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The meteorological background to the fall of Saharan dust, November 1984

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Summary

This paper reviews the meteorological background to the Saharan dustfall of 9 November 1984 in Britain. A comparison with the published evidence for earlier falls shows this most recent event to have been unusual in its association with a quasi-stationary low pressure system. All earlier documented dustfalls have been a result of dust transportation within anticyclonic circulations.

1. Introduction

The fall of Saharan dust over eastern Britain on 9 and 10 November 1984 was one of the most notable of several such events during recent years. Since a fall in July 1968 others in Britain have been documented for 1977, 1979 (2), 1981 and 1983, but none appear to have compared with the dramatic events of February 1903 so well described by Mill and Lempfert (1904) from whose report it is clear that the opening years of the twentieth century were marked by frequent and spectacular dustfalls over wide areas of Europe north of the Alps from Britain eastwards to Austria. It is hard to believe that 65 years should separate two such clearly defined periods of activity with, as far as can be determined, no single intervening major occurrence. But if such a situation is indeed the case then some pertinent questions might be asked regarding the peculiar timing and circumstances of these groups of events.

2. Dustfalls and anticyclones

In all researched cases both mineralogical and meteorological evidence suggest a Saharan origin for the dust. In some instances possible sources have been identified far towards the south of the Sahara Desert. Tullett (1978), in describing the 1977 dustfall, persuasively argues for a source region south of the Ahaggar Mountains on a latitude of approximately 21° N. But even more northerly sources would still require journeys of several hundreds of kilometres in order to reach the latitude of northern Europe. And in this connection it should be noted that dustfalls are by no means restricted to the southern regions of Britain; they are common in Ireland (Tullett 1978, 1980, 1984; O'Connor 1980 and George 1981), not unknown in northern England (Pitty 1968; Pringle and Bain 1981) and observed even as far north as Skye (Bain and Tait 1977).

For such journeys to be completed without dispersal and total disruption of the dust cloud some form of persistent or slow-moving pressure system is required, yet with winds strong enough in the middle levels of the troposphere to carry the material great distances in atmospheric suspension. These conditions are most often encountered in the vicinity of anticyclones which, though mobile, tend to move more sluggishly when compared to the majority of their low-pressure counterparts. Conversely, the strong wind fields within depressions would tend to dissipate the dust through the atmosphere whilst the greater likelihood of rain would lead to washout of any material in suspension. Carlson and Prospero (1972) have already indicated the importance of anticyclonic conditions for the movement of dust westwards across the North Atlantic towards the Caribbean from African source regions. Indeed they found such activity to be concentrated into the summer and equinoctial seasons when the Azores anticyclone is at its most intense.

Further support for the anticyclonic hypothesis of dust transport is found in the accumulated evidence gathered this century in Britain. A summary of this information is given in Table I where, for documented dustfalls before 1984, the dependence on anticyclonic systems is complete. The centres of these extensive systems were all located over western Europe, especially France, and provided an arc of clockwise airflow from north Africa, across the eastern Atlantic, to approach the British Isles from the south-west. Some of the anticyclones listed in Table I were stationary during the transport of the dust; as, for example, in 1968 and 1977 with pressure centres over south-west and northern France respectively. Nevertheless, movement of the pressure systems may occur sometimes over great distances without apparently dispersing the dust clouds contained within their circulations. In November 1979 the anticyclone centre moved from northern France southwards to eastern Spain. More notable movements took place in 1981 and 1983 when the respective pressure centres both drifted from the region of southern England as far eastwards as Austria during the time of the dust cloud's movement from Africa to England. Bearing in mind the seasonality found in Carlson and Prospero's (1972) study the lack of seasonal preference in this admittedly small sample is noteworthy.

Table I. *Table of dates of dustfalls recorded in Britain. The central position of the controlling anticyclones are also given together with any change taking place during the movement of the dust within their circulations. The data are abstracted from contemporary maps and sources cited in the text.*

Date(s) of dustfall	Location of anticyclonic centre
21–22 February 1903	Northern France – eastern Spain
1 July 1968	South-west France
6 March 1977	Northern France
15 May 1979	Eastern France – Austria
28–29 November 1979	Eastern France – northern Spain
28–29 January 1981	English Channel – Austria
29 September 1983	Southern England – Austria

The influence of low-pressure systems appears to have been in every sense peripheral, their principal function being either to steepen pressure gradients around the anticyclones, thereby hastening the passage of the dust in the stronger winds, or to create conditions of rainfall in which the dust can be washed out of the atmosphere. However, the dust may not have an entirely passive role to play in these matters. Pitty (1968) has shown, and the present author more recently confirmed (Wheeler, in press), that while the median particle size of the dust is 9 μm the size of the majority of particles is less than 3 μm. No precise figures of atmospheric dust loadings are available for British falls, but it is clear from published sources that the total weights should be considered in terms of several millions of tonnes; Mill and Lempfert (1904) suggest 10 000 000 tonnes for the 1903 fall.

The presence of unusual concentrations of fine material in the atmosphere could have a profound effect on cloud formation and rainfall, particularly if the material were to behave as freezing and condension nuclei. Most dust material in this small size range consists of aluminosilicate (clay) particles of which the illite groups are common. The precise hygroscopic character of these minerals will determine their cloud- and rain-forming potential but, assuming them to have no disadvantage in that respect, the problem is not unlike that faced by cloud-seeders; a greater number of freeezing nuclei will enhance rainfall potential, but an over-abundance and the consequent competition for the finite volumes of water may not permit cloud droplet growth to a size sufficient for rainfall to occur. Only the dustfall of 1968 (Stevenson 1969) was accompanied by heavy rainfall. On the other hand, 'dry' dustfalls are not unknown, the best example being that of 1903 when huge volumes of dust fell with no simultaneous rainfall. In more northerly regions of Britain where rain was recorded there was, conversely, no dust. George (1981) has noted a more recent, though less intense, dry dustfall in January 1981. Light or moderate rainfalls are the most probable accompaniment, with the dust coming to earth within the raindrops either as nuclei or acquired by collision. But the possibility of dry dust descent coincident with the falling rain cannot be excluded although it might be difficult to detect.

3. The dustfall of 1984

A number of attempts, generally assuming isentropic motion, have been made to reconstruct the trajectories of dust clouds (Mill and Lempfert 1904; Stevenson 1969; Tullett 1978, 1980; Pringle and Bain 1981). Using these data Fig. 1 was prepared. The trend of the inferred movements reveals a

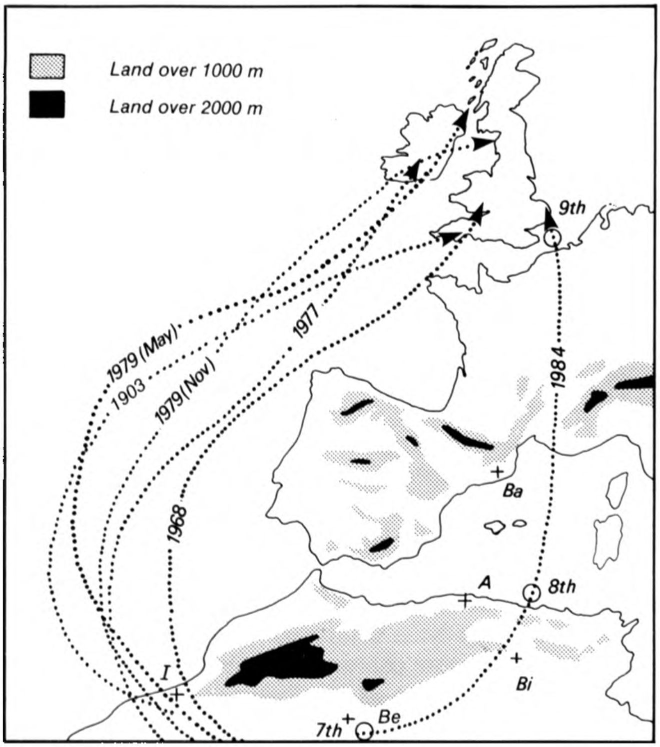


Figure 1. Summary map of Saharan dust cloud trajectories. The evidence of dustfalls before 1984 was obtained from items cited in the text. Place name key: Ba — Barcelona, Be — Béchar, Bi — Biskra, I — Ifni.

consistent pattern very much in accord with the airflows that might be interpreted from Table I. Such a concentration of pathways goes far to explain the relatively high incidence of dustfalls in Ireland and south and west England. But east coast falls are not unknown as Pitty's (1968) study shows. Nevertheless, the fact that the fall of November 1984 was so intense and localized to eastern districts suggested immediately that something unusual had taken place.

The reported intensities of the dustfalls showed south-east England to be most seriously affected with levels of activity decreasing northwards towards the Scottish border, although the author has received a report from as far north as Aberdeen (Dr D. C. Bain, Macaulay Institute, personal communication). An analysis of both the mineralogy and particle-size distribution of the material has shown it to be remarkably consistent with earlier falls and to support the theory of a Saharan, and certainly arid, source region (Wheeler, in press). The principal contrast is meteorological. Bearing in mind the established links between anticyclonic systems and British dustfalls this most recent event stands out by its association with a low-pressure system.

An almost stationary low lay over the Bay of Biscay as early as 5 November but extended both northwards and southwards on the 8th into a more complex and latitudinally elongated feature (Fig. 2). Along its eastern flanks a deep southerly airflow persisted until the system finally degenerated *in situ* on the 10th giving more than sufficient time for the dust to accomplish its long journey from north Africa to Britain.

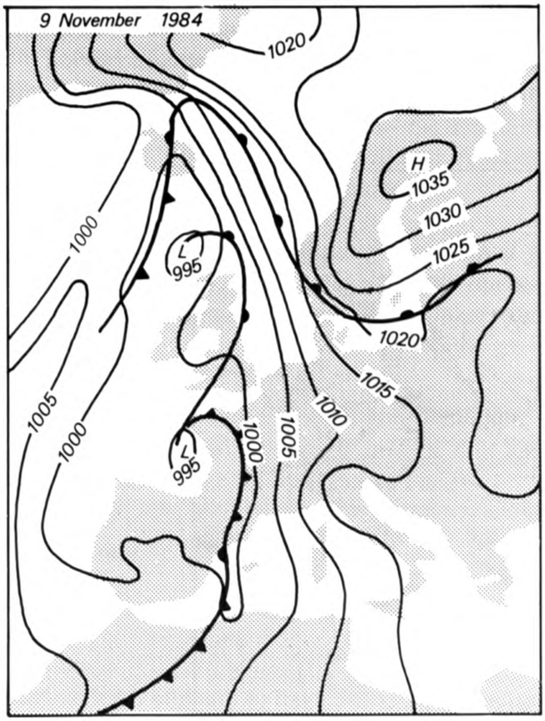


Figure 2. European synoptic chart for 1200 GMT on 9 November 1984.

The mechanism for introducing the dust into the atmosphere can only have been by dust storms through their associated turbulence. The information contained in the European Meteorological Bulletin was used to determine the possibility of any dust storms over north Africa in the days preceding

9 November. Meteorological stations are inevitably scarce in that inhospitable region but a general impression of conditions at the time can be reconstructed from the few data available.

The record for the Algerian station at Béchar (31° 37′N, 2° 14′W — see also Fig. 1) is most informative. Dust, in suspension but not raised by local winds, was reported at 1200 GMT on 6, 7 and 8 November. Meanwhile dust, this time due to local winds, was reported at 1200 on 5th and at 0000 on 7, 8 and 9 November. The last record was the final one during that spell of disturbed weather. Biskra (34° 48′N, 5° 44′E), some 600 km to the north-east but also south of the main Atlas mountain ranges, recorded locally-derived dust at 1200 GMT on the 9th. Perhaps most important, no other Saharan stations made any similar reports. Tamanrasset (22° 47′N, 5° 31′E) in the Ahaggar mountains, In Salah (27° 12′N, 2° 28′E) and Agadès (16° 58′N, 7° 59′E) all to the south of Béchar and more firmly within the Saharan domain remained seemingly unaffected. Other dust reports are far scattered. One was from the Niger valley east of Timbuktu where the river swings in its great penetrating curve into the southern Sahara. This appeared on the returns for 0000 GMT on 8 November and may have no strong connection with events on the opposite northern side of the Sahara. A further dust storm report was made from Ifni (on the Moroccan coast) at 1200 GMT on 8 November.

Two further reports, but of non-locally raised dust, are worth noting; they are for Algiers at 0000 GMT on 9 November and Barcelona at 1200 on the 8th. The latter is especially interesting and may represent a confirmed European sighting of the dust cloud on its northwards passage to Britain. If so, it remains the only such report until the eventual fall of the dust in northern Europe. The local winds at the time were east by south and could therefore have been drawing in air from a major dust concentration to the east.

On the basis of this evidence dust storms appear to have been localized within a possibly large area immediately to the south of the Atlas mountains which included within its limits the town of Béchar. From this source area the dust found its way towards Britain.

The surface isobars shown in Fig. 2 quickly convey the suggestion of a possible pathway for the dust cloud. But middle and upper troposphere winds provide a more reliable impression. Fig. 3 shows the 500 and 700 mb surfaces over the probably critical period between 7 and 9 November and both confirm the preliminary inference drawn from the surface charts, namely that the dust moved northwards along the low's eastern flanks. Starting from the north Saharan source region, the subsequent path involved negotiating the Atlas mountains, crossing the western Mediterranean, France and Belgium before reaching Britain. This trajectory is shown in Fig. 1 in which its distinctive character stands out clearly. The reconstruction is based on geostrophic wind patterns between 500 and 700 mb.

Both Stevenson (1969) and Tullett (1978) have presented good evidence for dust sources in the central Saharan regions in their respective studies of British dustfalls. In this case such southerly sources are improbable and a more northerly Saharan region is favoured. The geographical spread of the dust storms and the west to east geostrophic winds over the Sahara support this hypothesis even allowing for the incomplete nature of the evidence.

Isentropic analysis has not been attempted. Petterssen (1940) asserts that isentropic contours are often parallel to nearby fronts from which their orientations may be inferred. Given, therefore, the north to south alignment of the fronts within the low-pressure system no great differences between isobaric and isentropic trajectories were anticipated.

The dust storms were active over a period of several days between 5 and 9 November. The difficulty of not knowing the exact date on which the dust that reached Britain started on its journey can be tentatively resolved by examining wind speeds along the proposed trajectory. By working backwards from the known arrival time, which was early on the afternoon of 9 November in south-east England, some of the imprecision can be removed. Table II lists the average wind speeds at different levels over the period from 7 to 9 November. Although winds were increasing slowly throughout this time the

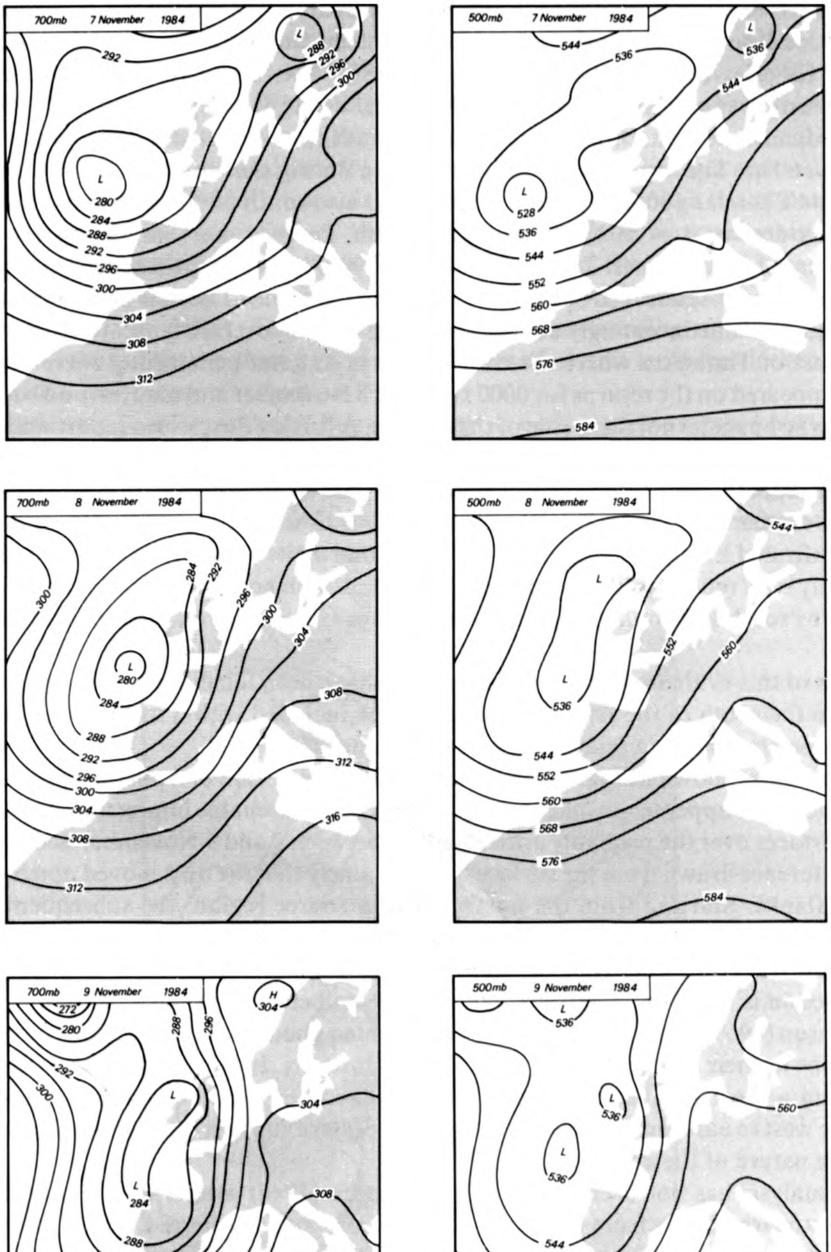


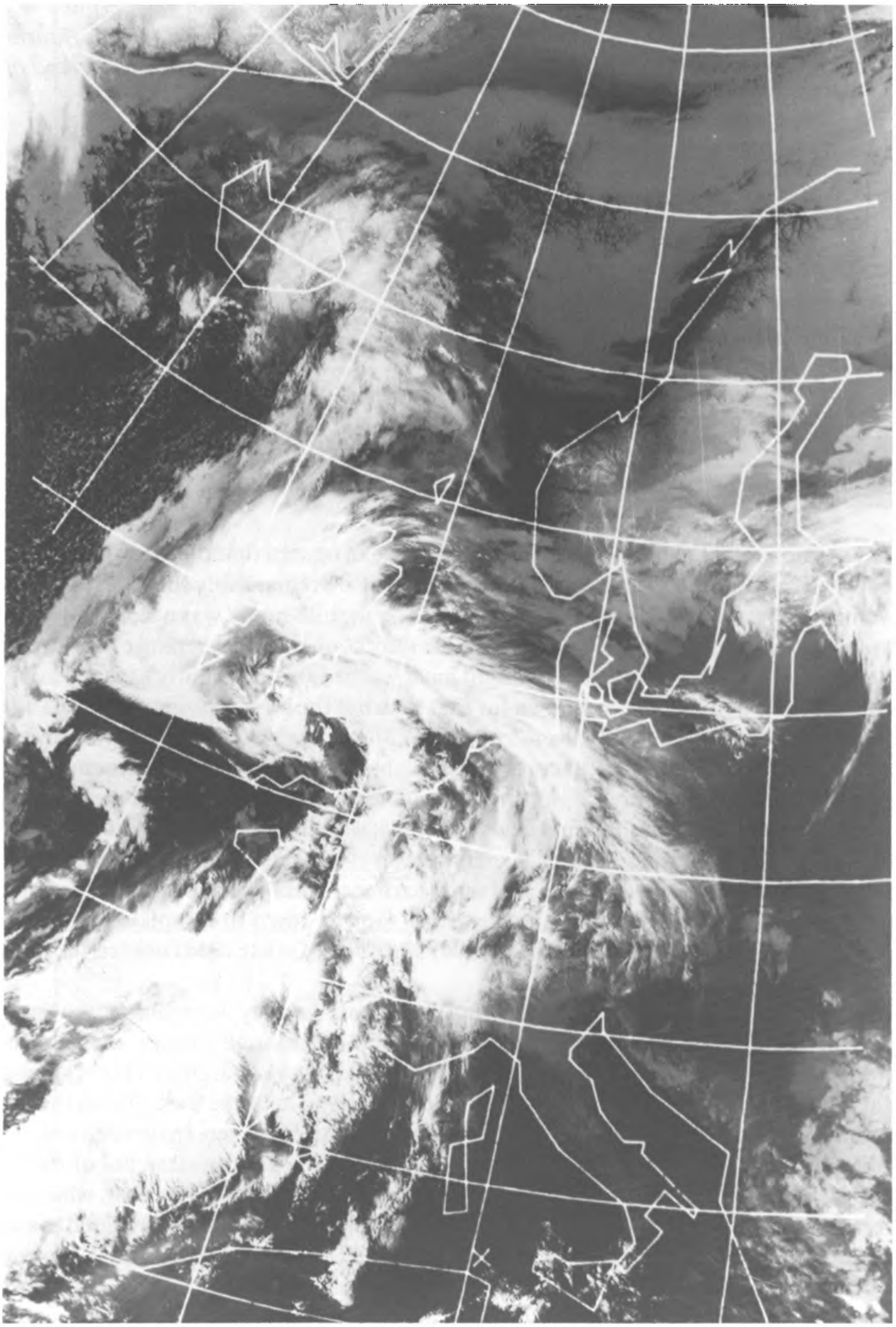
Figure 3. Compilation figure for the 500 mb and 700 mb surfaces at 0000 GMT on 7, 8 and 9 November 1984. The contours are marked in geopotential decametres.

Table II. *Average wind speeds (in knots) at different pressure levels over the period 7–9 November 1984 along the supposed trajectory of Saharan dust. The time taken to complete the journey is based on the average speed and a distance between the source region and south-east England of 2600 km. Data source: European Meteorological Bulletin.*

	Pressure altitude (mb)				
Date	1000	850	700	500	300
7 November	12	24	31	35	50
8 November	12	31	31	34	50
9 November	10	34	38	43	50
Mean	12	29	33	37	50
Time (hours)	116	46	43	36	27

day-to-day variation was slight. Using this information it can be seen that the times required to cover the 2600 km between the source region and south-east England are remarkably short. Assuming, initially at least, movement at between 500 and 700 mb a time of less than 48 hours was needed. On that reasoning the dust would have started its passage during the late afternoon or early evening of the 7th. If, however, some of the dust travelled at a higher level it might have reached Britain as early as the evening of the 8th. No confirmed reports of dustfalls are known for that time but the observations made by Thomas (1985) leave the possibility open. Conversely the movement of dust at high level would have allowed even later start times. In view of the developing configuration shown in Fig. 3 and the manner in which the apparent connection between source region and Britain becomes clearer towards the 9th this possibility should remain in contention. Dust, it should be remembered, was still crossing the Algiers area at 0000 GMT on the 9th. Whatever the precise timings of events were it is clear that the dust's movement was extremely rapid and in complete contrast with the record from earlier events. The dustfall of March 1977 (Tullett 1978), although originating in central Saharan regions, took five days to complete its marginally longer journey. The dust of 1903 (Mill and Lempfert 1904) and 1983 (Tullett 1984) needed four days to reach Britain.

Despite the speed with which the dust moved in 1984 its route was by no means as unobstructed as the oceanic pathway more commonly followed. The Atlas mountains, Pyrenees and Alps combine to present a formidable barrier to low-level northwards movement of Saharan air (Fig. 1) and could exert influence at higher levels. The Atlas mountains rise to over 3900 m in the west, but to the north-east of Béchar they decline to a more modest 2100 m, while to the south of Algiers they reach only 1600 m. The winds implied in Fig. 3 provided a convenient passage over these eastern stretches of the Atlas range. Once into the Mediterranean basin the route is unimpeded as far as the French coast, which was possibly crossed over the area around the Rhone delta. Here the Alps and Pyrenees are avoided to east and west respectively as the winds draw the dust northwards over the Rhone valley. The Massif Central lies along this route but reaching only 2100 m is unlikely to have caused much disturbance. Thereafter northern France, Belgium and Holland offer no obstacles. The trajectory hypothesized in Fig. 1 is based on the pattern of geostrophic winds. However, it also has the distinct advantage of avoiding the high ground between Britain and Africa and therefore strengthens the arguments in its favour. Evidence of dustfalls on the 9th in Belgium also supports the detailed reconstruction.



Photograph by courtesy of University of Dundee

Figure 4. NOAA-7 infra-red image taken at 1453 GMT on 8 November 1984 showing what might be the Saharan dust cloud stretching northwards over the western Mediterranean from the Algerian coast towards southern France.

4. Conclusions

The evidence offered above provides a consistent impression of the circumstances surrounding the dustfall of November 1984. The detailed pattern of the hypothesized trajectory is not in perfect accord with the character of the upper winds but the agreement is close enough not to cast any serious doubt on the issue. Unfortunately the degree of cloud cover during the events makes visual identification and confirmation of the trajectory from satellite images impossible. Nevertheless, Fig. 4, taken on 8 November, reveals what could be the dust over an otherwise clear western central Mediterranean. If this interpretation is correct it gives further substance to the arguments put forward in this paper.

It would appear, finally, that anticyclonic systems, despite the weight of earlier evidence, do not enjoy a monopoly in transporting airborne material over great distances. Given the correct circumstances low-pressure systems appear to be equally capable of accomplishing this task.

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Unusual wave clouds over northern Scotland

By J. N. Ricketts
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Summary
On 19 February 1984, wave clouds were generated at a considerable height over the Grampian Highlands of Scotland, showing up clearly on infra-red satellite pictures. In this article, the appearance of the wave clouds and accompanying low-level rotor effects at a station in the lee of the mountains in described. The radiosonde ascent considered representative of the airmass producing the wave motion is examined and theoretical consideration is given to the likelihood that wave enhancement occurred as a result of interaction between the original wavelength generated and the separation between downstream ridges.

Introduction

Wave-type clouds occur relatively frequently over Scotland and are only mentioned in the remarks columns of observations books if they are spectacular or are in some way unusual. Sunday 19 February 1984 provided a display which fell into both categories. The clouds were evident long before daylight since they formed at high levels and could be clearly seen on the NOAA-7 infra-red satellite picture taken at 0345 GMT (Fig. 1(a)). The evolution of the cloud pattern could be followed throughout the day, until it became disorganized by the evening. Comparison of this picture with two taken at 1519 GMT (Figs 1(b), 1(c)) shows that the relative positions of the clouds changed little and none developed more than a few kilometres downwind of the coast of northern Scotland. The later pictures show 'ice-streamers' downwind of the wave clouds at higher levels. By contrast, wave development within the frontal cloud which crossed Northern Ireland and the Hebrides was more regular and extended for several hundred kilometres downstream of the point of origin.

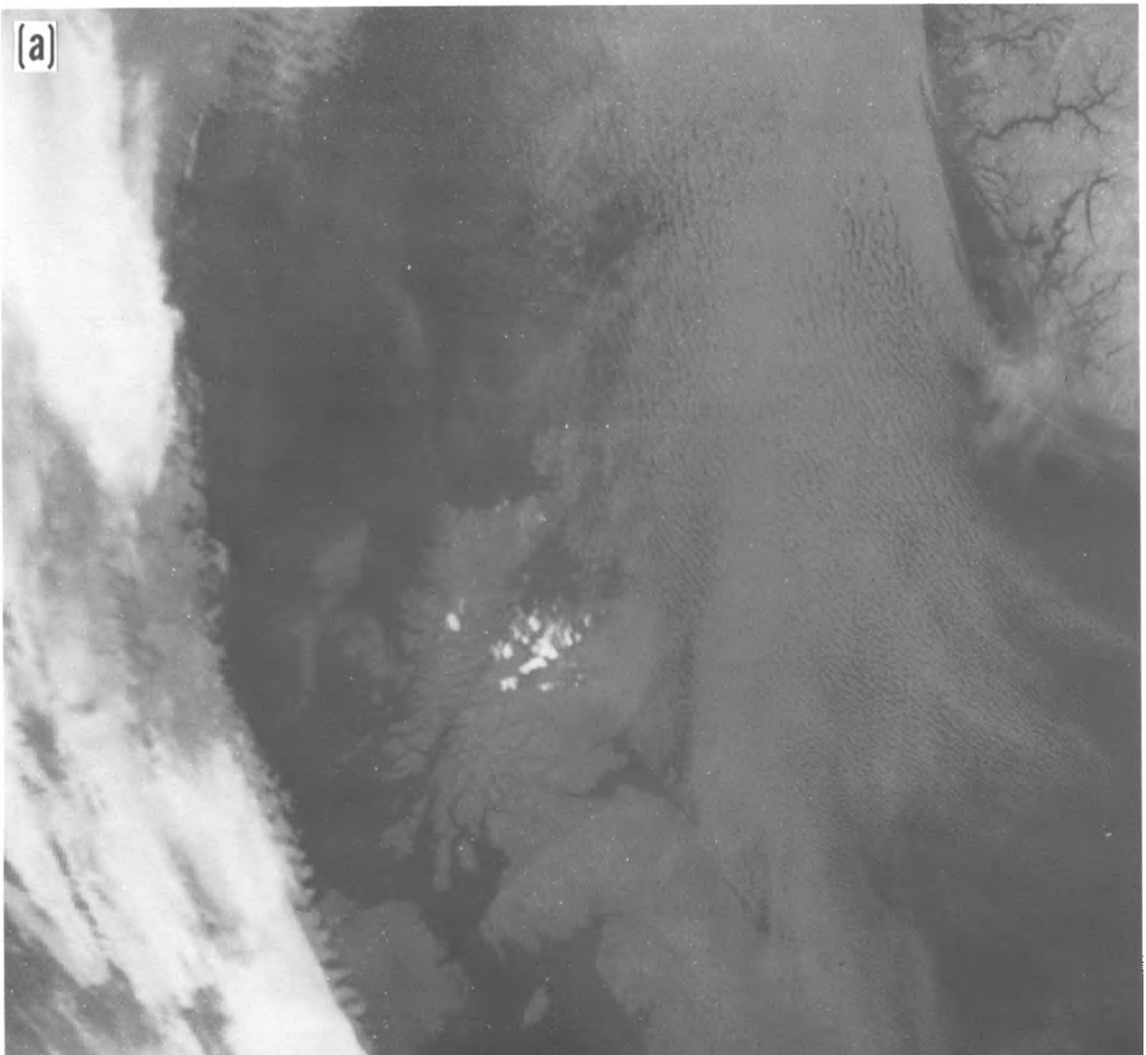
Synoptic conditions, geography and their effects

The surface synoptic charts for 0000 and 1200 GMT on 19 February over the British Isles are shown in Fig. 2. A large anticyclone over western Russia dominated the situation and the progress of the cold front across the Western Isles became slower. Gradient winds across the Grampian Mountains were 50—55 kn during the morning and early afternoon.

The Grampian Mountains are set in a series of ridges which face a little east of south, all within a broad plateau which is higher than 200 m above sea level. In the south, the ground rises steeply above Strathearn and Strathmore while the descent northwards from the Cairngorm and Monadhliath Mountains is more gentle. The distance between adjacent ridges is generally around 35—40 km.

The radiosonde station at Shanwell is situated near the coast just south of Dundee and was upwind of the Grampians on this occasion, so ascents from there would have been representative of the airmass crossing the mountains. The 00 and 12 GMT ascents are shown in Fig. 3, and the profiles of wind components from 160° at 00, 06, 12 and 18 GMT in Fig. 4. Actual wind directions were close to 160° at all levels, but slowly backed throughout the day with a gradual decrease in speed in the afternoon. The midnight ascent shows two marked inversions, whereas the midday ascent is noticeably cooler and drier below 400 mb, the higher inversion having become an isothermal.

Observations from the Meteorological Office at RAF Kinloss indicate the effects of the synoptic conditions from a position to the lee of the mountains. The anemograph trace (Fig. 5) shows frequent large changes in wind speed, particularly in the afternoon, and occasional wild fluctuations in direction. These wind variations are associated with rotors reaching the surface. Another characteristic of rotors is



Photograph by courtesy of University of Dundee

Figure 1(a). NOAA-7 infra-red image, 0345 GMT 19 February 1984.

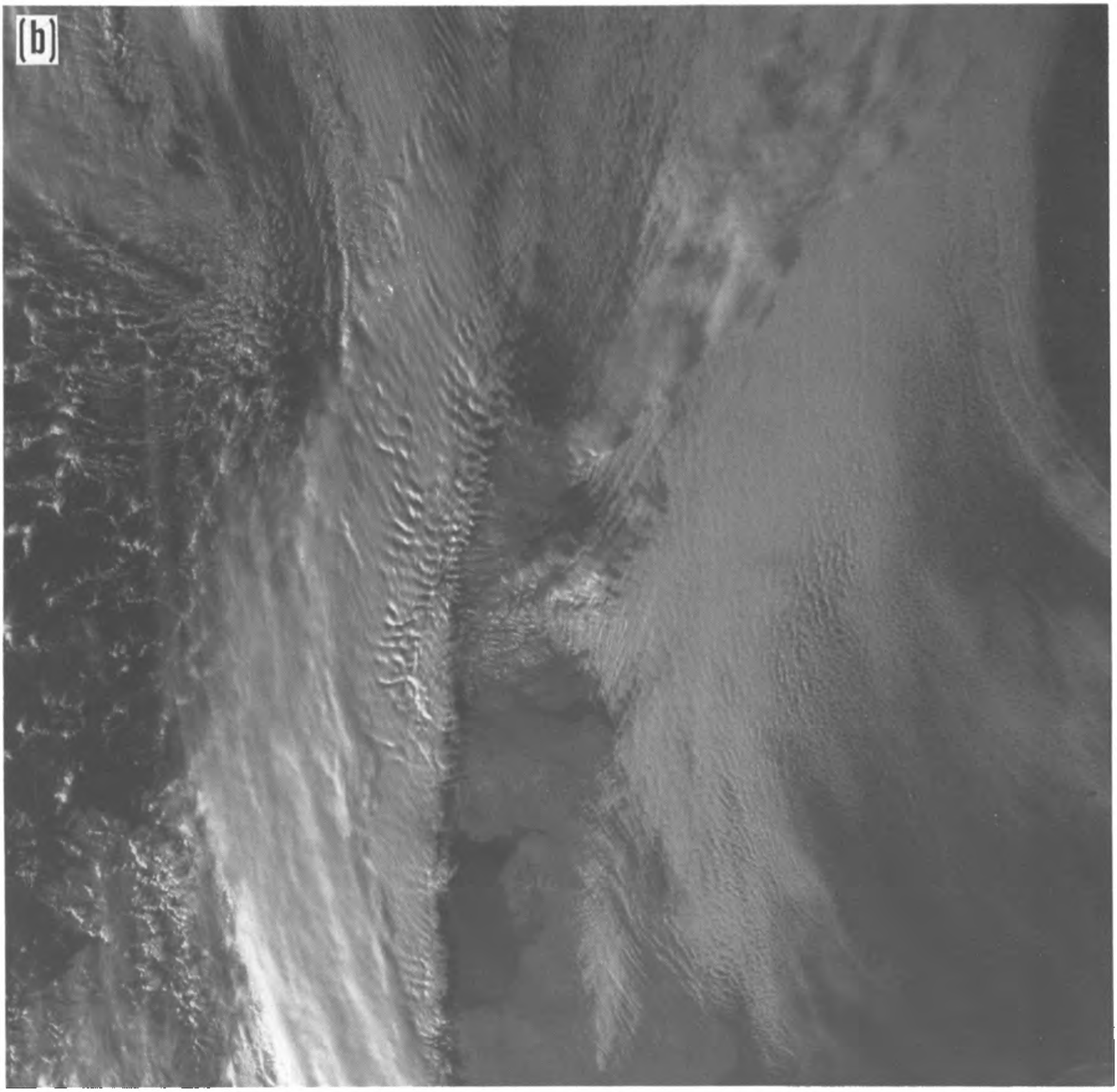


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Figure 1(b). NOAA-7 visible image, 1519 GMT 19 February 1984.

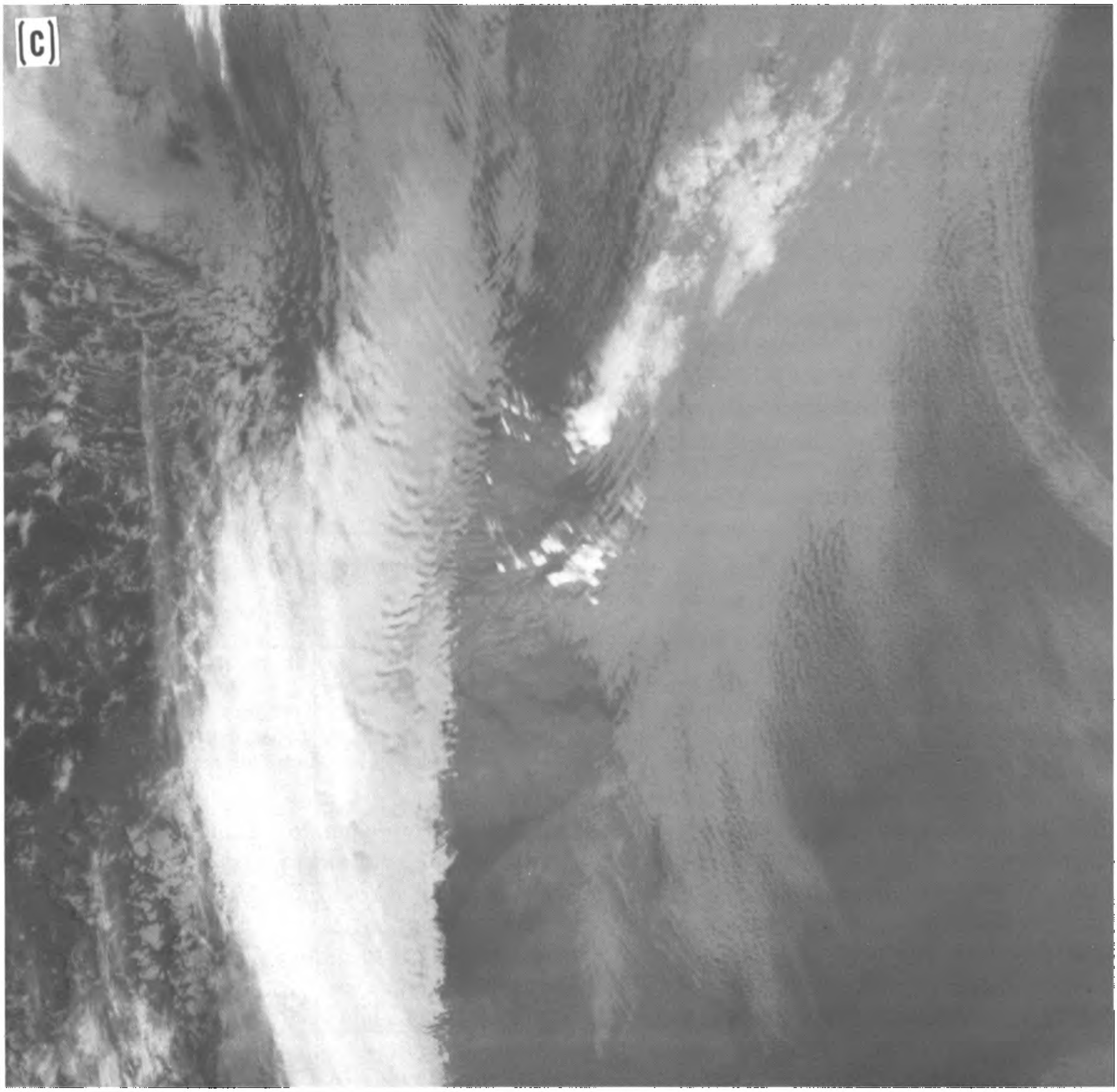

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Figure 1(c). NOAA-7 infra-red image corresponding to Fig. 1(b).

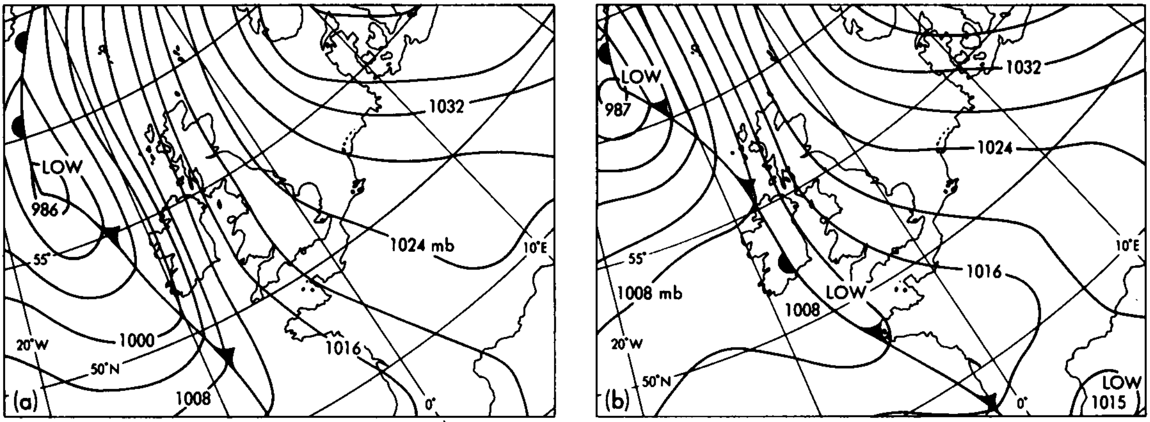

Figure 2. Surface synoptic situation on 19 February 1984 (a) at 00 GMT, (b) at 12 GMT.

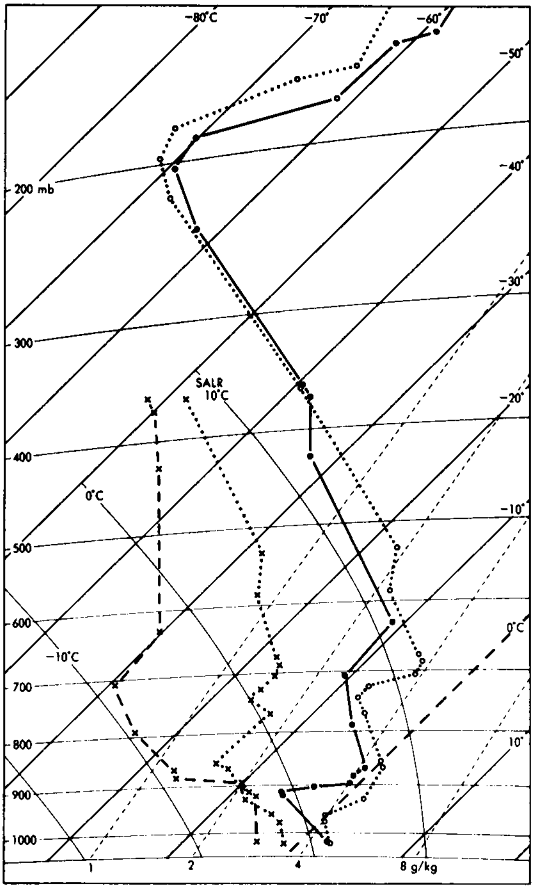

Figure 3. Radiosonde ascents made at Shanwell on 19 February 1984: the dotted lines show the 00 GMT ascent, and the solid and dashed lines the 12 GMT ascent.

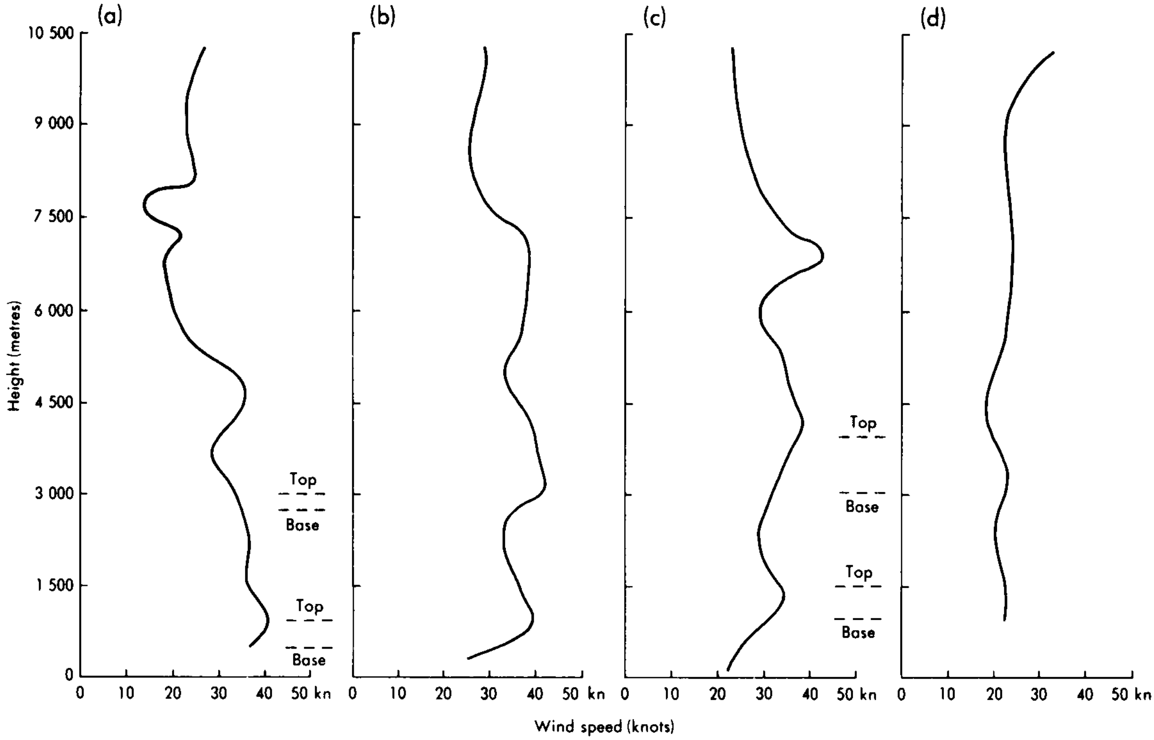

Figure 4. Wind profiles from 160° at Shanwell on 19 February 1984: (a) 00 GMT, (b) 06 GMT, (c) 12 GMT and (d) 18 GMT. The base and top of inversions are indicated on the midnight and midday ascents.

indicated in the remarks column opposite the 1100 GMT observation with the note 'wind on east side of airfield much stronger... (mean 20–25 kn?)'. The mean wind speed reported at the office was 14 kn. The conditions were also responsible for significant fluctuations in the barograph record.

Rotor clouds were evident for much of the day, appearing like cumulus which drifted slowly northwards before dissipating over the Moray Firth. Wave clouds were reported as altocumulus lenticularis with estimated base ranging from 3600 m (12 000 ft) to 4800 m (16 000 ft) and were described as 'well developed' at the 0900 and 1300 GMT observations. The 1400 GMT observation made mention of rotor cumulus, strong mock suns and 'lenticular cloud... at cirrus levels...'. Further remarks mentioned lenticular cloud to the south-west and the west, which is consistent with the satellite pictures. Also, a crew member from an aircraft which had landed at about 1330 GMT came in to the meteorological office to report that the cloud tops were 8400 m (28 000 ft) but wave motion was detectable in clear air up to 10 500 m (35 000 ft).

Theoretical discussion

Observational and theoretical studies have shown that when the air mass is stable a strong wind in a direction approximately normal to a long ridge is likely to produce wave motion over and to the lee of the ridge. Should there be further ridges beyond, the character of the wave motion will also be affected by them, depending on whether the atmospheric wavelength is in phase or out of phase with the separation between the ridges. Wave clouds may also be associated with conditionally unstable air overlying stable air of considerable depth (World Meteorological Organization 1960). This is broadly

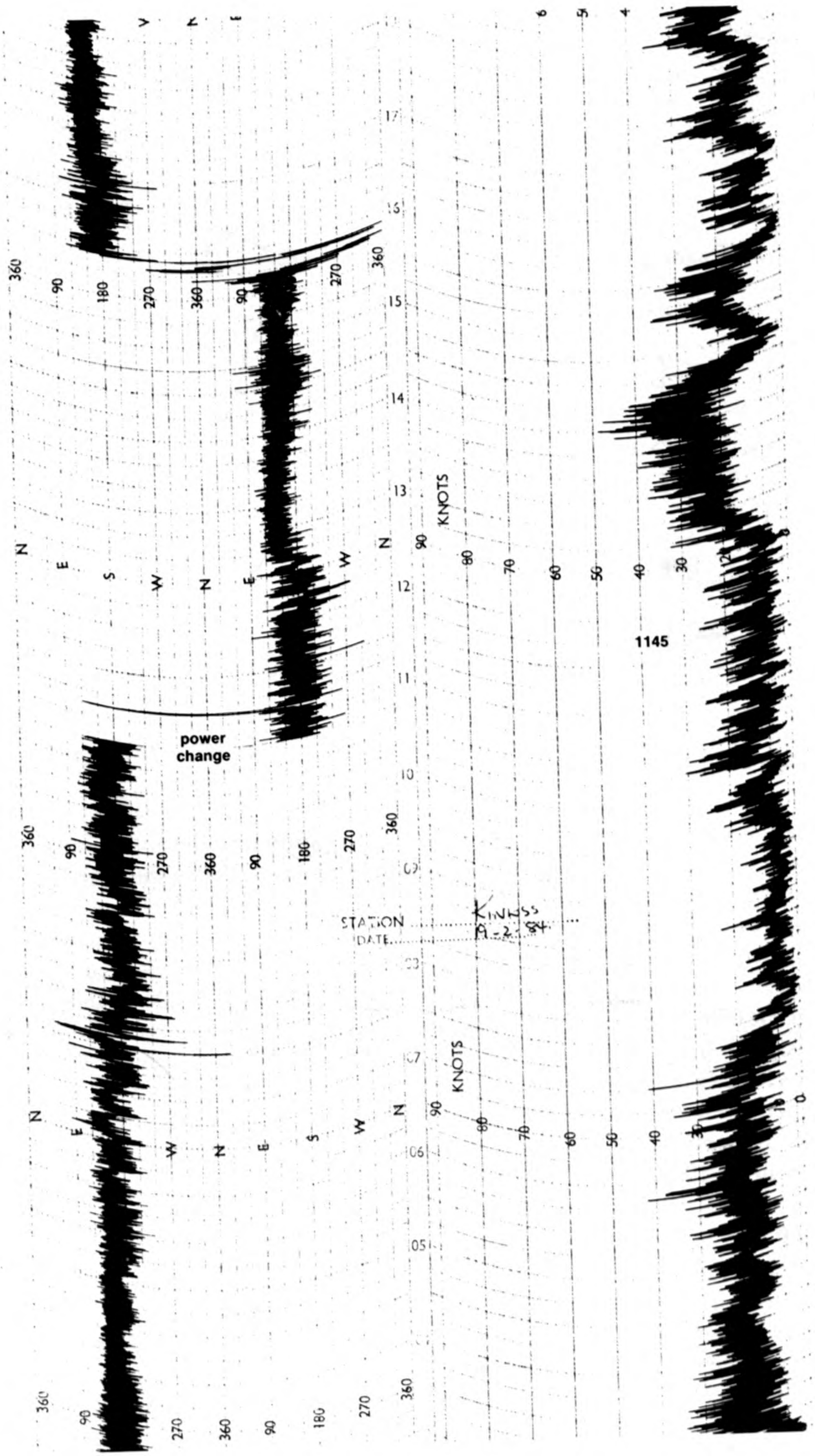

Figure 5. Anemograph trace from Kinloss, 03 to 18 GMT 19 February 1984, showing fluctuations in wind speed and direction associated with rotor effects.

shown by the midnight ascent at Shanwell. Lifting in the upper layers could lead to condensation at approximately 4200 m (14 000 ft), although above this level condensation is possible to a considerable height given sufficient vertical displacement. The midday ascent appears considerably less favourable for wave development.

A relatively simple if basic method of calculating the wavelength produced is given by Casswell (1966). Two sets of waves may sometimes be generated, depending on the depth of atmosphere that is favourable. Using the data from the Shanwell ascent for midnight on 19 February, the calculated wavelengths of the primary and secondary waves are given in Table I. Both values are approximate multiples of the distance between the ridges, and consequently wave enhancement might be expected. The wavelengths calculated from the midday Shanwell data are also given in Table I and in this case the secondary wavelength is out of phase with the ridge separation. This could explain why the higher level wave clouds tended to become more diffuse during the day. The vertical velocity values are appreciable if not extreme while the heights at which they occur are such that the maximum for the primary wave is within the higher inversion at midnight (although not at midday) and the maximum for the secondary wave is at the reported height of the cirrus clouds.

Table I. *Calculated wavelengths and vertical velocities in mountain waves — from Shanwell ascents on 19 February 1984*

	Primary waves			Secondary waves		
Ascent	Wavelength km	Maximum vertical velocity $m\,s^{-1}$	Height of maximum km	Wavelength km	Maximum vertical velocity $m\,s^{-1}$	Height of maximum km
00 GMT	9.3	5	2.8	12.5	3	7.5
12 GMT	9.2	6	2.4	15.5	7	7.5

Turbulent conditions and comparison with a similar synoptic event

Surprisingly, there were no reports of low-level turbulence from aircraft operating in the vicinity. By contrast, there were several reports the following day when conditions were not favourable for wave development and low-level winds were rather less strong.

It is interesting to compare this occasion with a similar synoptic situation on 21/22 January 1984. No wave clouds developed and examination of the Shanwell wind profiles from 1800 GMT on the 21st to 0600 GMT on the 22nd showed a marked wind veer above 3000 m (10 000 ft), which prevented wave development above that level.

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The Meteorological Office at Stonehouse 1939–45

By R.P.W. Lewis
(Meteorological Office, Bracknell)

Summary

An account is given of the move of the Climatological, Instrument, and Marine Divisions to the buildings of Wycliffe College at Stonehouse, Gloucestershire after the declaration of war in 1939. Reminiscences of official and leisure activities have been provided by several retired members of Meteorological Office staff who worked there between 1939 and 1945.

Introduction

Although certain aspects of the work of the Meteorological Office during the Second World War have been described in print, for example by Bilham (1947) and Scrase (1947), there exists no general account which gives due place to social upheavals and personal reminiscence. The official history (hereafter referred to as OH), issued as a classified document in 1954 by the Air Historical Branch of the Air Ministry and declassified only in 1975, although it contains much valuable information, is in many respects very dull to read. For example, the conventional anonymity of civil servants is rigidly preserved so that the only actual name to appear is that of Sir George Simpson who came back from retirement to look after the Observatories.

Various aspects of the move of the Climatological, Marine and Instruments Division of the Office to Stonehouse in November 1939, and the work that they did, are described in OH, but the accounts are scattered throughout the volume and no idea is given of the conditions of working of the staff and how they entertained themselves during the period of nearly six years that they were there; the present article is an attempt to fill this gap, at least partially. The author could not have written it had it not been for the readiness of many of the surviving wartime exiles to search their memories and put pen to paper. The chief regret is that all those who occupied senior positions at Stonehouse are no longer alive — Dr Goldie, Dr Scrase, Dr Glasspoole, Dr Brooks; they, no doubt, could have said much about their administrative worries and the fight to obtain adequate shares of scarce resources of manpower and equipment. For example, a file preserved in the Public Record Office demonstrates how Dr Scrase could not afford to divert staff to make the inventory checks demanded by the auditors because that would have meant failing to get the equipment to where it was urgently needed by Meteorological Office units in the battle zones.

Historical background

During the 1930s, the growing menace of the Fascist and Nazi dictatorships became more and more apparent and by 1936 a program of rearmament was embarked on by the United Kingdom Government, including of course an expansion of the Royal Air Force which would in its turn require increased meteorological support. The Meteorological Office began to grow and, for the first time, systematic training was given to new entrants. By 1938, thought was also being given to wartime dispersal of the Meteorological Office to a location or locations in the provinces, and initial planning was put in hand for a move of the Central Forecasting Office and telecommunications centre from Victory House, Kingsway to Dunstable, Bedfordshire, and of the rest of the HQ establishment from South Kensington to Southport. Early in 1939, the proposed site for South Kensington staff was changed to Tetbury, in Gloucestershire, but in the event the final choice fell on the buildings of Wycliffe College at Stonehouse, near Stroud (OH p. 31).

The move to Stonehouse

Wycliffe College is a Public School for boys founded in 1882 — though today some girls are taken as well — and the first intimation received by the Headmaster of the Government's decision to requisition his buildings in the event of war was contained in a letter from the Ministry of Works marked 'Very Secret' and delivered to him on Christmas morning, 1938 — probably the most unwelcome present he ever had. During the next few months he made arrangements for the accommodation of his school at St David's College, Lampeter, and on 7 September 1939, a few days after war had been declared, Air Ministry officials arrived at Stonehouse with a writ requisitioning all the school buildings save one or two occupied by the junior departments. The school was not to return until the war was over.

Meanwhile, Meteorological Office staff at South Kensington were told that they were going to be moved well away from London, but the exact destination was kept secret. During October and November, Commander Hennessey of the Marine Branch at Victory House visited the Stonehouse area with one or two colleagues to arrange emergency accommodation. Staff were told to have a bag packed ready for a move, and the books in the Library were all put into crates and boxes, the provision of which had been brilliantly organized by Dr Brooks (Glasspoole 1958). The move of the staff at South Kensington, and of the Marine Branch at Victory House, finally took place on 30 November, their destination being revealed only at the last minute.

Meteorological Office organization in wartime

Certain changes in the administrative structure of the Office were made following the declaration of war. On 1 September 1939, the Office was controlled by the Director (Mr N.K. Johnson, later Sir Nelson Johnson) and three Assistant Directors: ADMO I (R. Corless) in charge of M.O.1 (Marine), M.O.3 (Climatology), M.O.4 (Army and Instruments), M.O.10 (Personnel, General Services and Training School); ADMO II (E. Gold) in charge of M.O.2 (Forecasting and Civil Aviation), M.O.5 (Overseas) and M.O.6 (RAF); and ADMO III (A.H.R. Goldie) in charge of the Meteorological Office, Edinburgh and the Observatories. When war was declared, Sir George Simpson came back from retirement to take over the previous work of ADMO III, while ADMO III himself took charge of M.O.1, M.O.3 and M.O.4 (except as regards Army matters). On the move to Stonehouse, therefore, Dr Goldie was the senior officer on site, and remained so until the war was over. Subordinate to Dr Goldie were: as Marine Superintendent, Commander C.E.N. Franckom who went on active service in November 1940 being succeeded by his deputy, Commander J. Henessey; in charge of M.O.3, Dr C.E.P. Brooks; and in charge of M.O.4, Dr F.J. Scrase. In September 1939, the combined staff of M.O.1, M.O.3 and M.O.4 was a little over 100 and this increased to about 180 by 1945 (OH pp. 555–559).

Location of Branches at Stonehouse

The arrangement of the buildings of Wycliffe College, more or less as they were at the outbreak of war, is shown in Fig. 1. School House (Fig. 2) was occupied by M.O.3 (including the Library*), general administrative offices including receipt and despatch, and the kitchen and canteen. Dr Goldie was himself accommodated in School House, and occupied a room on the first floor. The Headmaster's room was for a time reserved for the Director in case he had to leave London, but was later used as an ordinary office.

Springfield (Fig. 3) was occupied by M.O.1 (including the Hollerith machines) and, at first, by M.O.4; later on, M.O.4 moved to Ryeford Hall (Fig. 4). When the new development section of M.O.4 was set up

* The Library in School House contained, it seems, only the most commonly used books and journals, the bulk of the reserve stock being located some 15 miles away in Cirencester. The room used was the 'Old Assembly Hall' which Wycliffe College themselves converted into a library in 1964.

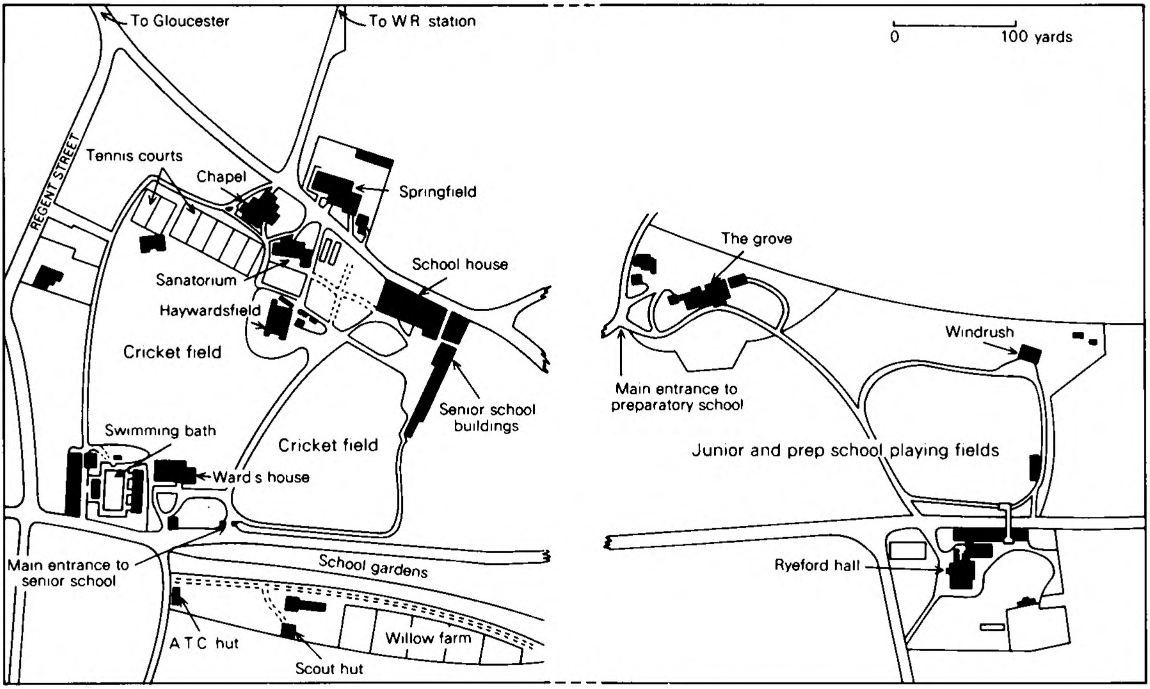
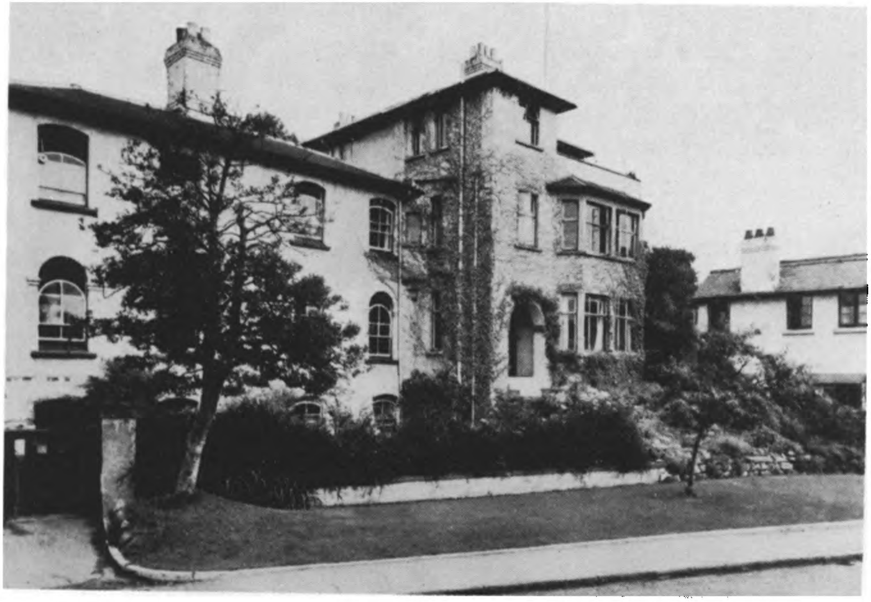


Figure 1. Location of the buildings of Wycliffe College, Stonehouse, late 1940s. (Copied by permission of the Headmaster and Governors from a plan in a school prospectus issued in 1950.)

Photograph by courtesy of the Headmaster and Governors of Wycliffe College.

Figure 2. School House, Wycliffe College.



Photograph by courtesy of the Headmaster and Governors of Wycliffe College.

Figure 3. Springfield, Wycliffe College.

Photograph by courtesy of the Headmaster and Governors of Wycliffe College.

Figure 4. Ryeford Hall, Wycliffe College.

Photograph by courtesy of the Headmaster and Governors of Wycliffe College.

Figure 5. The Science Building, Wycliffe College.

Photograph by courtesy of the Headmaster and Governors of Wycliffe College.

Figure 6. Huts erected on Wycliffe College cricket field to provide extra offices for Air Ministry staff.

as a separate unit in 1942 (to become M.O.16 some years later at Harrow) it occupied the Science Building (Fig. 5).

As well as the Meteorological Office, some Air Ministry Finance Branches were accommodated at Wycliffe; initially they occupied Ryeford Hall, later taking over Haywardsfield and the Sanatorium and also erecting a group of wooden huts on the cricket field (Fig. 6); this last development understandably horrified the school on their return in 1945.

Work

The work carried out by the staff of the various Divisions stationed at Stonehouse was in part a continuation of their pre-war activities but also, and in much greater degree, a response to wartime demands. The Climatological Division continued to collect and tabulate British climatological data and to give advice to specialist customers such as water authorities, but publication of series such as *British Rainfall* and the *Monthly Weather Report* was postponed until the war was over. Publication of the *Meteorological Magazine* ceased after the fall of France. An important part of the Division's work was the writing of Naval Handbooks on Weather dealing with the main theatres of war. The greatly increased volume of enquiries concerned with strategical planning and tactical execution of operations by the RAF and the Army caused difficulties, exacerbated by the removal of the main Library to Stonehouse, and it was found necessary to set up a special section — the Investigations Branch — at London HQ which would liaise with the RAF and Army on the one hand, and with Stonehouse and Dunstable on the other. There were regular visits by appropriate people from Stonehouse to the Naval Meteorological Branch and the new Investigations Branch (OH pp. 518–520). The Library also helped to answer questions from, and supply data to, many other Government departments, and the annual total of loans increased tenfold (OH p. 531).

The Marine Branch lost their regular supply of data from British ships, except those of the Royal Navy, on the outbreak of war because of an embargo placed by the Admiralty on the recording of positions, but liaison was maintained with merchant ships so that full reporting could be resumed as soon as conditions allowed. The main wartime work of the Branch was the preparation of climatological, sea current and ice atlases which were urgently required for operational purposes (OH pp. 531–532).

The Instruments Branch (M.O.4) had the tasks of (a) supplying meteorological equipment to the Meteorological Office, the Naval Meteorological Service and (later) to the Dominion and Allied Services as necessary, and (b) developing new equipment and instruments. The task was immense, and total annual expenditure on meteorological equipment increased nearly thirty times compared with the 1929–1933 average. The factories of many of our suppliers suffered from bombing, and the fall of France temporarily cut off the supply of high-pressure hydrogen generators, stop-watches, and fusee chain (for aneroid barometers). Over 100 varieties of radio valves were required. Stores at Stonehouse were distributed over six different buildings, and temporary marquees were also needed; there was also an emergency reserve at Cheltenham. In 1941 it was found necessary to reorganize M.O.4 by creating three sections dealing with (a) all technical aspects (b) provision of equipment and (c) storage and issue, including accounting (OH pp. 565–570). Despite all difficulties, M.O.4 seems to have met the extremely heavy demands placed upon it with a high degree of success.

The Meteorological Office staff at Stonehouse returned to London in August 1945, but not to the South Kensington office which by then was too small. Instead, they went to another Government building near the Stationery Office establishment in Harrow which remained in use by the Office until the move to Bracknell in 1961.

Social life

Despite all the difficulties of wartime and having to live far from home in strange surroundings, the Meteorological Office staff at Stonehouse were able to live a full and varied life in addition to carrying out their official tasks. After the fall of France a number of the ladies set up a National Savings group and a knitting circle under the leadership of Miss M.E. Robinson (later to be Senior Cartographer at Harrow and Bracknell). Additional funds were raised from sporting events, concerts, and even a swimming gala. Staff played active roles in such general wartime activities as 'dig for victory' on rented allotments and took their turn at 'fire watching'. Several members helped to run a local hostel for servicemen on leave or in transit, and others joined first-aid groups. Later in the war, professional recitals sponsored by CEMA (Council for the Encouragement of Music and the Arts) were given in the school assembly hall; artistes included Astra Desmond, Herbert Sumsion and Joy Boughton. (It was important to ensure that the piano was properly tuned and correctly placed on such occasions.) Amateur musicians in the Office joined local choral and orchestral societies, as well as joining together to give amateur performances in the school, and in December 1943 a pantomime was put on entitled 'The Babes in the Wood: A Nightmare' by William Thykke Phogge (i.e. W.T. Hogg), featuring 'Dirty Weather with Two Cyclones', for which the music was directed by Gale Hardblow (i.e. Geoffrey Hartley).

A good picture of the way life appeared to those members of the Meteorological Office who worked there is given by the short collection of reminiscences in Appendix 1; some biographical details of the contributors are given in Appendix 2.

Summing up

The abiding impression produced either by reading reminiscences of the staff who worked at Stonehouse or by talking to them is that their wartime 'exile' was, on the whole, a happy one. Despite the difficulties of rationing and the black-out, and — for most staff — having to live in billets, there was a feeling that everybody was working hard for a common purpose; also, what was very important, people joined together to make their own entertainment, with tennis and swimming, choral and orchestral concerts, and dramatic performances. A member of the Meteorological Office who was not himself at Stonehouse has remarked that those who had been always seemed to be talking about it. Much of the credit for this must, of course, go to the senior staff at the time, and to none more than Dr and Mrs Goldie. As regards the contribution of the Goldies to the welfare of their staff, one cannot do better than quote the words of C.E.P. Brooks in his appreciation of Mrs Goldie written after her death in 1948:

'Most of the younger members [of the branches at Stonehouse] were billeted in strange homes, and Mrs Goldie invited them to tea on Sundays, sympathized with their troubles and generally mothered them. I recall with gratitude that in an emergency the Goldies gave me a home for a week, and the same kindness was extended to visitors from London who could not find hotel accommodation. When the canteen arrangements broke down and we decided to become our own caterers, the triumphant success of the experiment was largely due to the energy which Mrs Goldie put into it, in addition to the work which she was already doing in the British Restaurant at Stroud. In all these ways, the fact that our exile in Gloucestershire was on the whole pleasant and comfortable, was largely due to the efforts of Dr and Mrs Goldie to make it so.'

As to the rightful occupants of the buildings — the staff and pupils of Wycliffe College — it is probable that they suffered more inconvenience than the meteorologists did; the Headmaster had many worries and difficulties to contend with, not the least of which was the daunting task of putting the school buildings into some sort of decent shape ready for the return to Stonehouse in 1945. The centenary history of Wycliffe College records that for '... six weeks in September and early October a dozen masters with their wives, and twice as many boys, scrubbed floors and washed walls while local builders, carpenters and decorators repaired the damage'. (Financial compensation from the Ministry of Works was, of course, obtained later.)

Perhaps we may now, after forty years, pay some public tribute to our involuntary hosts.

Acknowlegements

As well as to the retired members of our own staff whose reminiscences are reproduced, or who are otherwise mentioned in the text, I should like to express my gratitude to the present Headmaster of Wycliffe College (Mr R.C. Poulton) and to Mr S.G.H. Looseley (Headmaster from 1947 to 1967) who have provided a wealth of valuable information including maps and photographs. Other photographs and useful information have been provided by Mrs Margaret Tunnell (née Shirley), Mrs Stephanie Smith (née Hart), and Mrs Helen Goldie (née Carruthers).

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Appendix 1 — *Reminiscences supplied by former Meteorological Office staff*

The following reminiscences are reproduced from the original texts submitted by the authors with the minimum of editing such as the elimination of redundant information, or removal of tentative statements offered on the basis of hazy memories which are known on independent evidence to be incorrect.

Miss E.E. Austin

Evacuation of the staff of the South Kensington branches of the Meteorological Office in 1939

(As remembered 45 years later so the details may not be reliable)

Just before the outbreak of war some (if not all) members of the staff were told that they must make arrangements to be able to get to the Office in any emergency and provision was made for some to sleep at the South Kensington offices (I don't think this lasted for more than a few days). The Office had cellars where the *Daily Weather Report* used to be printed but I never visited them (they accounted I believe for the fact that the underground passage from South Kensington Station, intended to go to the Albert Hall, stopped at the Meteorological Office) and I do not know where the staff were accommodated for the night.

We knew early on that we were to be evacuated but I was not myself responsible for making the arrangements except so far as the needs of my own work were concerned — I was working on Naval Handbooks at that time.

As far as M.O.3 were concerned the great problem was the Library on which much of their work depended. I think the method adopted was to stick a small red label on the books that were to be taken and though one or two may have fallen off I don't remember any difficulties arising. (Dr Brooks — with possibly Miss Sawyer were in charge.)

At some stage we were told to have a bag packed, presumably small enough to carry, with clothes for a week and rations for a day — but I'm rather vague about this.

After we had waited some weeks with no air-raids we all hoped to be at home for Christmas so the evacuation at the end of November was a great disappointment.

Two billeting officers (Cdr Hennessey of M.O.1 was one) had already visited Stroud and fixed up accommodation for us all in private houses. We were known I think as guinea-pigs as our hosts were paid a guinea a week to house us and give us breakfast and an evening meal with dinner on Sundays — we had our main meal at the canteen in the Office. The allowance must I think have been increased later — we did not pay it over ourselves.

On the day of evacuation we met (? at the Office or at Paddington) presumably on a special train or in reserved coaches. There had been strict secrecy as to where we were going but we knew by then that it was Gloucestershire.

On arrival we were taken to a hall somewhere in Stroud and given a 'pep' talk telling us how to behave as we were the first Civil Servants to be sent there! We were then put into single-decker buses, with windows blacked out I think, and with a billeting officer at the door we were dropped off one by one as we passed the house where we were to live, and presumably had to find our own way to Wycliffe College where the Office was situated.

M.O.3 and the Library were in the main school building and M.O.1 and M.O.4 were in neighbouring houses.

There was a canteen in the main building where we met for lunch and tea.

Office hours were ?9.0—5.0 but at one stage we were told that we were to work until 7.0 and for a period we did — to set an example.

In the first few months there was a bus at noon on Saturday to allow us to get home at the weekends, and we could be picked up on Sunday evenings (? at Hyde Park Corner or Exhibition Road) and taken back to Stroud. When that ceased we had to rely on the railway — there was a station at Stonehouse within a few minutes of the Office.

RAF personnel were on duty to guard us at the Office and when air-raids started our own staff took it in turns to sleep at the Office on fire-watch duty. When invasion was expected a unit of Home Guards was formed and we were given some training in how to throw a grenade and I think I even had one shot with a rifle but I don't expect it hit the target!

Dr Goldie was in charge of the Office at Stonehouse; for a time the Headmaster's room was kept vacant —?for DMO if necessary — but ultimately we were allowed to use it and, as Dr Goldie preferred not to move from his room on the first floor, it was given to me to share with one other member of the staff — previously I had had to share with three or four members of the junior staff of Naval Handbooks.

Return to London after war ended

I came up to London, on duty, at least every fortnight during the war and visited the Naval Meteorological Service (under Cdr Garbett) then housed in Fitzmaurice Place, Berkeley Square, and Mr C.S. Durst at the Air Ministry, returning on Monday evening to Stroud.

The staff had increased so much during the war that it was thought that the South Kensington building could no longer house us. I was given the job on one of my weekend visits of going over it — it was an eerie job as I was alone and did not know whether any of it was occupied or not, actually it was not though it looked as though it might have been vacated with very little notice. I was also told to go over a convent (somewhere in North London, I forget where) but there I had with me a member of the Air Ministry staff. As might have been expected nothing came of that visit. (I had wondered who would occupy the little chapel and whether it would have to be deconsecrated.)

A short time before we left Stonehouse some half-dozen of the staff came up to London to see the building at Wealdstone which we later occupied. It had, I think, been the building to which the Air

Ministry would have been sent if they had had to leave central London, it had two floors of cellars well underground. It was occupied by Air Force Officers in some special unit. We had lunch in the canteen there and were allowed coffee in the mess provided we left immediately after it — or perhaps it was the ladies only who had to leave.

Of the actual move from Stonehouse there is not much to tell. The Library again was the most difficult and someone had to stand at the top of the stairs to prevent the books or cartons from being thrown down the stairs! The Library was on the first floor.

We left Stonehouse I think on a Friday and were expected to (and did) report at Wealdstone on the Monday giving us little or no time to settle in at home after five years away. We were told to work as hard for peace as we had for war!

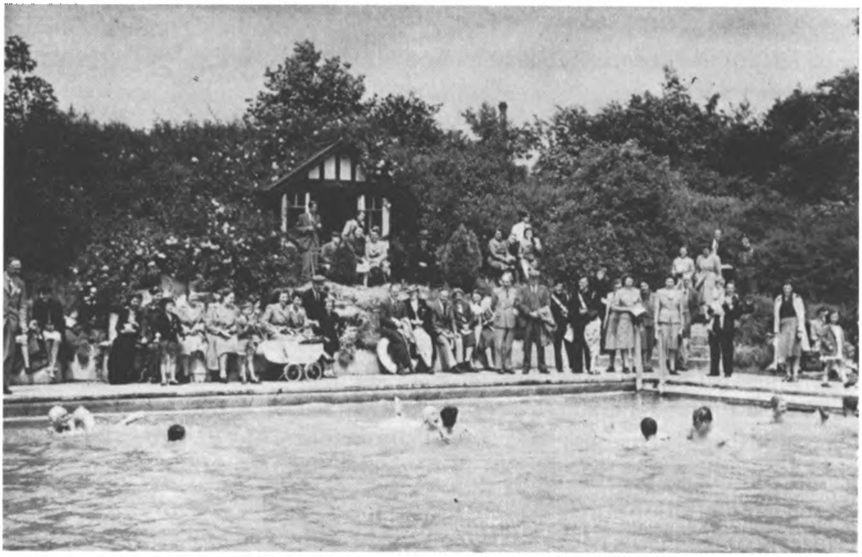
C.E.N. Franckom

I will try my best to tell you what I can remember of interest about Stonehouse days. Our location there was Wycliffe School; the boys had been 'evacuated' to somewhere in Wales. First of all it was Cdr Jack Hennessey, my assistant in M.O.1 who actually handled the move from Victory House (M.O.1) and South Kensington (M.O.3 and M.O.4) to Stonehouse; he was responsible for it all and an excellent job he made of it. I recollect that there were only six Divisions in the office then; M.O.1 — Marine, M.O.2 — Forecasting, M.O.3 — Climatology and Library, M.O.4 — Instruments and Stores, M.O.10 — Administration and Personnel, and M.O.6 — Royal Air Force, and there was only one Director, and three Assistant Directors as far as I can remember. M.O.2 were already at Dunstable, so only M.O.1, M.O.3 (Dr Brooks) and M.O.4 (Dr Scrase) went to Stonehouse, with one Assistant Director (Dr Goldie, one of nature's gentlemen) to keep us in order!

It is my recollection that Hennessey went down to Stonehouse several weeks before the move and more or less stayed there till we arrived and was able to welcome us! He had a lot to do; allocating office accommodation for each division, including stores and workshops for M.O.4, library for M.O.3 and Hollerith machines for M.O.1, arranging electric power supply, and black-out curtains for all windows. He also had to find billets or lodging for all those staff (of whom there were many who were very young) who didn't wish to make their own plans. With his Merchant Navy and Naval reserve background, Jack Hennessey was an efficient and versatile organizer and a good mixer, and he got on well with local authorities and local landladies. He had assistance at times from M.O.4 re workshops and stores, and Office of Works re electric and heating problems etc.

The move from London to Stonehouse went off very smoothly, as far as I can remember, and everybody settled in quite easily. I believe a representative from S2 (Air Ministry Secretariat) joined us for liaison duties and somebody from Office of Works, M.O.3 and the Library occupied the main building called School House, where the canteen was also located (previously the school dining room) and the kitchen. M.O.1 was rather select (!), being housed in the newest building, on the other side of the main road. We needed rather spacious self-contained premises because we were the only Met. Office Division that used machine methods for climatology (Hollerith machines). We were working on an urgent job of making climatological maps for certain ocean areas, on behalf of the Admiralty, in liaison with Naval Meteorological Office, important at a time when no weather reports or forecasts were available and there was radio silence at sea except in emergency. I had the pleasure of occupying the Headmaster's office; a very pleasant room with a nice outlook. M.O.1 had its own draughtsmen section of three people: a very convenient arrangement. Everybody seemed to settle down very well; Stonehouse and the neighbouring town Stroud, about 1½ miles apart, were pleasant country towns and the local people were very friendly. (There were the usual jokes about meteorologists bringing bad weather, but we were welcomed.) Shops were adequate (and pubs) both in Stonehouse and Stroud.

Railway communications were good with stations at Stonehouse and Stroud on the line connecting London and Gloucester, and with a fairly frequent local train service. Bus service was as adequate as practicable in wartime with fuel rationing. There were quite good recreational facilities; a very good cinema in Stroud, an excellent swimming pool in Wycliffe School grounds and, at Stroud, delightful countryside for rambling and plenty of interesting places nearby for sightseeing.



Private snapshot. Copy supplied by Mrs Stephanie Smith.

Swimming gala held by Meteorological Office staff at Wycliffe College.

Most of the junior staff in M.O.1 were young girls and they were accommodated in a large and quite pleasant boarding house near Ebley (about half-way between Stroud and Stonehouse). Most married staff rented furnished houses which wasn't difficult in those days. We had a furnished house at Ebley on the main road; I used to cycle to the office on an elderly (lady's) bicycle. Later we bought a largish terrace house in Stroud for £1000 (to avoid paying storage and furnished rental) and thought we were being very extravagant!

The Met. Office staff held occasional dances in the canteen, and the swimming pool was very popular in summer. A 'Swimming Gala' was held one weekend in the pool and included a water polo match with unlimited participants, and a fancy dress swimming race (both very exhausting items). I foolishly wore a tweed skirt of my wife's and nearly sank with the weight of it when it got wet. Proceeds went towards the 'Spitfire Fund'.

The winter of 1939/40 was extremely cold; one Saturday night there was a strong westerly wind and exceptional glazed frost, so bad that birds were frozen where they had perched and hundreds of telephone wires were brought down and branches from trees. Our back door faced west and in the morning it had a sheet of ice on it over an inch thick. It was almost impossible to stand up on pavements. We had a little river at the bottom of our garden, flowing through Stonehouse, and one morning I managed to skate to the office.

When Anthony Eden announced the formation of the Local Defence Volunteers (LDV, later re-christened 'Home Guards') on the 'wireless' one night several male members of the Met. Office staff joined at the local Police Station next morning. Some joined the Met. Office section but I joined the Ebley section as it was nearer to home. We had our headquarters in an old cloth factory and we were rather like 'Dad's Army' when we started. There were about thirty of us in the section and our arms were two shotguns (one of which was mine — an elderly 'hammer' gun). We were issued with our denim khaki uniforms and did a lot of drilling, marching and 'playing cowboys and indians' and eventually came the great day when we were each issued with an American '300' rifle and were able to do some limited target practice (but not much, due to ammunition shortage). One night (in the late summer of 1940, I believe) the phone rang at about 2 a.m. and my wife said 'Hurry up there is Hitler for you'. I went downstairs and on the phone was our LDV Captain, 'Get into uniform at once and report at HQ, Germans are reported to have landed'. I told my wife, 'You're quite right; it is Hitler'. 'Poor you and at this time of night', she said and went to sleep again! At our HQ, rifles were being issued in the light of a hurricane lamp, and six of us, with a Corporal in charge, were sent to man a trench we had previously dug alongside the main Stonehouse–Stroud road; all we did was to question the drivers of two cars and about 9 a.m. we were relieved and went home for breakfast. About 11 a.m. news came through on the 'wireless' that it was a false alarm; all very dramatic!

Soon after Dunkirk, Jack Hennessey and I asked the Director of the Office (Sir Nelson Johnson) for permission to volunteer for Naval Service afloat, as we considered that the best place for a seaman in real war (not 'phoney' by then) was at sea. Sir Nelson agreed that one of us could go, at the Admiralty's decision. I was selected, presumably because I was the younger. On 14 November 1940 I 'went back to sea' as a Commodore of North Sea Convoys. I got back to Stroud on various occasions and kept in touch with colleagues in the Office, but can only say that the general 'atmosphere' continued to be satisfactory.

I should mention that while I was in the Office in Stonehouse we had two air-raid warnings, one by day when some of us saw the aircraft and one at night; no bombs were dropped and we gathered the attack was on Bath or Bristol. Stonehouse could have been a target; Sperry's the gyro compass firm and Hoffman's who make ball bearings were there plus the Met. Office (all met. activities being of wartime value).

My wife's most vivid memory of Stonehouse days was of an open car passing our house one morning en route to the office with three elderly scientists in it with long wispy hair blowing in the breeze, thoroughly enjoying the informality of country life compared with London!

G.E.W. Hartley

Some memories of Meteorological Office, Stonehouse

I arrived at Stonehouse station at the end of January 1940 about 6 p.m. very cold after a six-hour train journey from Swindon (due to frozen points) and was lucky enough to find Mr Skelton who kindly directed me to a billet in Cainscross where I was made welcome by my hosts, Mr and Mrs Hewins. I had recently completed a forecasting course in Berkeley Square and was very relieved to be sent to M.O.4 to deal with instruments rather than forecasting. I began in Test Room, run by Mr Pace, but fairly soon moved to instrument design with special interest in wind measuring instruments — in this work I was concerned with the workshop, run first by Mr Stanley, and later by Mr Napier. I did a fair amount of travelling to visit firms and RAF establishments. I remember a trip to ICI in Cheshire, to be instructed (and later to instruct) in the use of a fog measuring device known as a Nubimeter, in connection with a project called FIDO, for dispersing fog by lighting petrol along the runway. I do not think the Nubimeter was very successful, but I do remember having bacon and eggs for breakfast at the ICI hostel. Later on I got involved in the design and construction of several wind-tunnels for anemometer testing, with help and advice from NPL and RAE Farnborough.

There was quite a lot of social occupation — such as tennis — I particularly remember a tennis match against Stroud Fire Brigade in which I partnered Dr Glasspoole; one of our opponents played in his fire-brigade headgear, which Dr Glasspoole was determined, but failed, to knock off.

Hair-cutting cost 3d at the Stonehouse barber who was also a bookmaker, and tended to leave his client in the chair while he telephoned for race results.

There was plenty of musical activity — some of us joined the Stroud Choral Society under Samuel Underwood; I played bassoon with the Gloucester Orchestral Society under Herbert Sumsion; I conducted an orchestra in Stroud and played in the Home Guard brass band. One Christmas we put on a pantomime in the library, in which all sections of the office in Stonehouse were involved — there was a small orchestra which included Mr Pace (cello) and Mr Napier (piano) and leading parts were taken by Dr Scrase and H.T. Smith.

I was fortunate to find a farmhouse near Painswick to live in with my wife and children — rather a long and hilly cycle ride, but well worth the trouble.

The move to Harrow meant leaving many friends behind, but fortunately Harrow was within commuting distance of my home 'Woodwind' at Ottershaw, Surrey.

O.M. Ashford

Recollections of Stonehouse — June 1943 to August 1945

I was posted to Stonehouse in June 1943 as head of M.O.4(a), the section responsible for the design and development of new and improved meteorological instruments. My 'office' was an enormous science laboratory, large enough for at least ten normal offices. Several attempts by other Branches to take over some of the space had been thwarted by arguing that the whole laboratory was needed for displaying a vast collection of meteorological instruments: few of these were in fact of any curent interest and several are now in the instrument museum.

Stonehouse was located in a billeting area and I therefore had to wait several months for a furnished house to be allocated. In the meantime, I went into 'digs' and my family stayed up in Scotland. In spite of the long working hours (48 hours a week, I seem to remember) I still had time on my hands and took the opportunity of enrolling in a Russian course and learning to play the oboe. For the latter I was encouraged by my colleague Geoffrey (Bill) Hartley, who needed an oboeist for the amateur orchestra which he directed in Stroud; he had a large collection of wind instruments and offered to lend me an oboe. As a Scotsman, I could hardly refuse such a generous offer. I used to cycle about 40 miles for my oboe lessons.

In due course I was assigned a house in Painswick, and later in Chalford, both of which were more than five miles from Stonehouse. I shall never forget the daily cycle ride to the office, downhill for the first mile or so and then along the valley. This meant that I did not get any exercise — apart from using the handbrake — on the initial stretch, which was especially trying in winter when I was often made painfully aware that cold air can be found in a valley.

As we only had a short break for lunch, few of the staff were able to go home in the middle of the day — perhaps I had been spoiled in this respect at my previous posting at Lerwick Observatory. I enjoyed the company in the canteen more than the food. After lunch I would often have a brisk walk with my boss, Dr Scrase or other congenial company; thanks to this, I got to know people from other branches, such as Dr Brooks, Dr Glasspoole and Cdr Hennessey.

The facilities at Wycliffe College, where the office was located, lent themselves readily to a wide variety of social activities. I enjoyed especially the tennis and swimming in the summer and the table tennis and badminton in the winter — also an occasional game of chess. We even had an annual athletics meeting, for which there was strong competition for the ladies' events but not so much for the men's — I was one of the few males under the age of thirty. To my amazement I had little difficulty in winning the 100 yards sprint against the only other competitor, considerably my senior; this is the only time in my life that I have won a race.

The office choir was ably led by Hartley who persuaded me, against my better judgement, to help to swell the thin ranks of the male voice section. I resigned in horror after finding that I was expected to sing a solo tenor part. It began: 'I hear the voice, I hear the voice of angels sing ...' I could hardly bear my own voice, let alone that of the angels. I had somewhat more success in the dramatic club — the Stonehouse Players, I believe. I played the part of a jingoistic politician in a very moving play with an anti-war message. I still remember my opening lines: 'My friends, this is a very solemn moment for all of us. The twin spectres of poverty and unemployment threaten the security of our fair land...' The Players were awarded first prize in a regional or county competition among amateur drama societies for this production, but before the end of the competition my part had been taken over by a much better actor, H.T. Smith. This story has an amusing sequel. Some years later I was invited to join the RAF dramatic group in Gibraltar. Imagine my surprise when I learnt that they wanted me to play the part of a jingoistic politician in an anti-war play! I readily accepted and the play once again won first prize in a local competition.

Other vivid memories of Stonehouse include trying to communicate with the three Polish assistants in the Test Room and with the office photographer who was stone deaf, the nights spent at the office on fire-watch duty, and the frequent visitors — there was even a Russian meteorologist with whom I was able to air my few phrases of Russian. But above all, it was a place of hard work and good companionship.

Appendix 2 — *Biographical notes on authors of reminiscences*

Miss E.E. Austin

Joined the Office in 1918. For many years Personal Scientific Assistant to Sir Napier Shaw and went with him to Imperial College, London on secondment from 1920 to 1935. The first woman Principal Scientific Officer. Retired in 1957, having been Head of the World Climatology and Upper Air Climatology Branches.

Commander C.E.N. Franckom, OBE

Marine Superintendent 1939–1969, but on active service with the Royal Navy from November 1940 to the end of the War. President of the WMO Commission for Maritime Meteorology from 1946 to 1956. Apart from his distinguished service in what may be called 'work', he participated enthusiastically in almost every aspect of Office social life.

O.M. Ashford

Resigned from the Office in 1952 to join WMO where he had a distinguished career, retiring in 1977 as Director of Programme Planning and UN Affairs.

G.E.W. Hartley

Joined the Office in 1939 after having been a schoolmaster. Spent his entire career dealing with instruments, particularly anemometers. A talented musician, with a gift for composing light music, he is an expert bassoon player. For many years until his retirement in 1971 he conducted the Office choral society.

Notes and news

The reopening of Ross-on-Wye

Thursday 16 May saw the reopening of the observing station at Ross-on-Wye after a gap of 10 years. Weather observations were first made at Ross in 1859 but the station is best known for the efforts of one man, Mr F.J. Parsons, MBE, the observer from 1914 to 1975 (when he retired at the age of 84). As well as providing climatological observations Ross-on-Wye was, under Mr Parsons, an important auxiliary synoptic station reporting at six of the eight synoptic hours. Station number 627 (or 140 for those with extremely long memories) was a key station in the network and its closure left a gap, not yet satisfactorily filled, on synoptic charts.

The Mayor of Ross for the year 1984/5, Councillor Arthur Clarke, made the reopening of the climatological station a mayoral project and was extremely fortunate in being able to acquire the site previously used by Mr Parsons. Accordingly, and because of the previous long record, the Meteorological Office took the unusual step of supplying all the necessary equipment and instruments on loan right from the start.

Observations will be made at 0900 and 1800 GMT for inclusion in the Health Resort bulletin published by the National Press. The data will also be validated and stored on the computerized data bank held by the Meteorological Office at Bracknell and, thus, form part of the National Weather Archive. As well as being the source of weather statistics this archive is much used by the Meteorological Office Advisory Services Branch to answer the very many and varied enquiries received from designers, planners, agriculturists, the legal and insurance professions as well as the general public.

The opening ceremony took place at the site at 1200 on 16 May with Ian McCaskill, one of the Meteorological Office team of BBC National TV weather forecasters, cutting the tape with the Mayoress of Ross. Also present were Mr F. Singleton, Assistant Director (Advisory Services) and Mr Denham representing the Bristol Weather Centre. Unfortunately Councillor Clarke was indisposed and could not be present. He was represented by the Mayor-Elect, Councillor Drew Lacey. Before and after the ceremony Ian McCaskill risked writer's cramp by signing autographs for at least, apparently, half of the several hundred people present and being photographed by the other half. The Meteorological Office representatives were introduced to the Principal Observer, Mr H.J. Ellis and his deputy, Mrs J. Swallow. Local interest is so great that there was a queue of people willing to be observers and the Local Council has now appointed a second deputy observer. The interest and commitment of the Council is evidenced by their willingness to pay the observers an honorarium.

In a short speech, Councillor Lacey paid tribute to the efforts of Councillor Clarke to reopen the station and he thanked the Meteorological Office for the loan of the instruments. In reply Mr McCaskill reflected upon the value of such observations, wished Ross-on-Wye all success for the future in this venture and faithfully promised to ensure that Ross-on-Wye received due mention in his television weather forecasts.

After the ceremony, and when the crowd had finally largely dispersed, the Mayoress, the Mayor-Elect and Town Clerk very kindly entertained Messrs Denham, McCaskill and Singleton in the reforging of the relationship between the Meteorological Office and Ross-on-Wye, a relationship which it is hoped will persist and prosper for many years to come.

Photograph by courtesy of The Ross Gazette

Ian McCaskill with Mr Howard Ellis, the Principal Observer at Ross-on-Wye.

Photograph by courtesy of The Ross Gazette

Ian McCaskill with the Mayoress of Ross, Mrs G.A. Clarke and the Mayor-Elect, Mr Drew Lacey.

Satellite photograph — 4 November 1985 at 0426 GMT

The satellite photograph opposite (Fig. 1) is from a NOAA–9 south-bound pass at 0426 GMT on 4 November 1985. The infra-red image shows the channel 4 (11 μm) data from the AVHRR received at the Lasham ground station and processed on the HERMES computer system. The photograph has been taken directly from the VDU screen. The synoptic situation at 0600 GMT is shown in Fig. 2.

Iceland can be seen clearly towards the top left-hand corner of the satellite picture. There was widespread convection in the polar air flowing across Iceland from the north-east, and a marked 'shadow' in the lee of the cold land surface. The reason for the 'streak' in the middle of this clear area is still obscure; however, it was still evident on the NOAA–6 pass later that morning.

Part of the north coast of France is visible on the extreme right of the picture (about half-way down) while the English Channel, much of Wales and northern England are also visible. The bright mass of cloud approaching the Channel is mainly cirrus and altostratus; however, rain did not reach the Brest peninsula until some 3½ hours later. This rain subsequently spread to some southern parts of England. A shield of stratocumulus can be seen over south-east England, which resulted in a gradual rise in temperature in those areas after local slight frost earlier in the night. A minor trough affected south-western parts of England, bringing light showers during the morning. Ireland is mostly cloud-covered, the cloud being associated with another trough; Valentia, in extreme south-west Ireland, reported thunder at about the time of the picture.

The cold front to the north-west of the British Isles was fairly weak at this time but the depression near Ocean Weather Station LIMA (57° N, 20° W) developed as it moved eastwards and subsequently deepened to 948 mb over the northern North Sea about 40 hours later.

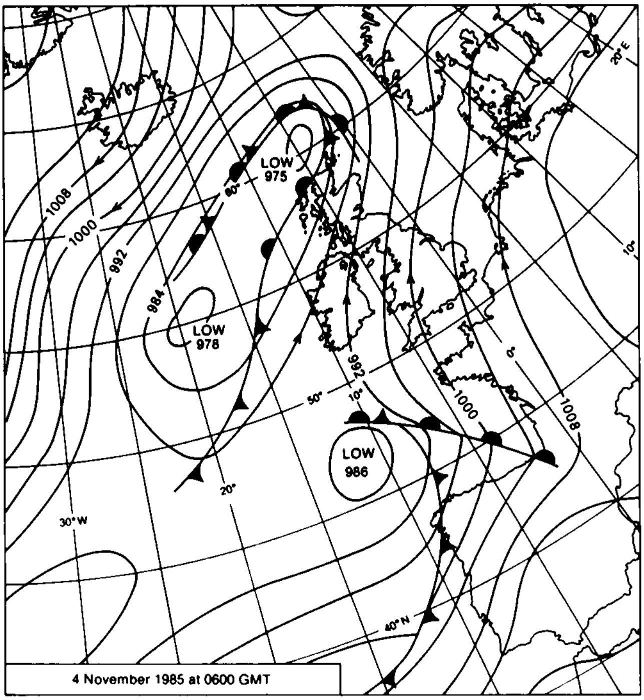


Figure 2. Synoptic situation at 0600 GMT 4 November 1985.

Figure 1. NOAA–9 infra-red image, 0426 GMT 4 November 1985.

Reviews

Air pollution by photochemical oxidants. Formation, transport, control and effects on plants, edited by R. Guderian. 170 mm × 248 mm, pp. xi + 346 , *illus.* Springer-Verlag, Berlin, Heidelberg, New York, Tokyo, 1985. Price DM 158.

The dramatic and rapid decline in the health of forest trees which has developed over recent years in West Germany, and other countries of central Europe, has had a major political impact, and has stimulated measures to control emissions from various sources of air pollution in many European countries. Although most scientists accept that pollution in some form is of central importance in causing this forest decline, it has not yet been possible to directly link the damage to any particular pollutant, or combination of pollutants. The role of photochemical oxidants, primarily ozone, is now the focus of considerable interest; in addition to its direct effects on vegetation, ozone plays a key part in the conversion of sulphur dioxide and nitrogen oxides into the sulphate and nitrate of 'acid rain'.

The concern about ozone, and other photochemical oxidants, led the German Umweltbundesant (the federal environmental protection agency) to commission a review of their formation and effects, which was published (in German) in 1983. This English text, which is largely based on that publication, consists essentially of two long review chapters. The first of these is concerned with the formation, transport and control of photo-oxidants. There are brief summaries of the physical and chemical properties of the relevant molecules, together with sections on sources of the precursors, the chemistry and modelling of oxidant production, and methods of measurement. However, control is only discussed very briefly on the basis of model predictions. There is no mention of the technical means of controlling emissions, and it seems rather misleading to have included 'control' in the actual title of the book. The German origin of the book is most evident in this first chapter, over a quarter of which is devoted to measurements made in West Germany of oxidants and their precursors. The second chapter, which is about twice the length of the first, is concerned with effects of photo-oxidants on plants. This review covers their biochemical, physiological and ecological effects, factors influencing plant response, dose-response relationships and the effects of photo-oxidants in combination with other pollutants. There are also brief discussions of the use of bioindicators and of the experimental methods available to evaluate effects on plants.

This is definitely not a book to be read for pleasure. The information is densely packed and the style of writing is uniformly dull. The presentation often still resembles that of an official report, and little effort seems to have been made to rewrite the material for this book in a way which might attract a wider range of readers. Nevertheless, the book is thoroughly researched (there are 52 pages of references), and it contains what is undoubtedly the most detailed, authoritative and up-to-date review of the effects of photochemical oxidants on vegetation. As such, it will certainly be a valuable source of reference for specialists in this particular subject.

M.R. Ashmore

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