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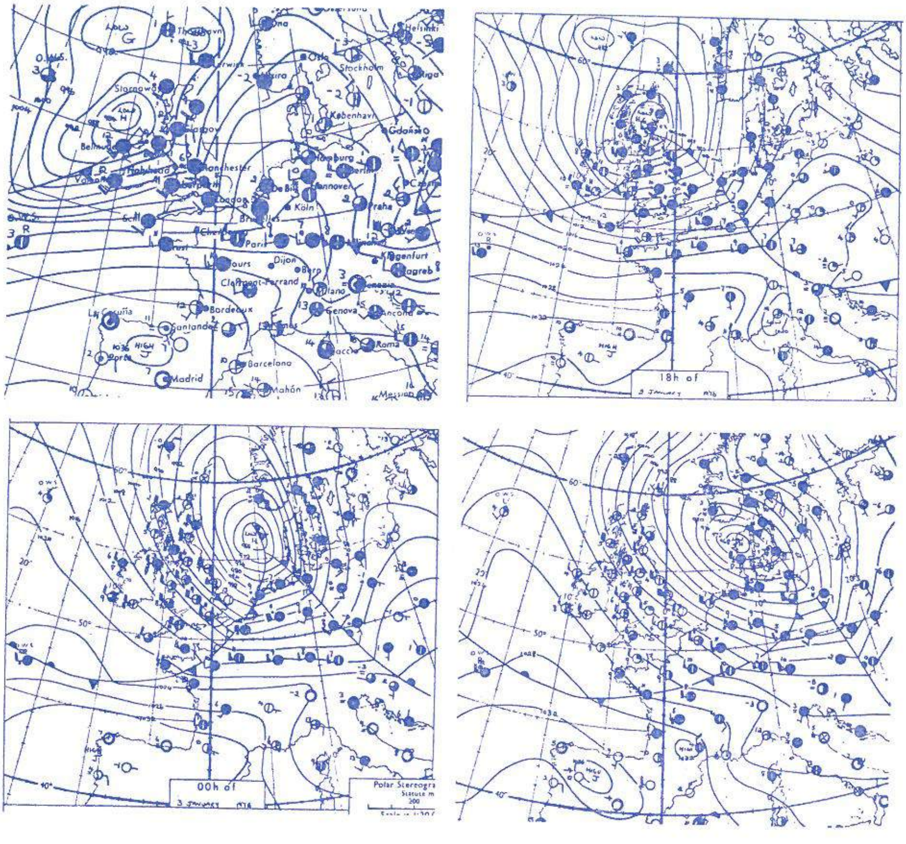

The gale of 2–3 January 1976 which claimed over 60 lives

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THE STORM OF 2-3 JANUARY, 1976

By C. LOADER

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Abstract: The storm of 2/3 January 1976 is described and compared with other storms of the recent past. The return period is discussed but not quantified owing to the lack of a composite index to provide a comprehensive gauge of the severity of such storms. The synoptic origin of the depression is examined and probable reasons for the intense development put forward. The use of satellite photography to assist the forecasting of such intense cyclogenesis is recommended as the numerical models in use in both England and Germany failed to anticipate the deepening. The accompanying storm surge in the North Sea is described and the high water levels explained in terms of surge/tide interaction. The surge is compared and contrasted with that of 1.2.1953 and the differences explained in terms of the dissimilar synoptic causes. Finally, the gale on land is compared to the historic 'Great Storm' of November 1703, and secular variations of the frequency of storm-surges are discussed.

Nor God alone in the still calm we find, He mounts the storm, and walks upon the wind.

ALEXANDER POPE, 1688-1744

INTRODUCTION AND COMPARISON WITH OTHER RECENT STORMS

The storm which struck Britain on 2/3 January 1976 has already been described as the worst for 23 years, i.e. since the gales and flood disaster of 31 January/1 February 1953 (see *Journal of Meteorology,* February issue). In central Europe the German Weather Service[1] has ranked it as one of the five worst storms for 25 years, being comparable to those of 31.1/1.2.1953 (the 'Dutch hurricane'), 16/17.2.1962 (the 'Hamburg' hurricane), 21.2.1967 (the 'Adolph-Bermpohl' hurricane) and 13.11.1972 (the 'Lower Saxony hurricane). Whereas in 1953 several thousand people were killed as a result of the very severe coastal flooding accompanying the storm (hundreds also perished in the 1962 floods in Hamburg), the other three storms, including the recent one, cost fewer lives, not only because of raised and strengthened sea defences but also because the synoptic conditions associated with the storms were different.

In all about 60 people died throughout Europe as a result of the gale, four in Ireland, 24 in Britain, one in France, two in Belgium, two in Holland,, 16 in West Germany, and 11 were missing from the East German coaster *Capella* which sank off the Dutch coast. None of these, at least in Britain, were killed as a result of the sea floods, but by events resulting from the gales inland.

THE DAMAGE AND INDICATORS OF THE SEVERITY OF THE STORM

A distinctive feature of the storm is that the hurricane force winds which were attained persisted for a long time over a large area, including wide areas of Britain and central Europe), and that they were most destructive over the land. The result was enormous material damage and widespread disruption of services both at home and abroad, estimated at well over £50 million for Britain alone, which was worst hit.

In Britain, the worst hit areas were the Midlands, East and North of England, especially East Anglia and the East Midlands, where storm and hurricane force gusts were quite widespread. Apart from the extensive structural damage caused by these gusts, at least tens of thousands of trees were blown down as well. At one of the Institute of Hydrology's experimental sites in Thetford Forest (Suffolk) 90 trees were blown over or snapped off within 1 hectare around the site which was planted to a density of about 800 trees per hectare. Thus the 'percentage destroyed' would be 11%, although estimates from other parts of the forest suggest an even higher figure. The corresponding figure for a 'destructive' gale in April 1973 was only about ¼%². In Norwich city about 650 trees were reported to have been blown down and 200 on one small estate outside the city.

At Elmdon (Birmingham) airport in the Midlands, gale force winds (> 38 knots) were recorded continuously for 3½ hours from 1930 until 2300 on 2 January, gusting to hurricane force (> 64 knots) between 1945 and 2145, the storm reaching its peak at 2120 with a gust of 73 knots (see Fig. 1). The maximum mean hourly wind speed was 44 knots between 2100 and 2200. The wind veered as the storm continued, from 220° at 1800 to 290° between 2200 and 0100 (3 January), subsequently backing to 280° as the storm abated.

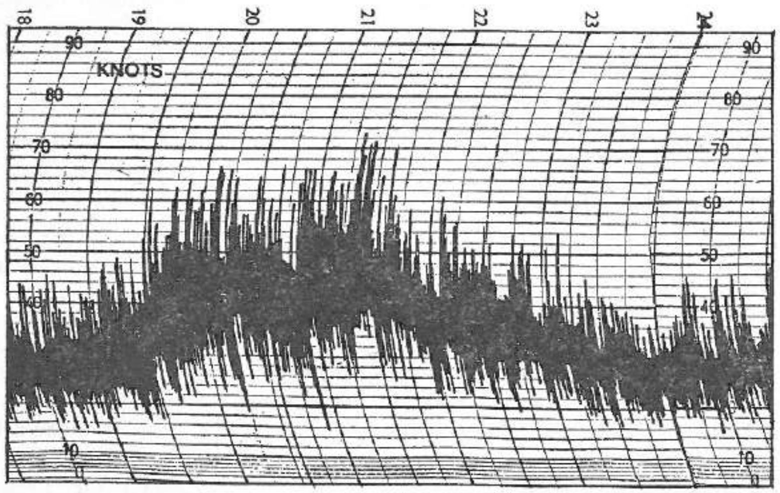

Fig. 1. A section of the anemogram recorded from 1800 on 2 January 1976 to midnight at Elmdon airport, near Birmingham.

At R.A.F. Coltishall, Norfolk, gales persisted for the 5 hours from 2100 (2 January) to 0200 (3 January), frequently gusting to hurricane force;

the storm reached its peak a little later than at Birmingham between 2200 and 2400, the highest gust of 85 knots being recorded at 2240. The maximum mean hourly wind was 48 knots between 2300 and 2400. The mean direction was from 210° at 1700 veering through 240° at 2200 and persisting at 280° for the remainder of the storm.

The most notable gusts recorded in Britain are summarised in Table 1.

TABLE 1: Notable gusts recorded in Britain on 2 January 1976

Knots	Location	Knots	Location
66	State House (roof), London	83	Cardington, Beds.
71	Leicester, Leics.	87	Northern Ireland
74	Gorleston, Norfolk (E. coast)	89	Norwich, Norfolk
77	Honington, Suffolk	90	Cromer, Norfolk
79	Gainsborough, Lincs.	91	Wittering, Hunts.

(Values exceeding 91 kt may have occurred at Coventry airport in the Midlands; 90 kt was reached several times but this was the limit of the anemogram scale).

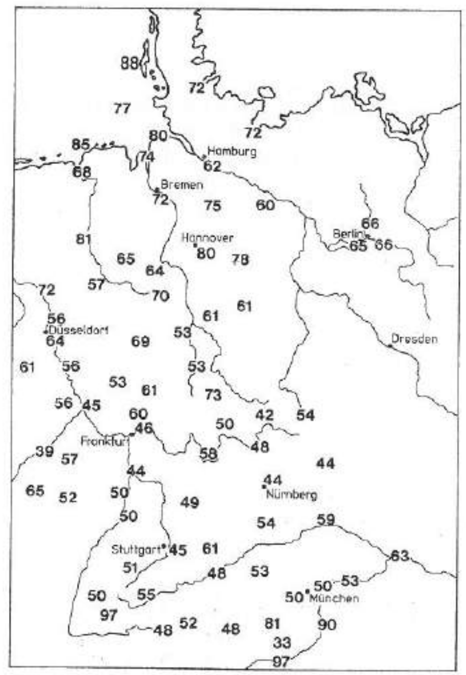

Fig. 2. Maximum gusts (knots) recorded on 3 January in Germany. (From *Beilage Zur Berliner Wetterkarte* 15.1.1976 reproduced by kind permission).

By the morning of 3 January the storm was affecting the Continent where gusts of 70 knots occurred widely, and even 80 knots and more were recorded at many places on the North German plain (see Fig. 2). The highest gust recorded for a lowland area was 88 knots on the Island of Sylt (off western Jutland), the second highest on record for this site. Higher speeds were attained in the mountains areas, e.g. a gust 97 knots occurred on the Zugspitz summit in the Black Forest.

RETURN PERIOD

Higher absolute values of wind speed, and storms of longer duration at individual stations have been recorded in the past, but apparently never (since anemometers have been available) have both criteria occurred so extensively in low-lying areas, as in the case of the storm of 2/3 January 1976. Table 2 shows the duration of gale force winds in the five recent major hurricanes (detailed in the introduction) in Berlin, and the fact that the 1962 storm lasted 12 hours longer. However, the duration of storm force winds (>52 knots) was less in 1962.

TABLE 2: Duration (hours) of gale-force winds in five recent major hurricanes in Berlin

Storm	Duration	Comments
1953	6	Max. speed only 42 knots, centre passed over Berlin
1962	36	Longest continuous storm since 1952
1967	12	
1972	21	
1976	24	Storm force gusts for 17 hours

These considerations bring to light a basic problem of assessing the return period of such severe storms. Normally, only the return period for a particular item, such as maximum gust strength at any given place, is quoted. The storm of 2/3 January 1976 was notable for high maximum speeds, duration of high speeds, and size of the area affected. Its ranking would be different in respect of each of these items considered separately. There would be an obvious advantage in developing a composite index combining all three criteria. In terms of such an index the recent storm is certainly rare—not approached by the other storms within the last 25 years—but just how rare is difficult to determine.

SYNOPTIC DEVELOPMENT

The meteorological cause of the gales was a depression which moved swiftly eastwards from the Atlantic across southern Scotland and the North Sea at about latitude 56°N, and deepened exceptionally rapidly as it did so. (See Fig. 3). The depression, low 'H', moved from a position at 54°N, 20°W in the N.E. Atlantic, to 57°N 9°E in northern Denmark in just 24 hours, at an average speed of 42 knots, while deepening from 992 mb to 968 mb.

The storm depression had its origins in a both extensive and intense low pressure area which had formed over the Atlantic between the Azores and Bermuda by the end of December 1975, very much in evidence on the noon chart of 31 December. This area extended from 20°N to 50°N in latitude and had a central pressure of 992mb. On its eastern flank, very warm, sub-tropical air was moving in a N. to N.E. direction, to meet a stream of very cold Arctic air which was moving S.E. from the East Greenland Sea. Both at the surface and at 500 mb, the temperature contrast between these air masses at source exceeded 30°C. For example, at noon on 31 December the surface temperature was —19°C at Angmagssalik (Greenland) and +16°C in the Azores; at midnight, the 500 mb level temperatures were —48°C and —16°C respectively. This factor alone would suffice to explain why the subsequent development was so great.

Warm front waves separated on several occasions from this mid-Atlantic low pressure system, moving north-eastwards. On New Year's night a vig-

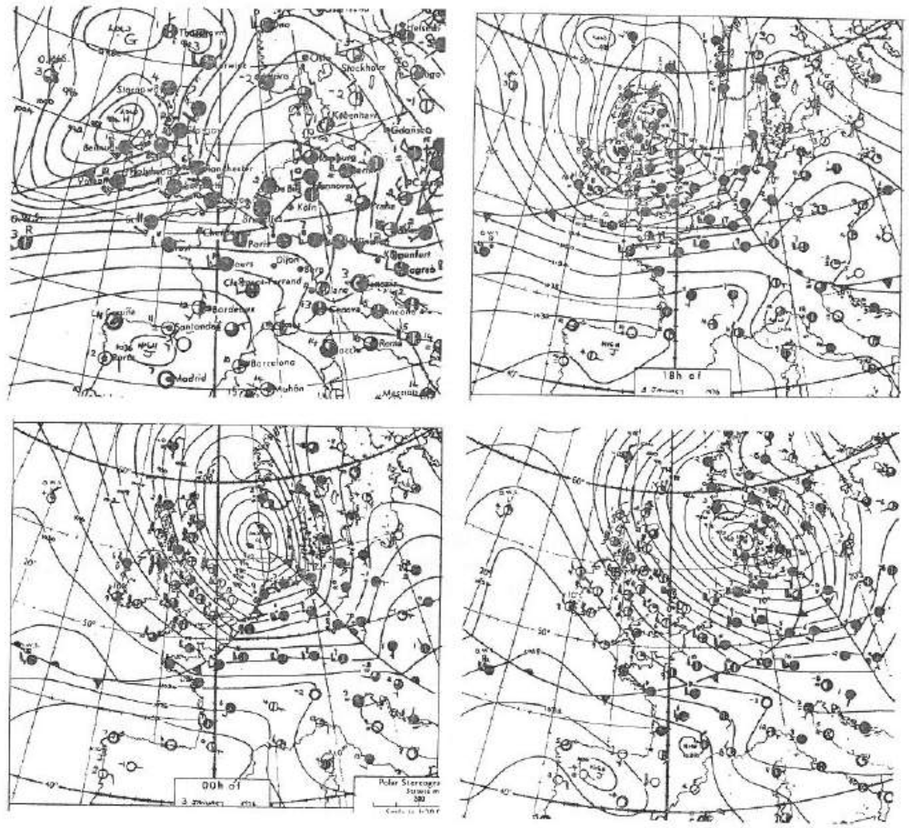

Fig. 3. Synoptic charts for 12 hrs., 18 hrs. (2 January 1976) and 00 hrs., 06 hrs. (3 January 1976). (From The *Daily Weather Report* 2.1.1976 and 3.1.1976, reproduced by kind permission of the Director-General of the Meteorological Office).

orous wave crossed central Europe, and by early morning on 2 January another warm front wave (low 'F') had followed a similar path (at least as far as the sea area between Ireland and the Hebrides). This former cyclone travelled so quickly on 31.12.1975 to 1.1.1976 in the strong upper air flow that it scarcely occluded as it passed over central Europe. It deepened over eastern Europe, but not greatly, having detached itself from its warm air source and quickly used up its internal supply of latent heat energy.

The frontal zone persisted over the Atlantic and low 'H' separated from the system arriving south of ocean weather ship 'L' by 0600 on 2 January. At this time Bellmullet, on the N.W. coast of Ireland, was recording slight continuous rainfall associated with the warm front and a light S.E. breeze of 10 knots, the pressure having fallen 5.3 mb in the previous 3 hours. Central pressure was now 992mb. At 0900 the same station, Bellmullet, reported gale force S.S.W. winds for the first time, pressure having fallen a further 8.9 mb since 0600. The corresponding figures for Malin Head and Tiree were 7.9 mb and 5.4 mb respectively.

With an extensive warm sector providing a copious supply of latent heat energy from the condensing water vapour, the depression continued to deepen, pressure falling to 984 mb by 12 noon. Gale force southerly winds were now being reported at several stations around the North Channel (between Scotland and N. Ireland), accompanied by moderate continuous rainfall, pressure having fallen by 12.1 mb in 3 hours at Malin Head. This was the first appearance of a pressure fall over 10 mb in 3 hours, signalling clearly the development of a storm of somewhat exceptional character for the British Isles-Europe region, despite the fact that the rest of England was still reporting light to moderate S. to S.W. winds at this time.

The coalescence of low 'G' (a pre-existing non-frontal low to the S. of Iceland) with the system, further augmented by the strong thermal contrast (which at 0100 on 2 January was 25°C over a distance of 1000 km at 500 mb), caused low 'H' to intensify by an exceptional extent. As a result, by 1500, nearly all stations on the W. coast of England and Scotland were reporting gale force S.W. winds (at Hartland Point, on the N. Devon coast, it was storm force westerly), and several stations in central Scotland recorded pressure drops exceeding 10 mb, in one case as much as 16.5 mb during the previous 3 hours. Even inland areas were now experiencing fresh to strong S.W. winds. By 1800 the central pressure near Edinburgh had fallen to 972 mb, and western coastal stations were suffering severe gales, central Ireland even 'violent storm' force, i.e. 60 knots. All of England now lay within the extensive warm sector and was reporting winds from 'strong breeze' to 'near gales' in the N.W.

As the depression moved to the North Sea, it drew into its rear fresh, very cold Arctic air from a direct northerly outbreak over the Norwegian Sea, which ensured its continued development. With the passage of the cold front the winds veered to almost W.N.W. and by 2200 the whole of Britain was suffering strong gales, with storm force in places and widespread gusting to hurricane force as the storm reached its peak. By midnight (0001, 3 January) the low was centred in the middle of the North Sea, central pressure now 968 mb although the system was beginning to occlude. Winds inland in Britain had moderated slightly, but coastal areas were still reporting severe gales.

During the night, as the depression moved rapidly eastwards, the continent began to feel its effects, the storm reaching its peak by mid-morning, with a central pressure of 965 mb and widely-reported gusts of hurricane force. (See Fig. 2). From noon onwards it began to fill so that by 1800 the central pressure was 975 mb, and the depression was slowing down as its energy supply became exhausted.

The origin of this storm is in many ways similar to that of the 1953 storm; indeed the similarity between the chart of 1200, 31.12.1975 and 1200, 29.1. 1953 is remarkable. The development of an extensive low pressure region in mid-Atlantic from which warm front waves break away and travel eastwards seems to have been a common feature of both events, although the track taken by these waves was further north in 1953. Such a series of fast-moving warm front waves is a sympton of a very strong thermal gradient which denotes an accumulation of potential energy[3]. It has been shown[1,4] that rapid cyclogenesis culminating in storms of full hurricane intensity (in Europe) has been commonly preceded by a characteristic 'cloud head', visible on satellite photographs in the early stages of deepening when nothing except a very weak frontal wave is seen on the surface map. The potential use of this phenomenon in forecasting seems considerable, especially as the numerical models in use for forecasting in both England and Germany seem to have missed the deepening of the depression concerned. The situation—a depression with very mild, very humid air in the warm sector which was about to draw into its circulation a fresh, very cold Arctic airmass—was recognised by experienced meteorologists in both countries as having the classical preconditions of deepening to a strong storm cyclone. In fact, the gale warnings issued seem to have been based on the first direct evidence of deepening in the form of unusually great falls of pressure over 3-hour periods reported in Britain from 1200 GMT (2 January) onwards. It seems that numerical prognoses at present often fail to anticipate these intense developments[4], which is doubly unfortunate because it is in such extreme and rare conditions that forecasts are of the most value. Evidently the very rarity of such storms explains why a sophisticated gale warning system comparable to the hurricane and severe storm warning systems of the U.S.A. has not been developed.

THE ACCOMPANYING STORM IN THE NORTH SEA

As the depression moved eastwards towards Denmark, the winds behind it veered so that the western half of the North Sea was subjected to storm force winds from between W.N.W. and N.W. for a period of several hours (See Fig. 3, 0001, 3 January). This generated a storm surge (disturbance of sea-level) which raised the level of the high spring tide sufficiently to cause flooding in several places on the east coast of England, notably at Cleethorpes (Humberside) and Walcott (Norfolk), where the sea-walls were breached and coastal dwellings inundated to depths of at least a metre. Fortunately, flood warnings were issued well in advance by the Storm Tide Warning Service (an organisation set up after the 1953 disaster), enabling prior evacuation from the endangered areas.

Fig. 4 shows the 'surge-residuals' (i.e. recorded sea-level minus predicted sea-level for six ports on the east coast of Britain and shows the progression and simultaneous amplification of the disturbance as it travelled southwards. A preceding 'negative' surge was caused by the strong S.W.—S. winds over the North Sea when the depression was further west. Of the six ports, the highest residual of 2.68 metres was recorded at Southend at 2100 on 3 January.

The phase relationship of the surge and the astronomical tide is revealed by the position of the short vertical lines on Fig. 4 (and by the graph of actual recorded levels in the case of Southend), which represent the time of predicted high water. In all six cases the maximum surge occurred on the rising tide*, 3 to 5 hours before high water. The time of (predicted) high water coincided with a secondary minimum in the residual (i.e. storm surge) curve at each place. Thus, at Southend the magnitude of the surge actually *at* the time of predicted high water (following the surge maximum at 0147

*If tide and surge are out of phase at Wick, they will be out of phase at the other ports because the tidal stream and the surge both travel at a speed governed by the depth, as long waves, with $V = (gD)^{0.5}$.

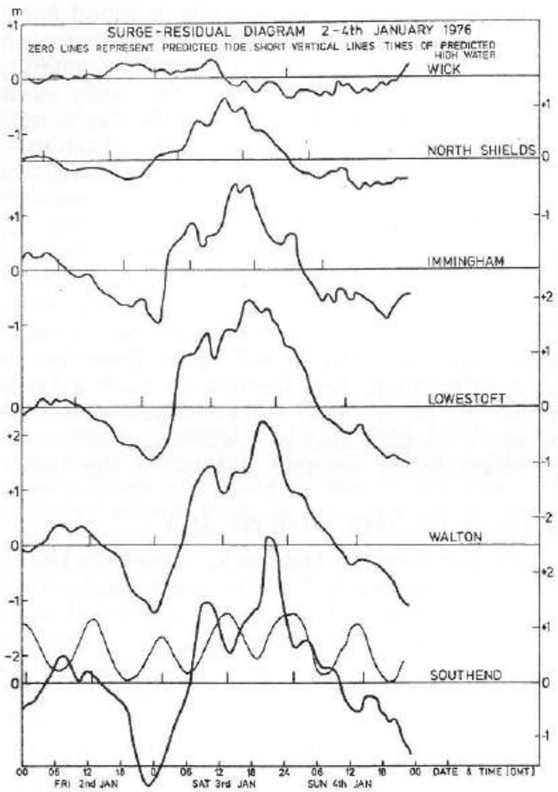

Fig. 4. Surge-residuals (metres) recorded at six ports on the east coast of Britain on 2-4 January 1976. Zero lines represent the predicted tide, short vertical lines the times of predicted high water; the dotted curve is the recorded sea-level height at Southend. (Drawn from data kindly supplied by Cmdr. J. Townsend, head of the S.T.W.S. Meteorological Office). The sinusoidal curve for Southend is the tidal curve and has a different scale (1 m on surge = 5 m on tidal curve).

on 4 January), was only about 0.6 m, compared to 2.68 m nearly 5 hours previously, when the predicted absolute height was 1.7m lower. Had the surge coincided with high water, the sea at Southend would therefore have risen about 2m higher (i.e. 2.68 minus 0.6), assuming that the tide and surge may be simply superposed. The corresponding (hypothetical) values

TABLE 3: Maximum possible increase of sea-level height(corresponding to coincidence of tide and surge and assuming that the two may be superposed)

Location	A	B	C
Wick	+0.1	+0.2	+0.3
North Shields	+0.2	+0.5	+0.7
Immingham	+0.3	+0.7	+1.0
Lowestoft	+0.3	+0.2	+0.5
Walton-On-The-Naze	+1.3	+0.3	+1.6
Southend	+2.0	+0.5	+2.5

Column A: Height difference (to 0.1 m) if coincidence of surge and tide.
Column B: Height difference of predicted tide on 3 January from the highest astronomical tide.
Column C: Total difference.

for the other five ports on the east coast of Britain are shown in Table 3. This table also shows (column 2) the differences between the highest predicted tide on 3.1.1976 from the highest astronomic tide (H.A.T.) (i.e. that which would occur near the equinoxes) for each of the six ports, and column 3 of the table sums the two differences. So if the storm had occurred near (for example) the vernal equinox, and tide and surge had exactly coincided, the sea at Southend would have risen about 2.5m higher, again assuming that the tide and surge may be simply superposed.

Such a fateful combination is unlikely, firstly, because most severe storms occur in the three months December, January and February[5], and secondly because the tide and surge interact in a *non*-linear way so that most (though not all) major surges occur on the rising tide, Keers[6] has shown that about 60% of large surges at Southend occur on the rising tide, and only 6% at high tide. A simple physical explanation of interaction is that large positive surges hasten the tide by the the increased rate of propagation of a free wave and, separately, because of the decreased effect of the bottom friction. Keers has also shown that this effect increases southwards (explaining the increase in surge amplitude), save for a discontinuity between Immingham and Lowestoft.

The exact nature of surge-tide interaction is still imperfectly understood; it depends on the interrelated variables of tidal range, depth, bottom friction, and surge amplitude. Mathematically, the problem is complex, especially near boundaries (i.e. coasts) where the depth is small.

On the continental shore very high levels were recorded everywhere from Holland to Denmark, the worst hit being the German Bight and Elbe estuary regions where at least 10,000 people were evacuated. On the afternoon of the 3rd, high water was 4.06 m above 'normal' at Vlissingen in Holland, the second highest value ever recorded, the highest having occurred during the surge of 1.2.1953, when 4.55 m was attained. At 1340 GMT on 3 January, a level of 10.66 m was recorded at Husum on the N.W. German coast. This value, 4.12 m in excess of the 'mean', was even greater than that recorded on 17.2.1962 (the Hamburg floods) when 10.27 m was reached.

Denmark was probably worst hit of all by the 1976 storm with a level of 4.90 m above 'normal' at Hajer in S.W. Jutland, the highest ever recorded and only 10 cm below the top of the dykes. Thousands of people were evacuated and widespread flooding and damage occurred. Some flooding was also reported in Copenhagen at the edge of the Baltic Sea.

TABLE 4: Comparison of the surge of 3.1.1976 with 1.2. 1953 for the Norfolk and Suffolk coasts

Location	1976	1953	Difference
Wells-Next-The-Sea	4.46	5.13	−0.67
Great Yarmouth	2.69	3.28	−0.59
Southwold	2.50	3.50	−1.00
Aldeburgh	2.83	3.78	−0.95
Ipswich	3.10	4.19	−1.09
Haddiscoe	1.76	1.50	+0.26

The levels given are the absolute levels above ordnance datum at Newlyn, in metres.

Thus, compared with the 1953 surge that of 3 January 1976 was generally less severe, except on the west coast of Denmark. Table 4 shows a comparison for the coasts of Norfolk and Suffolk where the 1953 levels were higher at most places by up to a metre or more, although the differences between the surge-residuals was usually less than 0.5 m. At Southend, the residual for

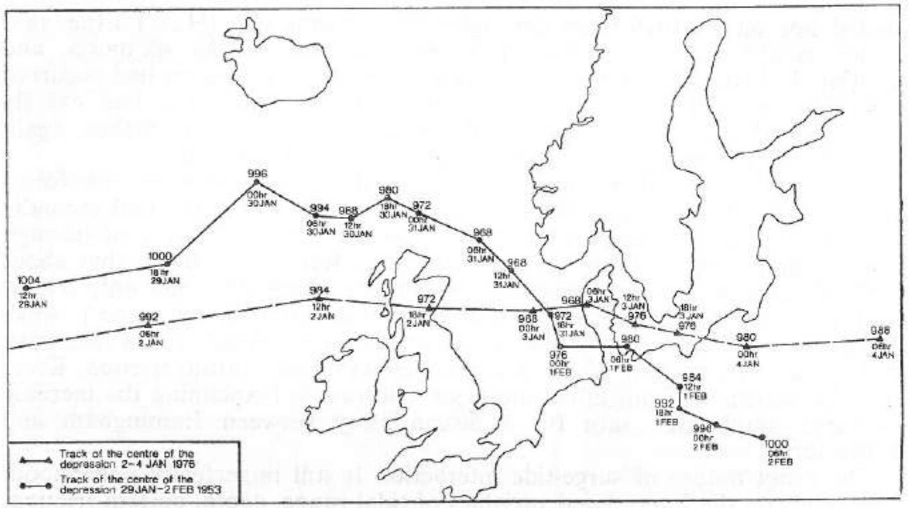

Fig. 5. Comparison of the tracks of the two depressions of 2-4 January 1976 and 29 January to Feburary 1953. The figures are pressures in millibars.

1976 *exceeded* that of 1953 by 0.2 m, but the absolute height was less.

The explanation for these differences lies in dissimilarities of the synoptic (atmospheric circulation) development of the two surges. This can be partly explained by Fig. 5, which shows the paths taken by the two generating depressions. In 1953, the depression was both further north and slower moving. This permitted the surge to be generated outside the North Sea (i.e. 'externally', by the strong westerly winds off the north coast of Scotland), and allowed more time for the winds to act. Subsequently, the depression turned southwards into the North Sea allowing further reinforcement of the surge by the N.W. to N. winds of its rear side. Moreover, in the 1953 case, these winds, being more northerly than on 2/3.1.1976, had a much longer fetch so that the surge was associated with larger and more damaging waves at the coast as Robinson[7] has pointed out. This resulted in large amounts of material being eroded at the coasts and severe breaches in the sea defences. These enabled repeated intrusions of the sea inland for a number of successive periods of high water after the storm. The defences have not only been restored, but also steadily improved after 1953 until the present day. While information on wave heights attained during the 1953 event is lacking, estimates for the 1976 storm range from about 12 m in the Forties oilfield to over 3 m at the Lincolnshire coast.

CONCLUDING REMARKS

The *wind* storm of 2/3 January 1976 was probably the most destructive in Britain for a considerable period of time. Comparable events from the historical past probably include the 'Great Storm' of 26/27 November 1703, which was reported in considerable detail by Daniel Defoe[8], and is still ranked as the most severe storm on English record. This event was the climax of almost two weeks of strong westerly gales, probably caused by

unusually deep depressions moving slowly N.E. between Iceland and Scotland[9]. An estimated 8000 people were killed, countless ships were lost and material damage was immense. From all accounts the 1703 'Great Storm' appears to have been similar to a true hurricane—with a calm centre, no obvious frontal activity and extreme violence—though on a larger scale.

The resulting storm-*surge* of 3/4 January 1976 was more noted for its effects on the continental shore, although it was exceeded by the surge of 1.2.1953 in most places. Comparisons of *magnitude* with surges of the historical past are difficult because of the lack of a long and homogenous series of quantitative sea-level heights, and use of documentary material is complicated by secular variations of mean sea-level and the changing state of the sea defences. Variations in the *frequency* of surges have been investigated by Benwell[5] (and subsequently Hunt[10]) who overcome this problem by defining the meteorological conditions associated with surges on the east coast of Britain and then examined the changes in the frequency of these favourable meteorological conditions since 1872. Benwell showed that, while "the frequency of occasions when meteorological conditions were 'favourable' for sea surges in the late 1950's and early 1960's has been above the long-term (90-year) average . . . ., the 90-year period is probably too short and the indications insufficient to justify attempting a forecast as to the future frequencies by any extrapolation methods". Considering periods greater than 100 years, both Flohn and Lamb[11] suggest that the frequency of sea floods has been nearly constant over the last 1000 years, with the reservations that the dearth of data impose.

More recently, an international newspaper article revealed that data had been cited which suggested the possibility that Europe may be entering a 'storm age' in which the time intervals between storms causing abnormally high tides is becoming shorter. Such predictions are in the realm of climatic forecasting, which is a science still very much in its infancy.

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CAIRNGORM SNOW-FIELD REPORT 1975

By I. C. HUDSON
Highland Guides, Inverdruie, Aviemore

Abstract: Four snow-fields were known to have survived in the High Cairngorms after one of the hottest summers on record in the Scottish Highlands. The survival of these snowfields was due to a number of factors: a cold spring with heavy snowfalls, clear cool summer humidities, and low scatter solar radiation.

ACCUMULATION HISTORY

At least 16 snow-fields survived to see the first winter snows after the very cool summer of 1974. The first snowfalls arrived on 23 September, and on the 25th a snow survey had to be abandoned in moderate snow, a force 6 wind with —1°C and the snow-fields fast disappearing under 15 to 30 cm of fresh snow. They did not see the light of day again—this was most unusual. (I know which had survived, and most of their shapes but not actual sizes).

October saw a continual build-up of snow with little thaw and by late November the build-up was well above average. At the end of the month temperatures changed from well below average to above average and snow cover depleted to below normal by the third week of December. This situation continued until mid-January. Late January had heavy snowfalls at all levels, but accumulations were quickly reduced by a thaw during the first three days of February. This was followed by a dry, frosty period that lasted into mid-March. Thereafter a slow build-up with much drifting onto western and northern slopes commenced, resulting in acute avalanche conditions that lasted into mid-April. (Thirteen persons were involved in two avalanches—three seriously hurt).

The first nine days of April saw heavy snow falls and the worst April blizzards in North and East Scotland for 20 to 25 years, resulting in extensive amounts of snow being drifted onto E.N.E. to S.E. facing slopes, a key factor to the survival of the 1975 snow fields. April's temperatures were normal and May's 2 deg. C below, so that at the time of the memorable June snowfall snow amounts and cover on the Cairngorms was well above average.

The snowfall of 1 June (night), 2 and 3 June (snow showers) accumulated an estimated 28 mm of equivalent rain.The centre of the Polar low passed virtually overhead, wind speeds were generally light, except in the afternoon of the 2nd when snow was drifted onto S.E. and S. faces. On the 5th a high south-westerly drifted snow onto N.E. faces above 1050 m. 6 June saw a rapid thaw of the June snow and commenced the summer depletion phase proper.

DEPLETION HISTORY

Snow cover above 900 m was considerably above normal on 6 June. During the rest of the month, thawing was rapid on sunny slopes but less than would be expected on shaded slopes considering that 8 days attained 26°C at 223 m before the end of the month. This was due to low day humidities, low scatter solar radiation and clear cool nights. An estimated 12 nights out of the remaining 23 had a grass minimum of 0°C or less on the High Plateau.

THAW RATE REDUCTION CRITERIA

1. The lower the relative humidity the slower the rate of thaw at any given temperature.
2. Cool nights not only slow the overall thaw rate, but the more often that snow freezes and thaws the more granulated it becomes (especially after the first three to five cycles) which slows the rate of thaw quite considerably.
3. The less the amount of cloud, especially in high summer, the less the scatter solar radiation to be absorbed by snow that does not receive direct solar radiation (or only receives direct radiation at an acute angle). This is an important factor especially as the snow surface becomes 'dirtier' as the season progresses.

These criteria were met very well during June.

At the beginning of July there were great stretches of snow on N.E. and S.E. slopes, and these facing slopes of Ben Macdui had a continuous field some 1700 metres long by 200 to 300 metres wide between 1100 and 1265 metres (3600 to 4150 ft). I was very tempted to take up my touring skis.

July was warmer than average and generally wet (+2.3 deg. C and 130%) which depleted the snow rapidly. Snow and sleet fell on the 22nd and 23rd. August was 4 deg. C above normal, dry and sunny with 26°C on 10 consecutive days at 223 m. Thaw rates slowed somewhat as the thaw reduction criteria were met during the first part of the month. During the latter part of July and during August all the traditional snow beds facing W.N.W. to N. disappeared. These facing slopes had received less than normal amounts of drift.

Late August and September were cool and wet (–1.5 deg. C and 140%). The first winter snows were on the 13th and 14th, ten days earlier than in 1974, and there was little melt of the old snow until October. October was normal in temperature but with only two light snow falls; November (–0.6 deg. C) had an average number of snow falls but amounts were extremely small; and December (+1.75 deg. C) had very little snow; hence, there was further melting of the summer snow fields. It is most unusual for further melt of the old snow to take place during the last two months of the year, but the last three months were unusually dry (58%) and there was very little new snow to protect the survivors from further loss. Normally the history of the summer survivors ends during the first week of November; buried under the first heavy falls of winter.

1975 SURVEY

On 24 September I carried out a detailed survey of the Cairngorm-Ben Macdui Plateau snow fields (1030–1320m). I could have chosen a better day. The first deep low of the autumn was rapidly approaching. There was heavy rain and sleet, mountain fog, force 8 winds, and 50 cm drifts on Macdui, but I was determined to complete the survey and not to be caught out as in the previous year. Anyway, it was an excellent navigation exercise, but it was just as well I knew exactly where all the traditional snow fields lay. Fourteen known snow-beds were checked, of which eight contained surviving snow-fields.

On 16 October I visited the 'Old Man' snow-field (the only snow in the British Isles that can be called 'Perpetual', for it has been known to have melted only twice this century). I was surprised at its size considering the hot summer. This was the only survivor on the Braeriach-Cairn Toul Massif of the Cairngorms.

As will be seen from the list below, eleven snow-fields survived to see the first winter snows. Two were known to have melted by mid-October. No further checks were carried out after 16 October, but it is definitely known that at least four survived and that one melted either in late November or during December (visited at New Year) which is most unusual. There was a good chance that three others survived.

As stated from the drift patterns during the previous winter and especially the spring, all the late survivors and surviving snow-fields faced N.E. to S.E. Definite survivors faced between E.–E.N.E. and E.S.E., an unusually narrow 'window'. The minimum altitude was 1055 metres (3470 ft) which is the normal minimum.

CISTE MHEARAD (at NJ 012044, near N.E. Cairngorm summit, altitude 1090–1110 m): 51 m × 24 m on 24 September, but thawed by mid-December.

LOCH AVON SLABS, LOWER (at NH 995014, head of Loch Avon horseshoe, altitude 980 m, facing N.E.): 4.5 m × 3 m on 24 September; thawed mid-October.

GARBH DISGE BEAG, NORTH (at NH 994011, near West Carn Etchachan, altitude 1055–75m, facing E.–E.S.E.): 60 m × 20 m on 24 September; survived.

GARBH DISGE BEAG, SOUTH: 24 m × 8 m on 24 September; thawed by mid-October.

BEN MACDUI, N.E. no. 1 (at NN 995998, 2 km N.N.E. of summit, altitude 1140–55 m, facing E.): 55 m × 24 m on 24 September; survived.

BEN MACDUI, N.E. no. 2 (1½ km from summit, altitude 1155–65 m, facing E.): 20 m × 24 m on 24 September; most probably survived.

BENMACDUI, E. no. 1 (800 m from summit, altitude 1240–50 m, facing S.E.): 32 m × 12 m on 24 September; probably thawed.

BEN MACDUI, E. no. 2 (as above, altitude 1235–45 m, facing E.S.E.): 63 m × 39.5 m on 24 September; survived.

GARBH CHOIRE MOR, NORTH (at NN 941981, altitude 1135–40 m, facing E.S.E.): 7 m × 3 m on 16 October; most probably thawed.

G.C.M., CENTRE no 1 (1120–50 m, facing E.–E.N.E.): 55 m × 23 m on 16 October; survived.

G.C.M., CENTRE no. 2 (1135–60 m, facing E.–E.S.E.): 33 m × 14 m on 16 October (joined to the former as 88 m × 23 m); survived.

G.C.M., SOUTH (1115–25 m, facing E.–E.N.E.): 18 m ×7.5 m on 16 October; small but deep, so probably survived.

CLIMATIC CHANGES AND OUTSTANDING SINGULARITIES IN THE LONDON AREA 1947-1975: Part, 6, JUNE

By C. R. FINCH

The first fifteen days of June have frequently proved to be one of the best holidaymaking fortnights of the post–1946 era, with a tendency for somewhat higher temperatures from the 10th or 11th to the end of the

period. Like any other part of the year, there have been failures, as in 1971 and 1972, when anyone relying on a statistical repetition of the usual

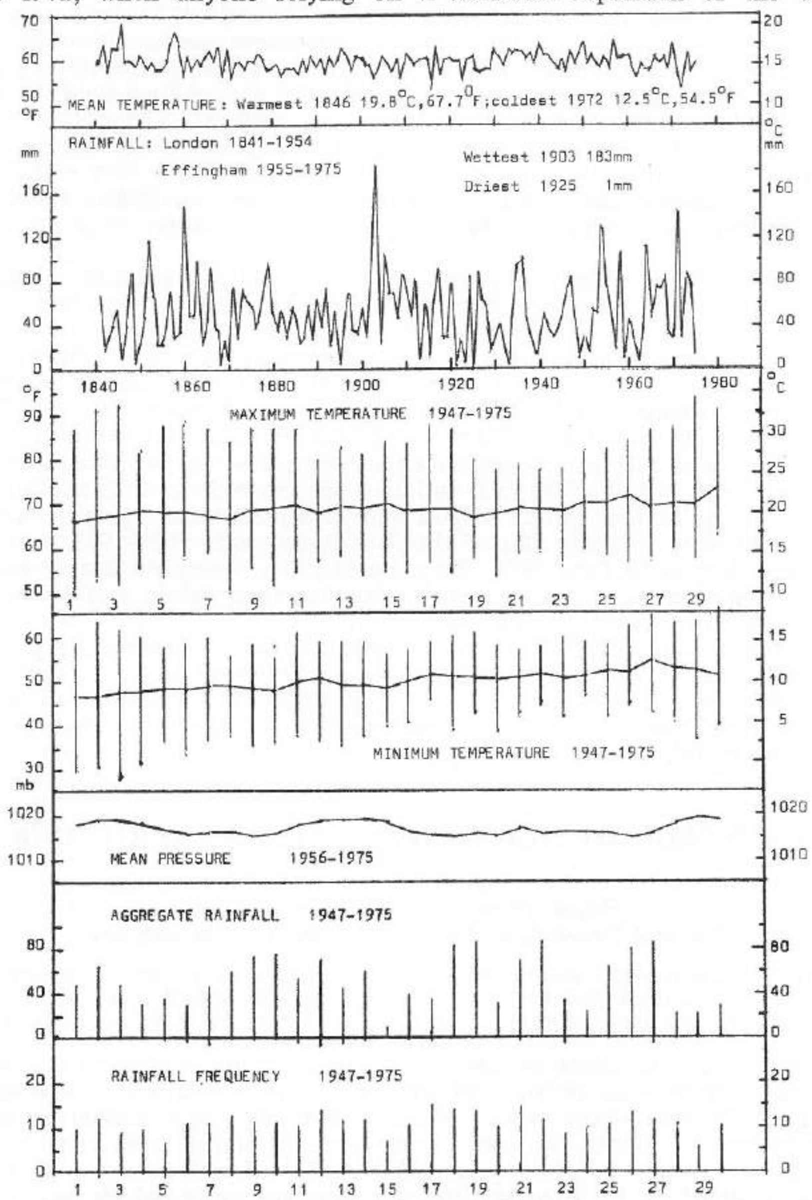

Fig. 1. Temperature and rainfall trends for June in the London area. The extreme temperatures, 1947-1975, are as follows: Maximum, highest, 96°F (35° C) on 29 June, 1957 lowest, 50°F (10°C) on 8 June 1956 and 1 June 1961; minimum, lowest 29°F (—1.5°C) on 3 June 1962, highest 66°F (19°C) on 30 June 1947.

pattern would have been badly caught, but those who selected, say, 1973 (after two poor examples) or 1975 (after a failure in 1974) would have been happily rewarded. The first fortnight of June throughout the whole of the 1960's had scarcely more than a couple of successive, cool, unpleasant days before higher temperature levels returned. The period around the 24th to 26th has frequently proved warm, as has the last day of June (and the first day of July, the warmest day of the year on average). The rise in mean night minimum temperature from the 23rd to a peak on the 27th is also outstanding; by this time it is often noticeable following a very warm day how much warmer and more humid the nights are, as distinct from the much colder nights which follow similarly very warm days in the first half of June.

Although mean monthly rainfall has been lower in February, March, April and July over the last 29 years, no month in the year has had fewer days on which measurable rainfall has been recorded. Out of a total of 870 June days, only 331 have had a measurable quantity of rain (i.e. 0.1 mm or more), equal to 38% of the maximum possible. The next nearest has been 40% for the month of July, the other extreme being January with 56%. The comparative dryness of June is reflected in the fact that only the 12th, 17th, 18th, 19th and 21st can be described as being on the wet side. The remainder, especially the 5th, 15th and 29th are much drier. In fact, 29 June shares the distinction with 22 August and 18 September of being the year's most frequently dry day. Out of the five recent years 1971–1975, 0.8 mm was recorded on 29 June 1974, the remaining four being rainless. Pressure changes in June are down to their slack summer levels and have less significance to rainfall than in other months.

June, like March, April and May, appear to be continuing the pattern of colder Junes which seems to have set in from about 1950, the chief exceptions being the warm Junes of 1957 and 1970. There appears to be no relationship between temperature performance in June and that in the following months of July and August.

RAINFALL DEFICIENCIES MAY 1975-APRIL 1976

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Abstract: The past twelve months (May 1975 to April 1976) have been exceptionally dry in many parts of the British Isles, particularly in the south and Midlands of England. Over England and Wales generally, it has probably been the driest 12-month period since comparable records exist (1727) and, as such, it is worthy of preliminary comment.

Over the period under review, the dominant synoptic pattern has been a large area of high pressure in the vicinity of Scandinavia, sufficiently extensive to raise mean M.S.L. pressures 2–5 mb above normal in most months and to 'block' the westward progression of the main rain-bearing Atlantic systems, thus reducing rainfall. Another effect has been to decrease the amount of cloud cover and to raise sunshine totals, which have been consistently above average in many parts of the country, although there has been little change in mean surface temperatures.

The occasional depressions, vigorous enough to penetrate this blocking pattern, have given heavy falls over much of the region; examples of this occurred on 17 May, 13/14 September and 1 December 1975. A scrutiny of rainfall data for the past year also reveals the noteworthy fact that in many months a far higher percentage of the month's total than usual has fallen on one or two wet days. The outstanding example was December, when many places in the south had 60–75% of the month's total falling on the 1st. The frequency of rain-days is, perhaps surprisingly, not as far below the average as the total rainfall, 80–85% generally, as against 60–70% for total rainfall.

The list below gives annual totals for the period May 1975 to April 1976 from 52 representative stations in England and Wales, and from some in Scotland and Ireland for comparison. Rainfall in the latter areas has tended to be below average as well (mainly 75–90%) but not as much as in the Midlands and southern England (55–70%).

Stithians (Cornwall) 1146 mm (ca. 90%); Dorchester (Dorset) 610 mm (63%); Penmaen (W. Glam.)656 mm; Gurney Slade (Somerset) ca. 790 mm (68%); Odd Down, Bath (Avon) 554.4 mm (65%); Corsham (Wilts) 492.0 mm (63%); Bradford-on-Avon 487.4 mm (59%); Trowbridge 477.3 mm (60%); Codford St. Mary 505.0 mm; Boscombe Down 399.1 mm (55%); Reading (Berks) 359 mm (55%); Lyndhurst (Hants) 548 mm; Newport, Shide (I. of Wight) 515 mm (ca. 65%).

Hove (E. Sussex) 527 mm; Guildford (Surrey) 438 mm (ca. 60%); Gillingham (Kent) 490 mm; Mill Hill (Greater London) 447 mm; Colchester (Essex) 379 mm; Buxton (Norfolk) 458 mm; Scole (Norfolk) 529 mm; Luton (Bedford) 423.5 mm (ca. 65%); Ely (Cambs) 382 mm; Oxford 354.2 mm (54%); Buckingham 350 mm (54%).

Malvern (Worcs) 401.6 mm (53%); Evesham (Worcs) 372.9 (60%); Newport (Salop) 400.4 mm (61%); Keele (Staffs) 604.5 mm; Knutton (Staffs) 589 mm; Oaken (Staffs) 477.9 mm (67%); Walsall 430 mm (60%); Edgbaston Birmingham 464.2 mm (63%); Birmingham 446 mm; Long Lawford Warwick) 379.2 mm (59%); Northampton (Westone) 391.5 mm (60%); Kettering (Northants) 342.9 mm (55%); Wingerworth (Derbyshire) 497 mm (63%); Sheffield (S. Yorks) 515 mm; Newark (Notts) 356.6 mm (56%); Ulceby (S. Humberside) 380 mm (ca. 62%); Cottingham (N. Humberside) 440 mm (ca. 68%); Pickering (N. Yorks) 571.5 mm; Low Etherley (Durham) 548 mm; Billington (Lancs) 892 mm; Liverpool, Knotty Ash 718 mm (80%).

Edinburgh 534 mm; Inverdruie, Aviemore 762 mm (ca. 85%); Banchory (Grampian) 657 mm; Whalsay (Shetland) 1082 mm; Belfast 693 mm; Dublin 493 mm; and Galway 1008 mm.

The lowest rainfall totals, with respect to average, occur in a wide belt from Nottinghamshire, the east and south Midlands to central southern England, where they are less than 60% of the 1941–70 or other longer-term average. The lowest percentages include Malvern 53%; Oxford 54%; Reading, Boscombe Down, and Kettering 55%; and Bradford-on-Avon 59%. Over the Midland region as a whole, *every* month since and including May 1975 has had below average rainfall: the lowest absolute totals are to be found in the south Midlands—for instance, Kettering 343 mm, Buckingham 350 mm, Oxford 354 mm and Reading 359 mm.

Rainfall over the six-month period October or November 1975 to March or April 1976 was less than half normal in many ways, and data for the first four months of 1976 show less than 40% of normal in some districts. April was the driest since 1957 (excluding 1974) in many areas of the country, and since 1893 over the Netherlands as a whole. Absolute drought was reported from many stations between 15 April and 1 May, even from Galway on the extreme west coast of Ireland. As a consequence of above-average sunshine and spells of strong, drying winds, evaporation has been very high; at Long Lawford the total rainfall since May 1975 has been 379 mm (the lowest 12-month fall since the 340 mm April 1933–March 1934) as against the evaporation from an official tank 587 mm; *this is a deficit of over 200mm.* Similar deficits over much of the southern half of England have led to a dramatic drop in the levels of reservoirs, rivers and water-tables. Many reservoirs are less than half-full. Hosepipe restrictions are in force over most of south-western, eastern, north-eastern and parts of northern England and south Wales. The Press has stated that many water authorities have purchased mobile 'water-tankers' and standpipes for use if conditions deteriorate further.

The situation in the agricultural world is very serious, and getting worse, with the drought and sharp frosts in April retarding the growth of vegetation considerably. The attention of the media centres on the price of potatoes, which has trebled in this period (adverse weather last summer greatly lowered crop yields). Thousands of acres of forest and heathland have been destroyed by forest fires in central southern England and fears are growing of a possible conflagration on Dartmoor.

Sources of Data: *Climatological Observer's Link* monthly bulletins, May 1975 to April 1976, and contributions received by the editor of the *Journal of Meteorology*—our thanks to everyone whose figures have been used.

NOTES ON RAINFALL AND SUNSHINE OF THE LAST TWELVE MONTHS IN BIRMINGHAM

Although by no means representative of the driest parts of the country, the rainfall statistics for Edgbaston Observatory, Birmingham over the last twelve months make interesting reading. The relevant monthly figures compared with the long-term averages are as follows:

	1975/76		Mean 1891–1970	
	mm	inches	mm	inches
May	21.7	0.85	60.7	2.39
June	17.7	0.69	53.2	2.10
July	58.2	2.29	65.2	2.57
August	34.8	1.37	71.8	2.83
September	69.7	2.75	56.4	2.22
October	23.0	0.91	68.6	2.70
November	57.4	2.26	71.3	2.81
December	51.7	2.03	71.2	2.80
January	33.7	1.33	64.1	2.52
February	37.6	1.48	50.5	1.99
March	42.3	1.67	50.0	1.97
April	16.4	0.65	52.1	2.05

The total for the twelve-month period 464.2 mm is approximately 63% of the 80-year average. Reference to Edgbaston's records shows that the period May 1975 to April 1976 was the driest 'year' for just over 40 years, and the driest May to April 'year' since comparable* records began in 1886. Occasions when less than 480 mm (19 inches) occurred are as follows:

	mm	inches
*Mar 1904—Feb 1905	428.2	16.86
*Nov 1920—Oct 1921	437.6	17.23
Nov 1933—Oct 1934	458.6	18.05
May 1975—Apr 1976	464.2	18.28
Jun 1943—May 1944	476.4	18.75

The nearest parallel twelve-month period is May 1904 to April 1905 when 19.87 inches (504.7 mm) fell.

Further analysis shows that, following the driest summer half-year in 1975 for 64 years, the 7-month winter period October 1975 to April 1976 inclusive has been unprecedentedly dry in Birmingham. This, of course, is the time of year when normal rainfall exceeds normal evapotranspiration, and therefore reservoirs and water-tables are usually being topped-up. Thus the importance of this winter 'drought' following a summer of abnormal excess of evaporation over rainfall is evident.

Occasions when less than about 300 mm (12 inches) were measured at Edgbaston between October and April are:

Year	mm	inches	Year	mm	inches
1975/6	262.1	10.33	1937/8	282.7	11.13
*1897/8	272.8	10.74	*1904/5	283.7	11.17
*1892/3	274.1	10.79	*1890/1	292.3	11.51
*1920/1	277.4	10.92	1953/4	302.4	11.91
*1887/8	280.4	11.04			

The number of rain days (0.2 mm or more) and wet days (1.0 mm or more) between May 1975 and April 1976 were 89 and 122 respectively; these are both new low records for Edgbaston, emphasising that mean rainfall intensity was unusually high.

The May 1975 to April 1976 year was also a notably sunny twelve-month period. At Edgbaston it was the sunniest since 1949 and the fifth sunniest of the century:

*Mar 1921—Feb 1922	1679.5	Feb 1929—Jan 1930	1573.0
*Mar 1893—Feb 1894	1670.5	Oct 1932—Sep 1933	1559.5
*Nov 1898—Oct 1899	1613.9	May 1975—Apr 1976	1557.4
*Dec 1886—Nov 1887	1584.5	Jan 1959—Dec 1959	1531.7
Jan 1949—Dec 1949	1575.4	*Oct 1913—Sep 1914	1502.7

* [It is no accident that there is a predominance in the above tables (especially the sunshine table) of years before 1925. This, however, does not necessarily reflect a prevailing dryness or abundance of sunshine at that time, as rainfall figures prior to 1923 and sunshine records before 1928 are not strictly comparable with those since, owing to instrumental and observational inconsistencies. If corrections of +7% for rainfall and −7% for sunshine are made to the earlier records, the figures for the period under study are all the more remarkable].

Edgbaston Meteorological Observatory, Birmingham. G. P. EDEN

NOTES ON THE RAINFALL OF THE LAST TWELVE MONTHS IN THE BRISTOL AVON AREA

The following notes concerning the dryness of the twelve months, May 1975 to April 1976, have been prepared from a brief report of the Bristol Avon Division of the Wessex Water Authority communicated to us by Mr. Gordon R. Hobbs. The Bristol Avon catchment has an area of approximately 2200 sq. km and covers much of Avon County and West Wiltshire. This includes Bristol, Bath, Trowbridge, Frome, Westbury, Melksham, Chippenham, Calne, Devizes, Malmesbury, and Tetbury. In the south-west annual rainfall rises to 1200 mm on the Mendips and in the north to 950 mm in the southern Cotswolds around Badminton. In the low-lying, rain-shadow area to the east, from Melksham to Chippenham and beyond, the annual average is less than 750 mm. The average rainfall (1916–50) for the whole catchment is about 827 mm per annum.

For the month of April 1976, rainfall over the Bristol Avon District was low with an area fall of only 10.0 mm. Although April is normally one of the drier months of the year, April 1976 had one of the lowest monthly totals ever recorded. For the entire region, the fall was 18% of the average. The rainfall distribution was normal with the lowest totals of 5.0 mm occurring in the east and the highest, 17.0 mm, occurring on the coastal plain to the west. The only two days with significant rain were the 13th and 14th with an area rainfall of 3.3 mm on each day.

In the first four months of 1976, 126.6 mm have fallen. This is 52% of the average. For the seven-month period from October 1975 to April 1976, the total has been 251.9 mm which is 50%. Finally, for the twelve-months May 1975 to April 1976, the area rainfall has been 520.8 mm, or 63% of the average.

The abnormality of the dryness may be further studied by considering the rainfall return periods at two typical stations for which over 110 years of records are available.

Firstly, at Batheaston (ST 769685) the rainfall for October 1975 to April 1976 of 259.0 mm has only once been lower in a record going back to 1862. This was in 1890–91 when it was 247.8 mm. Next nearest were 279.3, 282.0, and 290.6 mm in 1879–80, 1864–65, and 1937–38, respectively.

The total rainfall for May 1975 to April 1976 of 544.1 mm is 67% of average. There have been only three lower falls since the start of records. The most recent was in 1937–38 (535.7 mm), and the other occasions were last century in 1870–71 (499.7 mm) and 1864–65 mm (441.2 mm).

Secondly, at Litton (ST 589554) in the wettest part of the Mendips, the seven-month total of 366.7 mm for October 1975 to April 1976 is an October–April record for the period 1860–1976. The twelve month total for May 1975 to April 1976 is third lowest at 690.7 mm. It was lower in 1933–34 (644.2 mm) and 1937–38 (669.9 mm).

Lyneham (SU 012786) has had 438.7 mm and Tytherington (SU 668884) 511.8 mm in the same twelve months. These totals are respectively 60% and 58% of the 1916–50 averages.

THE EARLY MAY HEATWAVE: 1

Between 6 and 10 May 1976 north-west Europe enjoyed an early burst of summer weather, with temperatures rising to 29°C in southern England and exceeding 30°C on the continent.

On the 5th a belt of high pressure lay from Rumania to Denmark with a low-pressure area to the west of Portugal; late in the day, warm air from the continent spread to the south coast of England as a warm front edged slowly northwards. The next day, temperatures rose swiftly in the rather humid, south-easterly airstream to 22–24°C east and south of a line from Devon to Gloucester, Bedford and Essex; and on the 7th temperatures soared to 26–28°C in these areas, with 29°C attained in the London region (including Heathrow and Guildford). These temperatures are the highest to have been recorded so early in the season since 29°C was reached in London on 16 April 1949. Such, however, has been the comparative coolness of May in recent years that at numerous stations 7 May 1976 was the hottest May day for 13 years or more. At East Malling and other places in the south it was the highest May maximum since 1953. Temperatures of 23°C on the 7th occurred as far north as Lancashire and Nottinghamshire. Later in the day thunderstorms broke out in Wales, the Midlands, and Northern England.

TABLE 1

	6th	7th	8th	9th	10th
Guernsey	21	24	18	16	14
Bristol, Filton	21.6	25.8	22	20.4	19
Hemyock (Devon)	23.3	25.2	22.8	22.3	17.0
Ilminster (Som)	23.0	26.8	22.4	19.5	—
Corsham (Wilts)	23.3	27.2	24.7	23.3	19.4
Trowbridge	23.8	27.8	24.5	23.2	19.2
Codford	22.8	27.0	24.6	23.6	19.1
Boscombe Down	23.0	26.7	24.9	23.8	18.7
Reading (Berks)	23.8	27.4	24.9	25.5	18.1
Hurn (Hampshire)	24	26	25	26	20
Brighton (Sussex)	21.7	26.1	25.6	27.2	23.3
Hastings	24.9	26.2	27.1	25.4	22.0
East Malling (Kent)	21.3	28.5	25.5	25.2	20.6
Sidcup	22.7	30.0	28.0	26.6	21.4
Guildford (Surrey)	23.7	29.4	27.9	26.6	19.9
Sanderstead	21.2	28.5	26.8	25.1	19.8
Kew	23	28	26	26	18
Gt. Gaddesden (Herts)	23.8	26.0	24.7	24.7	17.7
Luton (Beds)	24.1	26.0	24.4	24.7	—
Evesham (Worcs)	20.6	22.4	24	22	20
Long Lawford (Warks)	17.8	23.2	23.3	20.7	17.9
Edgbaston	17.3	23.0	20.9	20.7	16.1
Leicester	17.8	23.6	22.8	18.9	18.2
Cribyn (Dyfed)	16.1	21.6	22.8	17.9	17.5
Nottingham	15.4	23.5	23.5	18.8	13.9
Newark	16.4	23.7	23.5	19.6	18.0
Manchester	17	23	18	19	15
Carlisle	15	19	15	18	14
Ukkel (Belgium)	28.6	30.9	30.3	31.8	26.0
Leuven („)	28.4	30.8	31.1	31.2	25.7
Schettens (Holland)	18.9	26.7	24.5	27.0	24.8
Rotterdam („)	25.2	28.6	28.1	28.7	22.3
Volkel („)	26.8	30.0	31.4	30.5	31.6

During the 8th the pressure gradient slackened as the anticyclone drifted further south-east and a thundery low developed over France. Temperatures rose quickly, but not usually to the levels of the previous day. There were isolated thunderstorms in the south-east, and a localised fall of 44 mm occurred in South London. By the 9th the wind had become northerly, and only the south-eastern and central southern regions were warm in England; scattered thunderstorms again developed. It was still hot and humid on the 10th in Belgium, the Netherlands, and Germany, but the only parts of Britain remaining warm were a few places along the south coast sheltered from the northerly winds.

G.T.M.

THE EARLY MAY HEATWAVE: II

In his classic book *Climate and the British Scene*, G. Manley notes that 'if an anticyclone in which the air as a whole has been derived from warmer regions is centered over these islands with clear skies, the May sun gives high maxima; 80°F (26.5°C) is occasionally reached in S. England before the 10th of the month'. The rarity of such an event is suggested by J. H. Brazell's finding that the highest temperature on record at Kew in the first ten days of May was 25.6°C reached in 1923, and 1945. He also suggests that temperatures of 28°C or above are likely to be recorded in May in only six years out of 80 (*London Weather,* Met. O. 783, 1968).

This year's short, intense heatwave from 6–9 May produced three consecutive days with maxima above 27°C in parts of S.E. England and on the 7th the maximum reached 29°C at Heathrow and some other stations. The Kew maximum was 28°C on the same day. In the north and west temperatures were near normal and in parts of N. Scotland maxima of about 10°C occurred during the period. This was probably the warmest spell of May weather in the S.E. since the spell late in the month in 1953. Temperatures generally in N.W. Europe were considerably higher than those in the Mediterranean basin and on both the 8th and 9th de Bilt in Holland reported values of 29°C, and Cologne 30°C while in S. Spain temperatures were between 17–22°C.

The warm air was advected northwards across Europe and into the British Isles behind a warm front associated with a filling depression west of Biscay. Simultaneously pressure rose over the North Sea with a well-developed anticyclone forming on the 6th which moved eastward to Denmark the next day and further east to Poland on subsequent days. Pressure remained high over Britain in a ridge linking the European high to the Azores high. On the 8th pressure began to fall over France and a thundery depression formed which then drifted northwards across Germany and the low countries. The warm weather ended in S.E. England early on the 10th as a cold front moved in from the west, triggering off thunderstorms and introducing fresher air of Atlantic origin.

University College of Swansea. A. H. PERRY

(Received 20 May 1976)

THUNDERSTORM IN LONDON, 8 MAY 1976

A heavy thunderstorm affected parts of south and east London on the evening of Saturday, 8 May 1976. The maximum recorded precipitation totals were at Brockwell Park (TQ 315740) where 43.8 mm fell, Telegraph Hill (TQ 357761) 41.8 mm, Ruskin Park (Denmark Hill) (TQ 326759) 33.2 mm, and Deptford Pumping Station 18.5 mm.

The storm started about 1630 G.M.T. and finished about 1830 G.M.T. It was centered over Lambeth and Camberwell districts and was extremely localised, covering a region only 6 km in diameter. Stations at Battersea Park, Eltham and Kensington Palace Gardens received no rain at all, whereas east and north-east London had some rain although below 5 mm with a duration of only 10–20 minutes. The maximum intensity of the precipitation was between 1730 and 1815 G.M.T., which is also the time that areas on the fringe of the storm experienced their precipitation.

Some local flooding incidents occurred in the Deptford area. The Rivers (Non-Tidal) Flood Warning Scheme became operative, but due to the very localised nature of the storm only the telemetered gauge at Deptford Pumping Station recorded the precipitation. A short-term alarm dial-out was received from Deptford at 1815 G.M.T.

Department of Public Health Engineering, C. M. HAGGETT
Greater London Council.

LETTERS TO THE EDITOR

VIVID DISPLAY OF COLOURED LIGHTNING

In the late evening of Friday, 7 May 1976, I witnessed what was for me the most beautiful sky phenomenon that I have ever seen.

At approximately 2050 G.M.T., from my home on the western outskirts of Northampton, I noticed sheet lightning in the N.W. The display reached a peak at 2130 G.M.T. by which time the flashes were of kaleidoscopic beauty—coloured patterns, mostly of pink, orange and red, in the form of shimmering streamers. There was the occasional flash giving a blueish, irregular, nebulous appearance. The flashes were vivid, yet not the slightest rumble of thunder could be heard.

The day had been very warm with unbroken sunshine. During this remarkable display, stars to about third magnitude were visible to about 30° above the horizon, where they became obscured by impenetrable haze. The moon was also visible in the western sky at about half phase. On the northern horizon were the silhouettes of towering cumulonimbi, around and between which the lightning flashes were seen.

102 *Main Road, Duston, Northampton* D. J. HAMMOND

TWO STORMS OVER SANTA EULALIA, IBIZA, BALEARIC ISLANDS, 17 APRIL 1976 AND 20 APRIL 1976

I have recently had a short holiday in Ibiza, and at the start of my visit on 16 April, strong northerly winds were developing. These winds rose to a fresh gale on 17 April, which I understand is unusual for the island. The wind was blowing from a north-north-west direction. During the evening the sky became extremely heavy and for a short period heavy rain fell. Accompanying this rain was a *red-coloured earth*, which I was told had been brought from the Spanish mainland, as a result of several tornadoes. Unfortunately, I have not established the location of these violent storms or tornadoes.

A few days later, on 20 April, there was a thunderstorm beween 1115 and 1245 GMT. The storm was travelling west to east with thunder audible throughout these 90 minutes. Rainfall was heavy—I would estimate 15 to 20 mm—although I had no instruments to measure it. The rain came mainly towards the end of this period, i.e. between 1210 and 1230 GMT, and the centre of the storm was moving about 3 km south of Santa Eulalia in an eastward direction.

27 *Haslemere Avenue, London, S.W.*18 DAVID ANDREWS

A SURPRISE FOR HOLIDAYMAKERS IN GREECE ON 29 APRIL 1976

On Thursday, 29 April, I had an unusual experience during my holidays in Greece. Together with others in the group, I went to the beach of Glifada, about 20 km south-east of Athens. The morning was fine with clear sky and a light air from the south-west. The temperature at 1000 local time (0800 GMT) was 22°C and the relative humidity 47 per cent.

After a bathe in Saronic Bay, estimated water temperature 19-20°C, the air felt remarkably cold considering the temperature should be about 22°C. Then, at 1200 local time, the brightness of the sun weakened, and for the first time we became aware of the eclipse of the sun. The temperature dropped quickly to about 15°C (estimated) and the wind rose to about 10 knots (estimated). Small altocumulus clouds appeared, but the cover did not reach 2 oktas. We all began to feel cold and got dressed quickly. We had not heard about the eclipse, so it was quite a surprise to us. Later we read that the eclipse began at 1155, and that at 1342 (local time) the moon concealed 92 per cent of the sun. No wonder that the temperature fell so much. During the eclipse, the day resembled a clear night. Afterwards the sun grew bigger, and the temperature rose to a maximum of about 23°C that day. But I shall always remember my holiday bathing in almost a total eclipse of the sun.

Faergevej 74, Frederkssund, Denmark E. SKJODT

A SHARP SPRING FROST IN THE NETHERLANDS

The night of 28/29 April was very cold in Holland. Temperatures dropped to —3°C in coastal districts, and to —6 or —7°C in the eastern part of the interior.

At the airport of Deelen, —7°C was measured; this is a new record for late spring in Holland. The previous coldest was —5.4°C at Castricum on 9 May 1944. The record for the third period of April (21st—30th) was broken at most stations as well. The previous lowest temperature for that period was —3.8°C, which occurred on 21 April 1938 at Winterswijk. At the head-office in de Bilt, the new record is —4.8°C, which is much below the old late spring record of —3.7 on 4 May 1929. However, Holland's lowest-ever April temperature of —8.1°C, set at the airport of Eelde on 19 April 1969, remains unchanged.

The frost was disastrous for the farmers. Many of the young vegetables, and the pear, apple and plum blossoms, were seriously damaged. That night, a belt of high pressure, filled with Arctic air, lay over us. The air was clear and dry, and there was no wind.

Buurt 4—12, Marken, The Netherlands. J. VISSER

EDINBURGH'S SNOWFALL OF 2 APRIL 1976

Edinburgh is normally relatively free of snow, but the heaviest fall this winter occurred in April.

During the 2nd a shallow 'low' moved across the Midlands into the North Sea, and heavy precipitation occurred in Edinburgh from about midnight to 14 h. At my station (altitude 80 m) this may have been rain or sleet initially, but by 07 it was snowing steadily and at 0830 the snow cover was 1.5 cm deep, precipitation for the previous 12 hours amounting to 15.1 mm. From 0830 to 1400 a further 10.5 mm fell, mostly as snow which reached a maximum depth of 4 cm. In higher parts of the city (altitude 150—200 m) much greater depths were reported, probably up to 15 cm.

As I was due to drive to Cumbria on the 3rd, I listened to news bulletins about the state of the roads, but the snow was local and no blocking was reported except near Edinburgh. The limited extent of the heavy snow was evident next day, for when driving south we passed snow-depths of 10 cm in Edinburgh's outskirts, but none at all 30 km south at Biggar.

Total precipitation for the whole month proved to be 45.4 mm, which is 15% *above* the April average.

31, Campbell Road, Edinburgh P. R. CUTFORTH

THE CLIMATOLOGICAL OBSERVERS LINK

The accompanying map shows the locations of 118 *Climatological Observers Link* stations in the British Isles. In addition, there are eleven stations on the continent of Europe, in Belgium, Holland, Denmark, Norway and Sweden, and one in the U.S.A.

COL issues a monthly bulletin about the tenth of each month, which provides a concise account of the previous month's weather. There is also an annual summary.

Each monthly bulletin begins with a synopsis of the weather, followed by discussions about the temperature, rainfall and sunshine extremes, besides any unusual occurrences at individual stations. Tables of the monthly returns

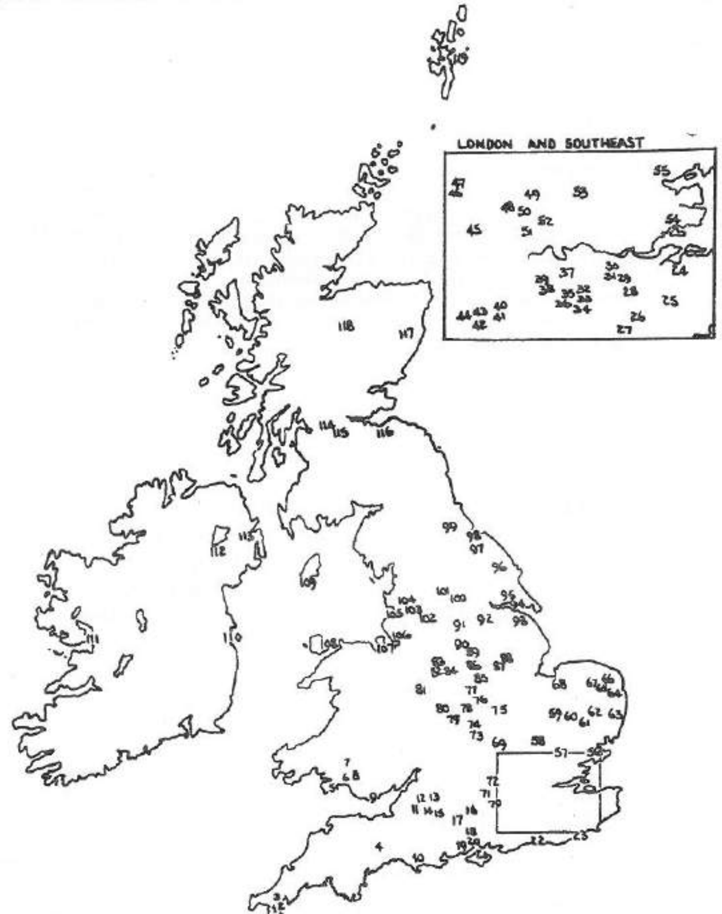

Fig. 1. Locations of the stations: 1 Constantine, Cornwall; 2 Penryn, Cornwall; 3 Stithians, Cornwall; 4 Hemyock, Devon; 5 Penmaen, W. Glamorgan; 6 Swansea, W. Glamorgan; 7 Brynamman, Dyfed; 8 Swansea City, W. Glam.; 9 Barry, S. Glamorgan; 10 Dorchester, Dorset; 11 Gurney Slade, Somerset; 12 Odd Down, Avon; 13 Corsham, Wilts.: 14 Bradford-on-Avon, Wilts.; 15 Trowbridge, Wilts.; 16 Overton, Hampshire; 17

Grateley, Hampshire; 18 Romsey, Hampshire; 19 Lyndhurst, Hampshire; 20 Totton, Hampshire; 21 Shide, Isle of Wight; 22 Hove, E. Sussex; 23 Hastings, E. Sussex; 24 Gillingham, Kent; 25 Maidstone, Kent; 26 Paddock Wood, Kent; 27 Tunbridge Wells, Kent; 28 Sevenoaks, Kent; 29 Orpington, Kent; 30 Sidcup 1, G. London; 31 Sidcup 2; 32 West Ewell, Surrey; 33 Sanderstead, G. London; 34 Caterham, Surrey; 35 Epsom Downs 1, Surrey; 36 Epsom Downs 2; 37 West Dulwich, G. London; 38 Morden, G. London; 40 Thames Ditton, Surrey; 41 Walton-on-Thames, Surrey; 42 Shalford, Surrey; 43 Guildford, Surrey; 44 Guildford (Pewley Hill); 45 Rickmansworth, Hertfordshire; 46 Great Gaddesden 1, Herts.; 47 Great Gaddesden 2; 48 Edgware, G. London; 49 Potters Bar, Herts.; 50 Mill Hill, G. London; 51 London NW2; 52 Highgate, G. London; 53 Epping, Essex; 54 Rayleigh, Essex; 55 Witham, Essex; 56 Colchester, Essex; 57 Dunmow, Essex; 58 Royston, Herts.; 59 Ely, Cambridgeshire; 60 Great Barton, Suffolk; 61 Elmswell, Suffolk; 62 Scole, Norfolk; 63 Halesworth, Suffolk; 64 Framingham Earl, Norfolk; 65 Old Costessey, Norfolk; 66 Buxton, Norfolk; 67 Taverham, Norfolk; 68 King's Lynn, Norfolk; 69 Buckingham, Bucks.; 70 Sandhurst, Berks.; 71 Reading, Berks.; 72 Henley-on-Thames, Oxon; 73 Byfield, Northants; 74 Long Lawford, Warwicks; 76 Leicester, Leics.; 77 Newtown Linford, Leics.; 78 Hinckley, Leics.; 79 Birmingham (Hall Green); 80 Birmingham, West Midlands; 81 Newport, Shropshire; 82 Silverdale, Staffs.; 83 Knutton, Staffs.; 84 Newcastle-under-Lyme, Staffs.; 85 Loughborough, Leics.; 86 Littleover, Derbyshire; 87 Bleasby, Notts.; 88 Newark, Notts.; 89 Wingerworth, Derbyshire; 90 Eastmoor, Derbyshire; 91 Sheffield, S. Yorks.; 92 Gainsborough, Lincs.; 93 Ulceby, Humberside; 94 Hull, Humberside; 95 Cottingham, Humberside; 96 Pickering, N. Yorks.; 97 Great Ayton, N. Yorks.; 98 Middlesbrough, Cleveland; 99 Low Etherley, Durham; 100 Bradford, W. Yorks.; 101 Bingley, W. Yorks.; 102 Todmorden, Lancs.; 103 Accrington, Lancs.; 104 Billington, Lancs.; 105 Preston, Lancs.; 106 Knotty Ash, Merseyside; 107 Neston, Cheshire; 108 Red Wharf Bay, Gwynedd; 109 Port St. Mary, Isle of Man; 110 Dublin, Eire; 111Galway, Eire; 112 Bessbrook, Armagh; 113 Belfast, Antrim; 114 Kirkintilloch, Strathclyde; 115 Glasgow Newlands, Strathclyde; 116 Edinburgh, Lothian; 117 Banchory, Grampian; 118 Inverdruie, Highland; 119, Whalsay, Shetland.

come next, ending with a table of regional differences from the average. The monthly returns include data on mean maximum and minimum, highest maximum and lowest minimum with dates, total monthly rainfall, number of rain-days (0.2 mm or more), greatest fall in a rainfall day (with date), total sunshine, and the numbers of days with air frost, ground frost, snow or sleet, snow lying at the morning observation, thunder and hail. Metric units are used throughout. Lastly there is a newsletter section about six sides in length, which contains interesting and varied short articles submitted by members. Recent articles, January—April 1976, include the following: November sunshine; the great gale of 2 January 1976; persistence of type; low minima over snow in Suffolk; local radio broadcasting; spring snowfalls 1966—75; meteorological seasons; and 1975 sunshine in Wales.

The annual subscription, including postage, is £3.00 in the U.K., and £3.50 (or equivalent) abroad (cheques and money orders payable to Climatological Observers Link). Anyone is welcome to join, whether or not he runs a weather station and enquiries from observers in areas under-represented on the map would be most appreciated.

Sample copies, report form, and further information may be obtained from the editor, Mr S. D. Burt, 2 School Street, Long Lawford, Near Rugby, Warwickshire., CV23 9AU, England.

WORLD WEATHER REVIEW: FEBRUARY 1976

United States. *Temperature*: rather cold W. Washington, Oregon, N.W. California; otherwise very warm, anomaly +5 deg. or more from Montana to Minnesota and S. to Tennessee and N. Texas. *Rainfall*: wet W. of 105°W (over 300% S.E. California, S. Nevada, S.W. Utah, N.W. Arizona) and round Great Lakes. Dry E. Montana, and from S. Minnesota via Nebraska

to Texas; also all S. E. states except S. Florida.

Canada. *Temperature*: warm British Columbia (except coast), Alberta, Saskatchewan, Manitoba, Ontario, S.W. Quebec, and islands beyond 75°N; anomaly +5 deg. or more S. Alberta, S. Saskatchewan. Yukon and N.W. Territories cold, —3 deg. or more Yukon, Baffin Island, Labrador, N. Newfoundland. *Rainfall*: w etN.W. Arctic islands, coast of British Columbia, band S. Yukon along 60°N to Hudson Bay; round Great Lakes and St. Lawrence estuary, most of Quebec, Edmonton to Winnipeg. Dry round Mackenzie estuary, most of the Arctic islands, N. Quebec, interior British Columbia, C. Saskatchewan, James Bay, S.E. Labrador.

South America. *Temperature*: mostly rather cold, especially N.W. Argentina and near Brazil—Peru border, but no large anomalies. *Rainfall*: wet Venezuela, Guianas (200—400%), N.E. Brazil, S. Uruguay, most of Argentina (300—1000% parts of S.E.). Dry in W. and most of S.E. Brazil, extreme N.W., S. and S. W. Argentina.

Europe. *Temperature*: mostly warm (+3 deg. much of Norway and Sweden); cold E. of 20°E. *Rainfall*: wet most of Norway, N.E. Spain, S. France, Italy, coastal Yugoslavia, Greece; elsewhere dry or very dry, below 25% Poland, E. Czechoslovia, Hungary, most of Romania, much of E. Germany and European Russia, and parts of Bulgaria, Austria and Denmark; rainless in S.E. Poland, N. Romania. *Notable Rainfalls*: 4th: 61 mm, Toulon, 58 mm, Mont Aigoual, France; 5th: 72 mm, Mont Aigoual, 60 mm in 12 hrs, Guardiavecchia, Italy; 6th: 71 mm, Solenzara, Corsica, 58 mm, Catania, Italy; 7th: 60 mm in 12 hrs, Malta; 15th: 59 mm, Rome; 19th: 186 mm, Mont Aigoual; 20th: 79 mm, Mont Aigoual.

Africa. N. coastal areas mostly rather cold; N.E. Algeria and much of Tunisia wet, S. Algeria dry; rest of continent not yet available. *Notable rainfalls*: 5th: 43 mm, Tangier; 8th: 48 mm in 12 hrs, Upington, South Africa; 14th: 43 mm in 12 hrs, Djanet, Algeria; 19th: 140 mm in 12 hrs, Fascene, Madagascar.

U.S.S.R. *Temperature*: warm along N.W. coast as far as Taimyr Peninsula, and from Sakhalin W. to near Afghanistan border; other areas cold; very cold in N.E. Siberia (—8 deg.), C. Siberian Plateau, very large area W. of 70°E., —6 deg. in many places N.E. of Black and Caspian Seas. *Rainfall*: wet in Caucasus (200—300%), broad band from Iran border via Lake Balkhash N. to Ob estuary, also Lake Baikal E. to Sakhalin, along 130°E and Kamchatka; over 200% Gulf of Ob, W. of Omsk and Samarkand, near 120°E 55°N and round much of Sea of Okhotsk. Dry W. of line Crimea—Novaya Zemlya (often under 25%), N.E. of Caspian Sea, W. of Irkutsk, C. Siberian Plateau, most of E. Siberia.

Far East. *Temperature*: warm China (except Tibet), Japan, Korea; anomaly +3 deg. in Manchuria; cold Iran, Afghanistan, most of Pakistan; India mixed. *Rainfall*: wet Iran, S.W. Pakistan (up to 400%), Himalayas, Korea (200–400%), Japan, W. Philippines, E. Borneo, Celebes. Dry much of India and China, N.E. Philippines. Worst drought for over 100 years in Malaya and Singapore: wells dry, rivers very low, crops affected.

Australia. *Temperature* not available. *Rainfall*: mostly wet or very wet, over 300% in large area round Lake Eyre; rather dry in various coastal areas; very dry round Kalgoorlie. Floods led to heavy loss of sheep in N.W. New South Wales and S.W. Queensland.

APRIL WEATHER SUMMARY: 1976

April was another dry month, with pressure above average over the greater part of north-west Europe. After seven consecutive dry months, and with 10 or 11 months dry in the last 12, much of England is facing a serious water crisis. The 12-month deficit is generally 30–40%, and it is as high as 45% in some central and southern regions.

April began with W. to N.W. winds, the highest pressure being over central Europe, but during the second week anticyclonic conditions increasingly influenced the weather of the north-west and the third and fourth weeks were almost wholly dry over Britain and the adjacent continent.

Early on the 1st, a wave depression developed on a weak cold front which had become stationary over southern England. This depression crossed the country to Denmark by the 2nd, giving mostly light rain while northern parts had wintry showers. The 2nd was the month's coldest day at a number of stations, with maxima around 5°C; at Eskdalemuir it was only 2°C. The Danish low lasted until the 3rd, with a long front trailing across Germany, France and Spain. Another depression persisted in Iberia from the 1st to 5th, and on the 4th it extended into France. Occasional fronts and troughs crossed Britain from the W. or N.W. but they were weak in the south, while a deep depression gave heavy rain or snow in northern Scandinavia on the 5th and 6th. In the northerly flow, as a ridge reached Britain from a strengthening anticyclone in mid-Atlantic, a widespread sharp frost gave minima down to —5°C in Britain on the 7th/8th and in Holland on the 8th/9th. At the same time, there was a thundery depression over Italy. The anticyclone continued to extend as a long belt into W. Europe on the 9th and then into E. Europe, while a complex area of low pressure lay to the north of Scotland and Norway. Gradually, a cold front edged across Scotland and Ireland on the 11th and England the following day, whereupon it formed a new wave near Portugal which moved east across North Africa in the ensuing three days. A frontal trough from a depression which deepened over Iceland crossed Scotland during the 13th, but as it reached the North Sea a secondary depression appeared upon it. This depression moved south to Belgium on the 14th, giving the only substantial rain of the month in the east and centre of Britain. Up to 10–15 mm rain were recorded, but the south and south-west escaped lightly.

For the remainder of the month, anticyclones dominated the weather. The Azores anticyclone intensified to reach and cover Britain, and winds became variable or often north-easterly. Fog affected the south on the nights of 16/17th and 17th/18th, remaining dense locally until 10 G.M.T. Apart from this, Easter (16th–19th) was fine and warm; in London, it was the warmest since 1952. Corsham (Wiltshire) recorded 18.3°C on the 17th, numerous places had 19°C on the 18th. Southampton and Hurn (Bournemouth) 21°C on the 19th, and Hurn and Valentia (Eire) 21°C on the 20th. Leuven, in Belgium, registered 22.7°C on the 19th, and Inverdruie, in a sheltered Scottish valley, enjoyed a Fohn-assisted 22.2°C on the 20th. Meanwhile, N. Sweden suffered heavy snowfalls from an intense depression on the 19th and 20th.

On the 23rd one metre of fresh snow fell in the upper Alps, closing all the passes; two days later three people died in an avalanche at Curon Venosta, near the Austro-Italian border. Wintry showers affected eastern parts of England on the 23rd and 24th with light snowfalls locally. The 27th was particularly cold, maxima being 8–10°C generally, but only 6.3°C at Butser Hill (Hampshire) and 1.1°C at Valla (Sweden). Several reports of land-devils have been received from the west Midlands for the 28th, and the Mendips and Essex for the 29th. The month ended with night frosts on 28th–30th, which were severe for the time of year on the night of 28th/29th. Minima of —5 to —6°C occurred in Somerset and Wiltshire, —5.7°C at Cardington (Bedfordshire), —4.9°C at Billington (Lancashire), —5.2°C at Braemar, —4.0°C at Gorredijk (Holland), and —6.4°C at Valla in Sweden.

The Central England mean temperature for April was about 7.9°C, or 0.4 deg. below the 1941–70 average.

Professor H. H. Lamb's classification of daily circulation types for *April* is as follows: 1 C; 2 CN; 3–4 W; 5–6 NW; 7 N; 8–9 A; 10 AW; 11—; 12 A; 13—; 14 CN; 15–18 A; 19–21 AE; 22 E; 23 ANE; 24 NE; 25 ANE; 26 NE; 27 ANE; 28–30 A

For *March* it was: 1–2 A; 3 AS; 4 S; 5–6 SE; 7–8 E; 9 A; 10 ASW; 11 W; 12 C; 13 CE; 14—; 15–16 C; 17 A; 18—; 19 ASE; 20–21 S; 22—; 23–24 A; 25–27 W; 28 AW; 29–30 W; 31 CW. (Further details are given in the Climatic Research Unit Monthly Bulletin).

SUPPLEMENTARY WEATHER NOTES: APRIL 1976

LEUVEN UNIVERSITY, Belgium (H. Poppe): 213 h sun; snow on 23rd.

FREDERIKSSUND, Denmark: 186.5 h sun; humidity of 22% on 24th; sleet on 27th.

GRENOBLE, Poisat, France: 38.9 mm de pluie, chute de neige le 24.

GORREDIJK (J. J. G. de Jong): Driest April in Friesland since 1893; — 4.0°C on 29th, lowest in late spring since 1851 judging by the long record of Leeuwarden.

SCHETTENS (K. Ybema): —3.1°C on 29th; snow on 23rd and 28th.

TEN POST (H. A. Veldman): tl on 14th at 15 GMT; —5.1°C on 29th; MSL pressure 1019.0 mb; rainfall 14%, driest April since 1883.

NORWAY (Bernt Lie): tl on 6th at Donski (0232 GMT) and Bergen; Oslo, second driest April of the last 30 years; Bergen, wettest April since 1949; Trondheim, snow cover on 24 days, double the normal; 41 cm deep on 1st and 2nd.

VALLA: 33.4 mm rain, 9.4 on 26th; snow 12 days, lay on 8th, 27th, 28th.

BESSBROOK: 28.6 mm rain on 10 days, 2 days with hail; 10.3 mm on 10th.

WHALSAY (S. G. Irvine): 103.7 h sun; 3 gales; snow lay on 1st.

FAIR ISLE (D. Wheeler): 8 days with gale; mean speed 16.9 kt; two fogs at 09.

KEISS: 106.5 h sun; M.E.T., 30 cm, 6.7°C.

BRAEMAR: 18.6 mm on 11 days, 5.4 on 1st; snow lay 1st and 2nd.

INVERDRUIE: Snow lay on 1st, 2nd, 8th; maximum winter snow accumulation above 1000 m (3200 ft) in Cairngorms on 14th—15th.

SWANSEA: 193.6 h sun; 30 cm M.E.T. 9.2°C; mean see temperature 9.0°.

STITHIANS (Miss Corey): 191.4 h sun; rainfall 26% of 1941-70 average.

ILMINSTER: 135 h sun; ground frosts 16th—30th; worst blossom damage since 1967.

DUNDRY HILL, south of Bristol (M. K. Vickers): 165 h sun.

CODFORD ST. MARY: 5.9 mm rain, 3.4 on 14th; 30 cm M.E.T. 8.4°C.

READING UNIVERSITY: 188.7 h sun (+47.9 h); mean temperature, +0.15 deg.

SANDHURST (J. M. Heighes): 41 h air frost; rain 21% of average.

ROMSEY (C. Watts): 193.3 h sun; rain at Lyndhurst, 9.5 mm (hail on 14th).

NEWPORT, Shide: 6.3 mm on 3 days, 4.1 mm on 14th; 199.2 h sun at Ryde; *correction*, the period October 1975—February 1976 was the driest at Ryde since before 1918, and the three winter months had 154.5 h sun.

BRIGHTON; 9.1 mm rain on 5 days, 4.3 on 13th; hail 14th, sleet on 23rd.

HASTINGS (D. I. Powell): Snow settled on 24th for half an hour; hail on 23rd.

EAST MALLING Research Station: 210.4 h sun; sleet on 23rd.

WORPLESDON, Merrist Wood Agric. Coll.: 177.2 h sun; 12.7 mm (6.1 on 14th).

EPSOM DOWNS (J. Bird): 20 mm rain; mean maximum, 13.1°C, minimum 3.2°C; 19.5°C on 18th and —4.7° on 29th; 65% average rain in the last twelve months.

EPPING (R. J. Prichard): tl 5 km ESE at 1218 on 2nd.

GREAT EASTON (R. C. Hinton): 11.6 mm on 4 days, 5.9 mm on 14th.

BUXTON, near Aylsham (Dr. Briscoe): 30 cm M.E.T. 9.1°C.

OXFORD UNIVERSITY, Radcliffe: 149.7 h sun (3 h below average); mean air temperature was normal; 30 cm M.E.T. 9.3°C; 29th was latest spring frost since 1960.

NORTHAMPTON: 10.8 mm rain on 7 days, 4.0 on 14th; sleet on 23rd.

BIRMINGHAM, Edgbaston Observatory: 119.5 h sun (—12.8 h); grass minimum on 29th was the lowest for April since 1929, and the lowest-ever so late iin the season.

LONG LAWFORD: Rainfall 31%, sunshine 93% (130.3 h), and mean temperature 0.6 deg. below 1941—70 average; 30 cm M.E.T. 8.4°C; M.S.L. pressure highest since 1957.

WINGERWORTH (D. Fellowes): 117 h sun; 30 cm M.E.T. 7.9°C.

BORROWASH, Derby: 9.4 mm rain on 5 days, 3.6 on 1st; 113 h sun.

KEELE University (M. B. Edge): Mean temp. 0.2 deg. below average: 116.9 h sun; MSL pressure 1020.7 mb (6.1 mb above average); mean wind speed, 5.1 kt.

LIVERPOOL, Knotty Ash: 142.6 h sun; 30 cm M.E.T. 8.9°C; late spring frost on 28th.

LEIGH, R. C. School: 26.9 mm rain on 10 days, 12.5 on 14th.

ST. HELENS (Pilkington, Analytical Lab.): 32.7 mm or 11 days, 11.9 mm on 13th.

SHEFFIELD (J. A. Groocock): 14.5 mm rain on 7 days, 3.7 mm on 2nd.

HIGH BRADFIELD (Dr. Smithson): 27.0 mm on 9 days, 7.9 mm on 2nd.

HULL (J. A. Edson): 18.4 mm on 6 days, 9.4 mm on 13th.

COTTINGHAM: 20.1 mm on 7 days, 11.2 mm on 13th; 30 cm M.E.T. 8.6°C.

CUMBRIA (P. R. Cutforth): Honister 212 mm, Coniston 115, Ambleside 81, Carlisle 50, Hawkshead 80, and Sellafield 33 mm; on 13th, Honister 86 mm, Ennerdale 50, and Coniston 47 mm; mean temperature 8.0°C at Carlisle and Sellafield.

HALIFAX—DARTMOUTH, N.S.: tl 20th, 23rd and 26th; 155.1 h sun.

WINNIPEG: tl 14th and 16th; snow lay 1st—3rd; Red River ice cleared on the 10th; 280.3 h sun, highest since 1952.

JAMAICA (Met. Service, Manley Int'l Airport): Kingston rain, —25.1 mm; Montego (Sangster) rain, +11.4 mm, tl on 9th and 16th.

OKLAHOMA (N.O.A.A.): 74.7 mm rain; 7 days with thunder.

MAURITUS: After stable weather for 2 weeks, frequent upper air troughs produced copious rainfall, ranging from 66 mm to 35 across the island; night temperatures were about 0.5°C below average.

DEVONPORT, N.Z. (M. R. Blake): tl at 00—01 on 11th, followed by 73.9 mm rain n one hour; in Otago (South Island) frost on 22nd ruined the peach crop.

TEMPERATURE TABLES: APRIL 1976

	MEAN		HIGHEST		LOWEST		GRASS	A	G
STATION	Max	Min	Max	Min	Max	Min	Min	F	F
BELGIUM: Leuven	13.8	3.3	22.7(19)	9.3(20)	8.7(4)	—1.3(9)	—2.7(9)	6	9
DENMARK: Fred'k'd	9.8	1.9	14.8(14)	5.4(16)	4.5(2)	—1.7(24)	—5.8(23)	3	11
MALTA	17.8	10.8	20.6(19)	14.8(28)	14.6(11)	6.6(4)	2.0(4)	0	0
NETH'L'S: Marken	11.5	4.8	15.5(19)	8.0(15)	6.5(7)	0.1(29)	—3.9(a)	0	4
„ Gorredijk	12.9	2.2.	17.8(19)	5.9(1)	7.9(23)	—5.6(9)	—5.6(9)	6	9
„ Schettens	11.0	1.9	15.7(19)	7.5(6)	7.1(3)	—5.2(9)	—8.8(29)	9	15
„ Ten Post	11.9	2.3	16.7(14)	6.2(30)	7.7(23)	—5.4(9)	—9.0(9)	4	16
NORWAY: Donski	10.5	—0.5	17.5(20)	4.0(15)	3.9(4)	—4.5(2)	—7.0(30)	18	26
„ Oslo	10.2	0.5	17.2(20)	5.7(15)	5.1(4)	—2.8(2)	—	13	—
„ Bergen	8.3	2.5	15.2(23)	5.3(v)	3.8(1)	—1.4(v)	—	3	—
„ Trondheim	5.5	—0.6	11.5(14)	3.6(14)	1.8(25)	—6.7(1)	—10.8(4)	17	20
SWEDEN: Valla	8.8	—0.3	15.7(16)	5.8(17)	1.1(27)	—6.4(29)	—12.1(29)	16	27
EIRE: Straide	13.5	4.2	19.0(16)	9.1(17)	7.2(1)	—2.6(29)	—	3	—
N. IREL'D: Armagh	13.0	1.0	17.2(16)	9.5(17)	8.3(1)	—0.9(2)	—5.4(2)	2	10
„ Bessbrook	12.7	4.3	18.3(19)	9.4(18)	8.3(11)	—1.7(28)	—	3	—
„ Moneydig	12.5	3.4	18.9(21)	9.5(18)	6.1(1)	—2.6(28)	—6.9(28)	4	15
MAN: Port St. Mary	10.3	4.2	14.2(21)	9.6(19)	5.5(2)	—1.6(8)	—	4	6
SHETLAND. Whalsay	7.9	3.5	12.2(19)	7.5(20)	3.9(18)	—0.2(6)	—3.6(3)	1	8
„ Fair Isle	7.9	4.4	10.2(23)	7.7(17)	4.2(12)	0.6(3)	—1.4(27)	0	11
SCOTLAND: Keiss	9.8	3.7	13.4(16)	9.7(17)	6.3(2)	—2.0(b)	—4.0(v)	4	9
„ Braemar			18.3(20)	9.1(17)	5.5(1)	—5.2(23)	—6.6(23)	8	11
„ Inverdruie	11.6	1.4	22.2(20)	6.2(17)	3.9(2)	—5.0(8)	—9.5(8)	7	15
„ Edinburgh	11.1	4.2	17.0(19)	10.1(17)	3.2(2)	—1.9(3)	—6.0(28)	3	9
WALES: Lampeter	11.8	3.0	18.0(20)	9.5(19)	5.0(2)	—3.5(28)	—5.6(28)	6	—
„ Swansea	12.5	4.5	19.1(19)	10.2(19)	6.9(2)	0.7(3)	—1.7(3)	0	5
ENGLAND:									
Penryn, *Cornwall*	13.7	4.0	19.0(19)	9.0(20)	10.1(2)	—0.5(30)	—4.0(30)	2	9
Stithians, *Cornwall*	11.4	3.8	16.7(19)	8.3(c)	7.8(2)	—0.6(30)	—4.0(30)	2	—
Ilminster, *Somerset*	13.6	1.8	19.1(19)	7.0(7)	9.0(27)	—4.5(29)	—9.0(29)	9	21
Gurney Slade, *Som*	11.8	0.8	18.1(d)	5.4(1)	8.3(27)	—5.5(29)	—7.2(29)	11	12
Bath, Odd Dn, *Avon*	12.9	3.0	19.4(19)	9.6(18)	8.8(e)	—1.5(8)	—5.1(8)	5	13
Corsham, *Wilts*	13.6	3.6	20.3(20)	9.0(18)	9.4(3)	—2.6(29)	—6.0(29)	4	14
Trowbridge, *Wilts*	13.6	2.8	20.1(20)	7.8(1)	9.2(27)	—3.0(8)	—6.1(f)	7	18
Codford, *Wilts*	13.5	0.9	19.4(20)	7.0(1)	8.9(27)	—5.5(29)	—5.9(29)	15	13
Reading Univ, *Berk*	13.0	3.8	18.5(20)	8.0(14)	9.0(27)	—2.8(29)	—	2	17
Sandhurst, *Berks*	13.8	2.6	18.9(v)	8.3(1)	10.0(g)	—5.0(8)	—	8	21
Butser Hill, *Hants*	10.4	3.6	16.2(18)	7.8(18)	6.3(27)	0.0(28)	—7.5(28)	0	—
Newport, *Wight*	13.4	4.1	20.1(19)	8.0(v)	9.4(27)	—1.5(29)	—5.0(29)	4	11
Brighton, *Sussex*	13.6	4.0	20.0(20)	9.4(19)	8.9(27)	—0.5(h)	—2.2(h)	3	7
East Malling, *Kent*	12.9	3.7	18.5(18)	8.0(19)	8.5(23)	—2.2(4)	—7.1(4)	2	13
Gillingham, *Kent*	12.8	4.1	17.8(18)	7.2(v)	8.3(g)	—1.7(29)	—	2	—
Sidcup, *Kent*	14.0	3.9	18.8(18)	8.5(1)	8.8(27)	—2.5(29)	—5.3(29)	2	10
Guildford, *Surrey*	14.1	3.8	19.0(18)	7.8(1)	9.4(27)	—2.0(29)	—5.7(8)	3	12
Worplesdon, *Surrey*	13.4	2.9	18.9(19)	7.7(1)	8.8(27)	—3.6(29)	—9.0(8)	4	18
London, Earlsfield	14.2	4.4	19.2(20)	8.3(21)	9.4(27)	—2.2(29)	—4.0(29)	2	5
Rick'worth, *Hert*	13.6	2.9	19.4(20)	8.0(1)	9.1(27)	—3.1(29)	—6.9(8)	6	14
Epping, *Essex*	13.5	2.7	18.9(17)	7.2(1)	6.8(14)	—3.4(29)	—8.0(8)	6	15
Leigh-on-Sea, *Essex*	13.5	4.1	18.3(18)	7.7(6)	9.2(27)	—1.7(29)	—4.5(29)	2	8
Buxton, *Norfolk*	11.7	3.9	15.6(13)	10.5(6)	8.0(27)	—3.6(29)	—5.9(29)	2	10
Ely, *Cambs*	12.6	2.5	18.2(19)	8.0(18)	7.5(14)	—2.9(i)	—6.4(28)	5	10
Luton, *Beds*	12.9	3.4	18.8(20)	10.9(18)	8.0(14)	—4.9(29)	—7.2(29)	4	7
Witney, *Oxon*			18.9(20)	12.2(18)	8.3(27)	—3.1(29)	—6.6(8)	4	12
Oxford (Radcliffe)	12.9	4.2	18.8(20)	10.6(18)	7.9(27)	—1.8(29)	—7.3(29)	4	10
Buckingham, *Bucks*	12.7	3.2	18.2(20)	11.1(18)	8.1(27)	—3.9(29)	—7.8(29)	5	12
Kettering, *Northants*	12.9	3.8	18.9(20)	10.6(18)	7.2(14)	—5.0(8)	—7.8(8)	5	9
Edgbaston, Bim'ham	11.4	4.6	18.0(20)	10.5(18)	6.8(2)	0.4(28)	—9.5(29)	0	9
Long Lawford, *Wks*	12.7	3.1	17.9(17)	9.8(18)	7.7(2)	—4.8(8)	—8.3(8)	5	12
Hinckley, *Leics*	12.1	3.9	18.9(20)	9.4(19)	7.3(14)	—1.4(29)	—4.7(29)	3	7
Braunstone, *Leics*	12.5	3.9	18.5(20)	10.5(18)	7.3(14)	—2.8(29)	—6.5(29)	4	10
Newark, *Notts*	13.1	3.8	18.5(17)	10.7(18)	8.5(14)	—3.3(29)	—7.4(29)	1	15
Nottingham, *Notts*	12.9	3.9	18.7(17)	10.8(18)	8.4(27)	—2.2(29)	—	3	—
Borrowash, *Derby*	12.9	3.8	18.5(20)	10.5(18)	8.5(2)	—3.6(29)	—7.2(29)	5	13
Wingerworth, *Derby*	11.0	2.9	16.2(20)	8.8(19)	5.3(2)	—4.6(29)	—7.4(29)		
Keele Univ, *Staffs*	11.1	3.4	16.5(20)	9.5(19)	5.8(2)	—1.0(28)	—6.0(29)	3	13
Liverpool (Kn Ash)	12.1	5.0	18.4(20)	10.2(18)	7.5(2)	—0.9(28)	—7.3(28)	1	12
St. Helens, *Mer'side*	12.0	4.3	17.8(20)	11.0(20)	5.5(2)	—1.7(28)	—	2	—
Billington, *Lancs*	11.9	3.4	17.7(20)	9.4(19)	6.4(2)	—4.9(28)	—9.9(28)	4	12
Sheffield, *S.Yorks*	11.4	4.0	16.7(20)	8.9(18)	6.1(2)	—2.2(28)	—7.8(28)	2	9
High B'field, *Yorks*	7.2	1.9	12.7(20)	6.6(18)	3.3(2)	—2.0(28)	—	5	—
Hull, *Humberside*	12.0	4.4	15.8(10)	10.0(6)	7.2(2)	—0.6(29)	—5.0(28)	2	7
Cottingham, *H'side*	12.3	4.0	18.0(17)	9.9(18)	6.8(2)	—2.3(29)	—3.9(29)	2	10
Pickering, *N. Yorks*	11.2	2.6	16.5(17)	9.3(6)	5.5(2)	—4.1(29)	—8.4(28)	6	14
Low Etherley, *Durh*	9.9	2.8	16.1(16)	8.2(19)	2.3(2)	—3.2(8)	—7.0(3)	8	12
CANADA, Halifax	9.0	0.4	25.2(20)	4.5(29)	2.8(10)	—5.8(12)	—	10	—
„ Winnipeg	12.8	—0.9	22.8(13)	6.6(14)	1.3(18)	—7.2(11)	—	22	—
U.S., San Francisco	16.5	7.1	22.2(30)	9.4(v)	11.1(3)	2.8(1)	—	0	—
„ Oklahoma	22.8	10.1	29(2)	19(23)	15(25)	1(1)	—	0	—
JAMAICA, Kingston	30.0	22.8	31.1(23)	25.6(7)	27.2(14)	20.6(18	—	0	0
„ Montego Bay	29.4	21.7	32.2(8)	24.4(9)	26.7(14)	19.4(20)	—	0	0
N.Z. Devonport	20.4	15.3	23.6(9)	19.0(8)	18.6(18)	11.1(30)	—	0	0

(a) 9, 29; (b) 2, 8; (c) 20, 21; (d) 19, 20; (e) 2, 27; (f) 8, 29; (g) 23, 27; (h) 3, 29; (i) 7, 28; rain table (j) 13, 14; (k) 1, 13.

APRIL 1976

STATION	RAINFALL 9—21	21—9	9—9	WETTEST PERIOD 9—21	21—9	9—9	RAINY PERIODS 9—21	21—9	9—9	snow	hail	thunder
Leuven*	3.5	4.5	8.0	1.1(14)	2.8(13)	2.8(13)	4	2	8	1	0	0
Frederikssund*			20.9			7.9(4)			9	2	1	0
Marken*			4.7			3.2(8)			3	2	1	0
Gorredijk†			6.0			2.6(24)			9	2	1	0
Schettens*			7.8			4.6(23)			9	2	3	0
Ten Post*	2.1	5.0	7.1	1.0(23)	1.8(3)	1.8(3)	3	5	6	4	2	1
Donski*	10.6	10.7	21.3	6.9(4)	7.3(4)	14.2(4)	5	6	8	9	4	1
Oslo*	5.1	6.8	11.9	1.8(5)	4.3(4)	5.8(4)	5	4	6	10	0	0
Bergen*	86.4	118.1	204.5	17.0(5)	45.6(16)	52.0(16)	13	13	18	3	—	1
Trondheim*	25.8	35.3	61.1	8.8(18)	9.5(8)	10.4(18)	11	13	19	17	2	0
Straide			39.7			10.5(10)			10	2	4	0
Armagh			17.5			7.4(10)			10	0	0	0
Moneydig			24.1			7.3(1)			12	0	4	0
Port St. Mary			29.8			8.0(11)			8	1	0	0
Whalsay			96.0			27.2(1)			19	7	9	0
Fair Isle	17.9	17.3	35.2	5.1(16)	3.5(4)	7.1(16)	11	14	17	6	7	0
Keiss			17.1			2.4(6)			17	2	1	0
Inverdruie			27.7			4.8(1)			15	5	1	0
Lampeter			34.5			14.4(11)			8	0	0	0
Swansea†			19.6			10.2(3)			6	1	0	0
Penryn†			15.0			8.7(11)			4	0	1	0
Stithians			20.9			8.6(11)			5	0	0	0
Gurney Slade			15.8			6.1(13)			6	0	1	0
Dundry Hill	9.0	4.1	13.1	5.6(14)	1.9(13)	5.8(14)	4	4	5	0	0	0
Bath, Odd Dn†			9.8			3.6(j)			6	0	2	0
Corsham*	1.9	3.7	5.6	0.6(4)	2.2(13)	2.7(13)	4	3	5	1	2	0
Bradford-on-Avon	3.7	3.0	6.7	3.1(13)	1.4(14)	3.4(13)	2	5	5	0	1	0
Trowbridge	3.1	2.8	5.9	2.3(13)	1.3(14)	2.6(13)	3	5	6	1	1	0
Reading Univ			10.3			4.5(14)			6	1	0	0
Sandhurst	8.5	2.0	10.5	6.0(14)	2.0(13)	6.0(14)	3	1	4	1	0	0
Romsey	8.0	4.6	12.6	3.2(14)	2.9(14)	6.1(14)	5	3	6	0	0	0
East Malling	4.9	5.1	10.0	2.0(23)	3.2(13)	3.3(13)	5	4	6	1	1	0
Gillingham	8.5	4.0	12.5	2.8(23)	2.5(13)	2.8(23)	5	3	7	1	1	0
Sidcup	10.9	3.7	14.6	7.4(14)	3.5(13)	7.6(14)	4	2	5	0	1	0
Guildford†	7.6	4.1	11.7	4.6(14)	3.0(13)	5.7(14)	5	2	5	0	1	0
London, SW18	8.0	4.0	12.0	5.5(14)	3.0(13)	6.5(14)	3	2	4	1	1	0
Rickmansworth†	6.4	6.4	12.8	4.1(14)	3.6(14)	7.7(14)	2	5	6	0	2	0
Epping	14.9	3.0	17.9	10.4(14)	1.7(13)	11.7(14)	4	2	4	1	0	1
Leigh-on-Sea	4.4	2.5	6.9	2.3(7)	2.0(13)	2.3(7)	4	2	6	1	1	0
Buxton	10.5	6.8	17.3	6.5(13)	6.3(13)	12.8(13)	5	3	6	1	1	0
Ely	14.9	3.4	18.3	7.6(14)	3.3(13)	7.7(14)	6	1	6	0	0	0
Luton	15.9	2.9	18.8	14.0(14)	1.4(13)		4	4		0	0	0
Stroud	6.3	8.0	14.3	2.4(14)	4.0(14)	6.4(14)	5	4	6	0	1	0
Witney	2.9	6.6	9.5	3.0(13)	3.5(14)	4.6(14)	4	2	4	0	0	0
Oxford			8.1			4.0(14)			5	1	0	0
Buckingham			13.0			8.7(14)			5	1	1	0
Edgbaston	12.7	3.7	16.4	4.3(14)	1.9(1)	4.8(14)	4	4	5	0	1	0
Long Lawford	12.9	1.1	14.0	5.3(13)	0.4(k)	5.7(13)	4	3	4	1	0	0
Hinckley	11.5	1.5	13.0	3.6(14)	0.6(13)	4.1(14)	6	3	6	1	0	0
Braunstone†	15.7	1.3	17.0	4.8(14)	0.5(j)	5.3(14)	6	3	6	0	1	0
Nottingham	13.2	1.6	14.8	5.0(l)	0.6(6)	5.5(l)	5	3	8	1	0	0
Newark†			12.1			4.4(14)			7	1	0	0
Wingerworth	7.6	6.2	13.8	2.9(14)	3.5(6)	3.5(6)	4	4	6	0	0	0
Keele Univ			23.5			7.9(14)			7	0	0	0
Billington†			35.9			13.3(13)			10	0	0	0
Pickering	4.8	10.2	15.0	3.5(13)	4.3(13)	7.8(13)	4	6	8	0	0	0
Low Etherley			33.5			11.0(l)			10	2	0	0
Halifax (Can)			87.7			38.4(23)			9	4	—	3
San Francisco			23.4			10.4(7)			6	0	0	0
Kingston	1.5	6.4	7.9	0.5(v)	2.5(9)	2.5(9)	3	5	6	0	0	0
Montego Bay	73.9	26.4	100.3	54.6(26)	5.6(27)	58.2(26)	3	4	5	0	0	2
Devonport (NZ)	56.6	109.7	166.3	41.0(30)	73.9(10)	73.9(10)	7	8	12	0	0	1

MAY RAINFALL: Late News

S. and S.E. England have again had less than 50% normal rainfall, with under 30% in places. 100% or more was recorded in much of N. Ireland, Scotland. N. England and the N. Midlands. The first returns received for May are as follows:

Armagh 102.1 mm (175%); Stithians 57.7 (59%); Gurney Slade 53.3 (63%); Corsham 29.2; Bradford-on-Avon 23.8 (34%); Trowbridge 24.5; Brighton 18.7; Rickmansworth 26.9; Ely 36.0; Long Lawford 44.2 (77%); Hinckley 58.0 (109%); Northampton 40.9 (81%); Kettering 54.0 (88%); Hull 85.3; and Borrowash 39.1 mm.

Late frosts include: May 1st, Kettering —1.6°C; Long Lawford —0.8°C; Trowbridge —0.6°C; Borrowash —0.5°C; May 14th, Rickmansworth —0.4°C.

EARLY MAY HEATWAVE: Late News

Belgium: Temperatures for Leuven and Ukkel, received from Professor Poppe, have been added to the table. On 10 May 33.0°C was recorded at Genk 150 km from the coast. The same day, under sea-breeze conditions, maxima at Oostende, Gent and Bruxelles (respectively 0. 50 and 100 km from the coast) were 11.4, 20.0. and 26.0°C.

Holland: Maxima for 17 stations have been received from Mr. K. Ybema. Those for Schettens, Soesterberg and Volkel have been added to the table. Further details will be given in the next issue.

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