10)	160.0		62.2(20)	8	0
JAMAICA: Kingston	33.5	24.9	34.9(11)	23.2(24)		41.8	25	22.8(31)	8	7
" Montego Bay	30.9	23.9	31.9(6)	22.9(28)		77.7	46	37.4(1)	12	9
AUSTR'LIA: Leopold	18.8	8.2	27.7(18)	5.1(17)		77.2	138	23.5(25)	13	0

## CUMBRIA RAINFALL:

Carlisle, 70.6mm (88%); Seathwaite, 353.0mm (114%); The Nook, Thirlmere, 276.8mm (106%); Coniston, 313.0mm (124%); Hawkshead, 231.7mm (127%); Ulverston, Poaka Beck, 135.7mm (98%); Honister, 486.0mm.

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 (b) Spare issues of *Weather* magazine: 1953 (12 issues), 1965 (12 issues), 1967 (12 issues), September 1960, December 1969.  
 (c) Virtually complete set of Quarterly J.L. Roy. Met. Soc. 1946-1977 inclusive.  
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### Conference Announcement

## INTERNATIONAL CONFERENCE ON THE CIRCLES EFFECT

A one-day international conference on this important new research discipline has been organized for Saturday 23rd June 1990, at Oxford Polytechnic, Headington, Oxford, starting at 10.30 a.m. (registration from 9.30 a.m.). The conference is intended for those who are genuinely interested by the meteorological aspects of the subject, and the proceedings will be published as a booklet entitled *Circles Research 1*. People wishing to attend the conference are invited to request details from Dr Derek Elsom, TORRO Research Centre, Oxford Polytechnic, Headington, Oxford, OX3 0BP, England.

### DAILY WEATHER SUMMARY

The charts of the Daily Weather Summary issued by the London Weather Centre comprise the following:

*Surface isobaric charts for western Europe for 0600, 1200, 1800, 2400 GMT, including frontal analysis and a simple weather description for many stations on the chart. The 1200 GMT chart extends across the whole North Atlantic.*

*Selected plotted observations from U.K. stations for 0600, 1200, 1800, 2400 with full coverage of 'significant weather' (e.g. thunder, snow, fog, gales, heavy rain).*

*Maps of daily minimum and maximum temperatures, rainfall and sunshine for places throughout the U.K.*

*A plain-language weather summary (about 100 words) of each day's weather, and a list of the daily 'extremes'.*

*An upper-air chart for 1200 (500mb, and 1,000-500mb thickness).*

*A copy of a satellite picture showing cloud patterns around the U.K.*

There is also a monthly weather summary based on the daily summary, and this includes mean pressure maps for the three ten-(or eleven) day periods in the month, and tables and maps of the mean monthly weather. Sample copies and subscription rates, which are especially favourable for customers taking out annual subscriptions, are available on application to the London Weather Centre, 284 High Holborn, London WC1V 7HX.

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Tornado funnel cloud, Chedgrave, Norfolk, 13 April 1989  
(Mrs. Cynthia Gibling)

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