NOAA INFRARED IMAGE FOR 1426 GMT ON 24 MARCH 1992.
DEEP COLD AIR REACHES TO THE MEDITERRANEAN.
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World in the Age of Philip II. In this admirable text the author states “... I would not go so far as to claim that the Mediterranean winter is bitterly cold. But it is less warm than is commonly supposed... Every year it is as though the cold air streams take the sea by surprise.” So it was in late March 1992.

Following a spell of warm spring weather with maxima in excess of 25°C, the final week of March 1992 was unseasonably cool in the Catalan region of north-east Spain. A northerly airstream produced the fresh local wind known as the tramontana, much favoured in summer but less welcome at other seasons when it may be accompanied by showers of rain, hail and even, as on this occasion, snow. Throughout the region temperatures fell sharply on the night of 23rd. The morning of 24th was cool even at sea level and, although sunny, the streets of Barcelona had an unseasonal chill. In the days that followed most inland and high level locations recorded air frosts. Over most of the inland province of Lleida (Figure 1) minima of between -2 and -3°C were commonplace. In the Pyrenees and the southern foothills conditions were even less clement. At Viella (alt. 971m) temperatures failed to rise above freezing on 27th. On 25th Nuria (alt. 1967m) recorded a minimum of -10.0°C. Coastal districts, although not recording frosts, had temperatures that were well below normal. At Barcelona Airport, where the average monthly minimum is 6.8°C and the lowest minima on record for March is -1.2°C, the minimum on 25th was 2.3°C. The following night Granollers, not far to the north-east of the city, registered 0.6°C.

It was within this run of northerly weather that Barcelona experienced a fall of snow at about 1700 hours local time on 24th. The snow did not settle and soon melted. It was commented upon in the Geography Department of the University (personal communication), but appears to have passed otherwise unnoticed. Some indication of the frequency of such an event is given by the statistics for snowfall in the city gathered between 1933 and 1991. During that time snow fell on 75 days. Hence, although the absolute frequency is not great, the total is perhaps remarkable for the latitude (41°N) and altitude of the city, most of which is within 100m of sea level. February is the most likely month for snow with thirty-three occurrences, January had twenty-six, December nine and March only six. The average frequency of March snow can be estimated, hence, at only once in ten years. November has had snow on just one occasion. A study of those events (Jimenez Vidal and Terradellas Jubiteny, 1992) has shown that
they are almost exclusively associated with winds from between north-west and north-east and with temperatures on average, eight degrees below the respective monthly norms. Such was the case in this most recent event which, interestingly, follows the even more remarkable cold spell of May 1991 in the same region which has been discussed by Perry and Wheeler (1992).

The synoptic situation for 1200 UTC is shown in Figure 2. A depression lay to the immediate north of the Alps, the former being the rapidly-decaying remnants of a system that had crossed to the north of Scotland on 22nd before turning southwards over mainland Europe. The northerly airstream on its western flanks was enhanced by the anticyclone to the west of Ireland. The cold front had passed over during the early hours of 24th and in its wake showers were widespread across western Europe. There is also an indication of ice cyclogenesis over northern Italy. The satellite image for 14-26 GMT on 24th March is shown in Figure 3. The location of the cold front across Italy, the western Mediterranean and the Atlas Mountains is clearly seen. The upper air charts (not shown) indicate a marked meridional airflow. At the 500mb level the focus of low pressure lay over southern France. This is a situation well-known to Spanish meteorologists and described in both Font Tullot (1983) and Capel Molina (1981). In late summer and autumn such cold pools may give rise to rain storms of notable severity (Wheeler 1989) but during the spring season the Mediterranean rarely has sufficient heat to initiate such extreme instability, and precipitation is largely confined to isolated showers.

REFERENCES

A REMARKABLE SURREY VALLEY: ITS REPUTATION FOR EXTREMES CONFIRMED
BY IAN J. M. CURRIE
77 Rickman Hill, Coulsdon, Surrey, England

Abstract: The Chipstead Valley set within Surrey’s chalk Downland has a reputation locally for temperature extremes. Pilot surveys revealed some outstanding readings in the 1980s and the establishment of a permanent station on the valley floor since October 1990 has shown night minimum temperatures on a par with the Scottish Highlands; and this at a location no more than 24 kilometres from the heart of London. This paper outlines some of the findings after 18 months of observations.

Not more than 8 km from the Manhattan-like heart of Croydon and just 25 km south of central London lies a remarkable Surrey valley. It has a local reputation of being a particularly cold locality. My recent research confirms this notion and to it can be added another feature, large diurnal temperature ranges.

The Chipstead Valley has a mixed land use, suburban development at its lower end at Coulsdon but still rural in the upper reaches. Being a dry valley on chalk with a gravelly bottom this encourages rapid radiation on calm clear nights and a railway embankment across the valley effectively ‘ponds’ up cold air. Readers may note a similarity in this description to that of the famous Rickmansworth frost-hollow in Hertfordshire on the northern outskirts of London set among the foothills of the Chilterns. An excellent article by E. L. Hawke in Weather, June 1946, emphasises the frostiness of this locality even during the months of July and August and compares it favourably with the ‘Aberdeenshire plateau’. However suburbanization seems to have curved the more outstanding pereginations of the thermometer there in recent years.

My interest in the potential for extremes of temperature and the effects on horticulture in this part of Surrey was enhanced by a study of the Whyteleafe area in which I was involved (see Currie and Harrison, Journal of Meteorology, November 1979). Severe frost damage to plants was not uncommon well into the last week of June. I began to monitor another site in the Halliloo Valley but was abruptly terminated when a hedge trimmer led to the demise of my recording instruments! When I moved house to the Chipstead Valley I soon learned of its rigours from local residents and subsequent winters provided evidence.

A good example was 7th January 1985. A ridge was moving south over the area in a very cold continental air mass and there was an 80mm snow cover. I made my way to a suitable site in a field adjacent to some houses. It was 11 pm and the night was still. The snow lay crisp and frost covered. Clouds of vapour rose from manhole covers along a nearby road. Using a pocket whirling hygrometer a dry-bulb reading gave -17.5°C (0°F) and I mused what a permanent station here would have read the next morning, although low cloud did spread across later in the night.

Two further examples confirmed my suspicions that this was a very interesting spot. At 0.55 am on 30th October 1988 a reading of -4.5°C (23.9°F) compared with a 60.50°C temperature at Gatwick of 0°C (32°F) and 2.2°C (36.1°F) near the summit of Reigate Hill (230 metres) 5 km to the south. At sunrise on 5th June 1989 the valley was ‘etched in white’ with a reading of -1°C (30°F), a figure that some inner London stations did not attain in January that year.

There are of course many sites in Britain which could rival the Chipstead Valley but they have yet to be monitored. I was lucky enough to achieve sponsorship from Casella London Ltd. who generously donated a Stevenson Screen and maximum and minimum sheathed thermometers in order to carry out a proper survey of the area. I also obtained a station at the Old School House thanks to the generosity of Mr. Ernest Williams in allowing me access to his garden. Measurements began on 1st October 1990 and have continued on a daily basis since. The site is on the floor of the valley, 107 metres above sea
level. My own garden weather station lies 3 km north-east at Coulsond and is 40 metres above the valley at this point.

Almost straight away readings were of interest, for instance 14 air frosts in November 1990, compared to a mere 2 at Coulsond and none at Tadworth a few kilometres distant. In February 1991 with the valley deep in snow perhaps the most interesting reading to date was measured on the morning of 10th, that of -15.8°C (5.8°F), a candidate for the lowest value in Britain during 1991. Conditions were not necessarily ideal for such temperatures due to patchy cloud and something of a breeze. Another outstanding figure was a minimum of -1.7°C (29°F) on 2nd June 1991. However on 1st September it did achieve a credible 29.9°C (85.9°F). Large diurnal ranges of temperature are a feature of the valley, a good example being 20th September 1991 with a maximum of 18.9°C (66°F) after an overnight low of -0.6°C (31.9°F); or a dawn value of -3.0°C (26.5°F) followed by a maximum of 18.0°C (66°F) on 9th May 1991.

Air frosts totalled 90 for the year 1991 compared to 55 at my own station at Coulsond. So far, in all winter months from December 1990, the average minimum is below freezing and most have not been particularly cold over England as a whole. The effects of the low temperatures can be spectacular. Severe frosts in December 1991 led to a ruptured water main that promptly sprayed a silver birch tree. An overnight low of -12.9°C (8.3°F) on the 11th turned it into a cascade of icicles, like giant organ pipes, which shimmered and sparkled in the sun.

The readings for 1992 have been no less interesting. From January to April inclusive, Chipstead experienced 47 air frosts. If we compare this to Morden in London's southern suburbs with 18, or Birmingham University with just 17, or even more rural Buckinghamshire's 28 it is to the Scottish Highlands that we must turn for a similar value. At Inverie, Ayrshire, 49 air frosts were recorded.

An interesting point arises from analysis of mean temperatures from the Chipstead Valley and those of my station above the valley at Coulsond. In both January 1991 and January 1992 mean temperatures were lower in the valley by 0.6 and 0.5 deg. C respectively. Higher daytime temperatures are offset by the strong night-time cooling. This difference increased to 1.2 in August. One thinks instinctively that temperatures decrease with altitude but the inversion effects in such hilly areas can reverse the normal pattern. Indeed there is an almost optimum climate level in the Surrey Downs, viz. the 125-metre (400-foot) contour. At this height one is above the worst excesses of the frosty valleys but not high enough to be swathed in hill fog, nor suffer the windiness and lower mean temperatures of the plateaux and crests often above radiation fog. Perhaps this helped perpetuate the extraordinary advance of housing in the early part of this century at Coulsond.

Way back in 1946 Hawke stated that Britain's frost-hollows have not been adequately studied and this is most true today. I dislike the term 'hollow' as at Chipstead for instance the affects extend for several kilometres along the valley floor. Given a longer time span there is no doubt that air frost will be recorded in every month of the year as at Rickmansworth and given suitable conditions values below -20°C (-4°F) are likely to occur. They are an important factor in determining what to grow. Mr. Williams found to his cost that the growing season is severely limited. Fruit and vegetable cultivation is often a series of calamities.

Another aspect is road safety. Not infrequently I have driven from relative mildness on the hillsides only to plunge into sub-freezing conditions in the valley. There are several important road junctions along its route and ice can be a problem for the unfamiliar motorist as well as the sudden condensation that can appear on windscreen on extreme occasions.

LONG-PERIOD RAINFALL DEFICITS AT OXFORD

By T. P. BURT and M. SHAHGEDANOVA

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Abstract: This is a brief note on long-period rainfall totals at Oxford, 1767 to 1992, in relation to the current drought.

Recent comments in the press concerning the unique nature of the current rainfall deficit (e.g. The Independent, 27 May 1992) have led us to re-examine the rainfall record for the Radcliffe Meteorological Station at Oxford University which dates from 1767. It is well known that rainfall totals for long periods (one year or more) can be correlated over relatively large distances, so it is reasonable to assume that the Oxford record will be applicable to larger parts of central and southern England although not, of course, to the whole country.

We have calculated total rainfall for various periods (from 3 to 60 months) for each month from January 1767. Of most interest are the long-period totals (24, 36, 48, 60 months) because protracted droughts are of most concern, especially in southern England where groundwater storage can buffer the impact of shorter droughts. The accompanying tables list those months when total rainfall in the period up to and including the month in question fell below a certain threshold. Our choice of threshold total is somewhat arbitrary but reflects some element of rarity in the series. It will be noted that the threshold

| Table 1. Periods in which rainfall totals fell below 1000mm for the 24-month period up to and including the named month. |
|---|---|
| 1781 December | 1802 November, December |
| 1782 May to September | 1803 All months |
| 1786 July to September | 1804 February |
| 1788 December | 1805 March, May, December |
| 1789 January to April | 1806 April |
| 1800 January, February | 1807 May |
| 1801 March | 1808 June |
| 1802 December | 1809 July |
| 1803 August, September | 1810 August |
| 1804 April | 1811 September, November |
| 1805 May, June | 1812 October |

N.B. All periods are inclusive.
Table 2. Periods in which rainfall totals fell below 1600mm for the 36-month period up and including the named month.

<table>
<thead>
<tr>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1785</td>
<td>1808</td>
</tr>
</tbody>
</table>
| 1785 June  | 1808 February 
| 1786       | 1808 November |
| 1785 January | 1808 May 
| 1787       | 1808 June |
| 1788       | 1808 October |
| 1789       | 1808 November |
| 1801       | 1808 September 
| 1803       | 1808 October |
| 1803 January | 1808 March 
| 1803 March  | 1808 February |
| 1807       | 1808 March |

The value is somewhat closer to mean annual rainfall (642mm) for longer periods, reflecting the narrower range of variation about the overall mean which necessarily occurs as we extend the period of interest. This exception to this is our choice of the 48-month threshold (2100mm) which is more extreme than the 36-month value; this was selected in order to highlight the most severe droughts.

It is clear from the tabulation that the current protracted drought is notably severe, but certainly not unique. The droughts of the 1780s and early 1800s were much more prolonged and, for short periods at least, rather more extreme than the present one. Since then, however, such extended droughts have not occurred; those of the early 1890s and early 1900s are comparable in length and severity to the present one. Naturally enough, rather more drought periods emerge when a 24-month period is selected (even given a 1000mm threshold) and the events of 1993/4 and 1975/6 show up at this stage. Even so, the 2-year period ending February 1992 has been the driest (883.7mm) since 1803 when the months September to November inclusive all recorded lesser totals (881.1, 839.4, 877.3). On this basis, we must regard the current drought as remarkably severe over the shorter as well as the longer term.

Table 3. Periods in which rainfall totals fell below 2100mm for the 48-month period up to and including the named month.

<table>
<thead>
<tr>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1786 August</td>
<td>1806 February</td>
</tr>
<tr>
<td>1788 May</td>
<td>1806 September</td>
</tr>
<tr>
<td>1789 January</td>
<td>1806 October</td>
</tr>
<tr>
<td>1803 September</td>
<td>1806 October</td>
</tr>
<tr>
<td>1805 July</td>
<td>1806 December</td>
</tr>
</tbody>
</table>

The two pre-1815 droughts require some comment in relation to the quality of the report. The records collected by Dr. Thomas Hornsby from 1767 are incomplete and the full record to 1815, from when a continuous daily record of observations is available, has been estimated by Craddock and Craddock (1977; see also Craddock and Smith, 1978), partly from Hornsby’s own data but partly using records from nearby stations, notably that at Shurburn Castle 21 km to the south of Oxford (Smith, 1979). There are monthly totals at Shurburn from October 1779 to October 1794 which were certainly made with Hornsby’s knowledge and probably under his direction; at this time only annual totals are available for Oxford, and only then from 1784 to 1794. Then the drought of the 1780s has to be assessed essentially using Shurburn-derived data, although as Smith shows, this was a highly reliable record and monthly totals are very similar to those for Oxford (the conversion factor from Shurburn to Oxford totals is 0.965). We can be more confident about the 1808s; Hornsby provides a monthly record for the Radcliffe Observatory from July 1794 to August 1805. We conclude that the pre-1815 Oxford record is sufficiently accurate for us confidently to compare today’s drought with those of the 1780s and early 1800s; both those droughts were much more protracted than the current drought has so far been, and on occasions the rainfall deficits were larger then too.

Rainfall in May 1992 (62mm) was just above average (51mm) and sufficient to raise cumulative totals above the 1000mm threshold for the 24-month period. At the end of May 1992 therefore, only the 60-month total remains below the selected threshold. In fact May 1992 was very warm and sunny in Oxford and the weather only broke right at the end of the month. The 2-day total for the 28th/29th of 41mm was the wettest such period since 13/14 December 1989; almost 10mm fell between 0900 and 1000 GMT on the 29th. It remains to be seen whether this is a temporary reprieve to the drought or if, as happened in 1976, the drought will be ended by a period of very wet weather.

Postscript: Rainfall in June 1992 amounted to 43.4mm, 10.6mm below average. The 60-month to the end of June 1992 remains below the 2800mm threshold, at 2765.3mm.

REFERENCES


POUSSIÈRES SAHARIENNES SUR LA FRANCE ET L'ANGLETERRE, 6-9 MARS 1991
SAHARIAN DUST OVER FRANCE AND ENGLAND, 6-9 MARCH 1991

By ALAIN BUCHER and JEAN DESSENS

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Abstract: A large influx of atmospheric aerosol of Saharan origin occurred in France and England between 6 and 9 March 1991, and led to spectacular falls of dust or mud mix. Reports gathered by a special observation network operating in the south of France enabled the geographical extension of the outbreak to be determined. The analysis of the meteorological situation accounts for the transport of the dust between Africa and West Europe.

INTRODUCTION


Fig. 1. Couche superfinisée de neige colorée photographiée le 25 mars 1991 dans la vallée de la Vésatile (Alpes-Maritimes). Cliché A. Verlain. [Superficial layer of coloured snow].

COMPTE-RENDU DES OBSERVATIONS

Devant l’augmentation de la fréquence des retombées de poussière saharienne sur le sud de la France, et compte-tenu de l’intérêt de ce phénomène pour la météorologie, le géologie et l’environnement en général, un de nous (A.B.) a constitué un réseau d’observateurs des retombées de poussière sèche ou humide avec les personnels des Centres Départementaux de la Météorologie, des Parcs Nationaux des Alpes, des Pyrénées et du Massif Central, enfin de divers organismes particulièrement intéressés par les problèmes liés à l’environnement (Centre de recherches bioclimatiques de Briançon, Centre d’initiation à l’environnement...). Au total, les observateurs sont en place dans 67 stations de la moitié sud de la France, bien informés a priori des phénomènes à observer. De plus, des collecteurs de poussière complètent ce réseau dans 7 stations de montagne. Le réseau a été baptisé “Pousaha”, abréviation de POUSSière SAHarienne.

Dès réception des premières informations sur l’épisode du 6-9 mars, un questionnaire a été adressé aux 67 stations. 57 réponses ont été reçues, donnant 98 indications relatives à des observations de poussière soit en suspension dans l’air ou déposée au sol (“poussière sèche”), soit mélangeée à de la pluie (“pluie de boue”) ou à de la neige (“neige colorée”). Le tableau 1 donne la répartition journalière de ces événements.

Table 1. Répartition journalière du nombre de stations où le phénomène de poussière saharienne a été observé, et répartition des cas suivant la nature de l’observation (poussière sèche et poussière humide ont été observées simultanément dans plusieurs stations).

<table>
<thead>
<tr>
<th>Date</th>
<th>6 mars</th>
<th>7 mars</th>
<th>8 mars</th>
<th>9 mars</th>
<th>10 mars</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations concernées</td>
<td>38</td>
<td>30</td>
<td>21</td>
<td>8</td>
<td>1</td>
<td>98</td>
</tr>
<tr>
<td>Poulssière sèche</td>
<td>10</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Pluie de boue</td>
<td>32</td>
<td>24</td>
<td>17</td>
<td>8</td>
<td>1</td>
<td>82</td>
</tr>
<tr>
<td>Neige colorée</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

On note d’une part sur ce tableau que le nombre d’observations de retombées humides (pluie ou neige) est supérieur à celui des suspensions ou retombées sèches. Le phénomène de pluie de boue ou de neige colorée se remarque en effet bien plus facilement que celui de poussière sèche. On constate d’autre part que la fréquence des observations a été maximale le 6 mars, puis a été en décroissant jusqu’au 9 mars, celle isolée du 10 mars étant probablement entachée d’une erreur de date.

La pluspart des observateurs ont été frappés par l’intensité et l’étendue du phénomène autour de leur station météorologique. A Ajaccio (Corse-du-Sud), on note par exemple que “le sable en suspension réduit la visibilité à 800 m le 7 mars à 10h00 UTC.” Au Parc National des Ecrins (Hautes-Alpes), une épaisse couche de neige colorée est observée jusqu’à plus de 2500 m (épaisseur de 41 cm à Orcières-Merlette). La couche de poussière persistant après les chutes est
notée comme particulièrement épaisse et tenace en de nombreux endroits:
Bouches-du-Rhône, Alpes-Maritimes, Gard.

Fig. 2. Départements Français où des retombées de poussière saharienne se sont produites au cours
de l'épisode du 6 au 9 mars 1991, avec indication des jours où le phénomène a été observé (en
Corse, non représentée sur la carte, les retombées ont eu lieu les 6, 7 et 8 mars). [French
departments where Saharan dust fell in the period 6-9 March 1991, with the dates indicated when
the phenomenon was observed. In Corsica the falls happened on 6, 7 and 8 March].

La répartition géographique des observations, avec indication de leur date,
est donnée sur la carte de la figure 2. Le sud et le sud-est de la France ont été
massivement concernés par l'épisode du 6-9 mars 1991, et le phénomène a
egalement été observé en de nombreux endroits du centre et de l'est de la
France. Des chutes considérables de poussière se sont également produites en
Angleterre, dans le Berkshire, entre le 6 et le 8 mars (Burt 1991).

On peut estimer très approximativement la quantité de poussière reçue au sol
à cette occasion. Par comparaison qualitative avec d'autres épisodes pour
lesquels les poids de poussière avaient été mesurées (Dessens et Pham Van
Dinh 1990), c'est au minimum 1 g/m² de poussière qui est tombé sur la bande
méridionale de la France où pratiquement aucun département n'a échappé au
phénomène, soit sur environ 150.000 km². Le poids total déposé au sol peut
donc être estimé très grossièrement à 0.15 MT.

EVOLUTION DE LA SITUATION MÉTÉOROLIGIQUE

Le 5 mars, une dépression au large de l'Islande établit un flux rapide de sud-ouest en altitude sur l'Afrique du nord-ouest, l'Espagne, la France et l'Angleterre. Le Bulletin Météorologique Européen signale des poussières ou
du sable en suspension dans l'air au Mali (Gao, Tessalit).

Le 6 mars, le système dépressif se décale vers le sud en s'étendant. Un
front froid se développe du Sahara occidental à la Bretagne. Poussières ou sable
sont toujours signalés au Mali ainsi qu'en Mauritanie (Nouakchott) et en
Algérie (Djelfa). En altitude, le flux de sud-ouest se renforce sur l'Espagne et le

Fig. 3. Situation synoptique le 6 mars 1991 à 12 UTC au sol (en haut) et au niveau 700 hPa (en
bas), d'après le Bulletin Météorologique Européen.
sud de la France (40 à 60 nœuds entre 700 et 500 hPa). Le front froid est à peu près stationnaire, de l'Algérie au Golfe de Gascogne (Fig. 3).

Le 7 mars, la situation évolue peu, avec simplement une composante plus méridionale des vents en altitude. Poussières ou sable soulevés par le vent sont observés au nord du Sahara (Et-Rachidia, Djelfa, Ghadames), et des poussières en suspension au-dessus d'Alger.

Le 8 mars, l'ensemble du système s'est déplacé vers l'est, et la zone nuageuse, le front froid au sol (de la Tunisie aux Pays-Bas) et le vent rapide de sud en altitude intéressent alors la moitié est de la France. En Afrique, les tempêtes de sable se sont simultanément déplacées vers l'est notamment au sud-est de l'Algérie (Hauts-Plateaux) et en Tunisie (Tozeur) et en Libye (Ghadames, Tripoli). De la poussière en suspension dans l'air est signalée en Sicile et en Italie (Rome).

Le 9 mars enfin le système a poursuivi son déplacement vers l'est en s'affaiblissant, mais des tempêtes de poussière et de sable sont encore observées en Libye.

L'essentiel des transports intercontinentaux de poussière saharienne s'effectuant au niveau 700 hPa et au-dessus (Dessens et Pham Vin Dinh, 1990; Ott et al., 1991) on a représenté sur la Fig. 4 les courbes d'équale pression à ce niveau reliant l'Afrique du Nord à la France entre le 6 et le 9 mars 1991. Ces courbes figurent approximativement les lignes du courant des masses d'air. On observe bien sur cette figure le décalage vers l'est du transport dans son ensemble (zones de production et de retonbée). Pour le 6 mars, les tempêtes de sable étaient localisées plus au sud du départ de la trajectoire, ce qui suppose un

![Fig. 4. Trajectoires probables des masses d'air chargées de poussière saharienne d'après les courbes d'équale pression au niveau 700 hPa aux dates indiquées (6, 7, 8 et 9 mars 1991), 00 UTC. (Likely trajectories of the air masses charged with Saharan dust according to the 700 hPa pressure curves).](image)

![Fig. 5. Evoluation de la situation météorologique du 6 mars 1991, 12 UTC (en haut) au 8 mars 1991, 11 UTC (en bas). Photographies METEOSAT 4, canal Infra Rouge (documents Météo-France, C.M.S. Lannion).](image)
mélange préalable des masses d’air. Par contre, à partir du 7 mars et jusqu’à la fin de l’épisode, il y a eu transport direct entre les zones de tempêtes de sable et celles de retombées. Compte tenu des vents en altitude, la durée de ce transport ne devait pas excéder une quinzaine d’heures sur les 1500 km de trajet, ce qui explique en partie la densité des chutes observées.

L’évolution de la situation météorologique du 7 au 9 mars est illustrée par les images satellitaires en infrarouge de la Fig. 5. Ces photographies montrent bien en particulier comment l’Angleterre et l’Italie on pu être concernées par des arrivées de poussière saharienne.

CONCLUSION

Les chutes de poussière saharienne du 6 au 9 mars 1991 sont remarquables par leur importance, leur durée en un lieu donné et l’étendue géographique des zones touchées. En effet, si la présente étude concerne plus particulièrement le sud de la France, le phénomène s’est étendu au centre et au nord de la France, à l’Angleterre et à l’Italie.


Au cours de cet épisode, il n’a pas été observé de phénomènes météorologiques violents (pluie, inondation, trombe) comme cela arrive assez fréquemment (Dessens et Pham Van Dinh, 1990), à l’exception cependant de vents violents au sol au sud du Massif Central entre le 5 et le 7 mars, et de précipitations intenses sur les Cévennes entre le 6 et le 8 mars (plus de 200mm d’eau par endroits).

Dans l’hypothèse d’une augmentation de la fréquence des retombées de poussière saharienne jusqu’en Angleterre, le réseau des observateurs de TORRO (Tornado and Storm Research Organisation) pourrait constituer une excellente base d’information qui compléterait les données recueillies dans le sud de la France par le réseau POUSSAH.


RÉFÉRENCES


MAMMATUS OVER MUSTANG

Excerpts From The Weather Journal of Dana Mack
El Dorado, Kansas, 16 May 1991

By Dana Mack

We had arrived home in Mustang after our Laverne, Oklahoma, chase the previous day and a rather harrowing drive through several severe thunderstorms that had prompted the issuance of Tornado Warnings for Dewey and Major Counties. The lightning associated with these cells had been unusual in its intensity, spreading the great lavender, flaxen and blue-white arcs through the sky, lighting up the evil-looking clouds. We had stopped in Woodward to fill Greg’s gas tank with diesel fuel, since once we left the main towns, it would be very difficult to locate any diesel — this would pose the threat of being Duffilled (a word I use to mean stranded, left behind) in the middle of nowhere, in the middle of a dark and stormy night. As we climbed out of the car to gas-up, a trucker from Colorado came up to us: “Say, what do you do if a tornado comes at us?”, he anxiously inquired. An obvious answer came to my mind: “Kiss your tail goodbye”, but we kept our answer to the standard safety tips; after all, the poor guy seemed truly concerned.

We continued towards the south-east along US Highway 270, the main route running from Oklahoma City north-west through Woodward and into the Oklahoma Panhandle. As we drove south-eastward, the reports of severe thunderstorms were repeatedly given by the radio station in Woodward. We were about fifteen miles north-west of Seiling when a Tornado Warning was issued for Major County for a twister four miles south of Cestas, Oklahoma, moving east-north-east at twenty miles an hour (2300 hrs approximately). This track would bring the center of the circulation just north of Seiling, a course which was interesting ours! “Oh, come on ... we can’t carry-on like this, can we?”, inquired a rather apprehensive Adrian [Mackey].

We soon came to the conclusion that we would be wiser to retreat and circle this complex of storms than to be mauled by a tornado seeking revenge for its brethren in Laverne. Adrian summed this up succinctly: “It would be nice to get home to see our video without getting nabbed by one further south!”

Late the next morning we arose, a bit lethargic from our previous day’s adventures, to find a bright sun glaring down from an opalescent sky — a very strong and gusty south-east wind was still in evidence. This zephyr was entraining a richly-endowed moist air-mass into the state from north Texas and the Gulf of Mexico further south. A powerful upper-air disturbance was moving east from eastern Colorado into western Kansas, and was predicted to take a route through south-central Kansas on its way to western Missouri.
At the surface, an intense and rapidly-deepening area of low-pressure was located in northwestern Oklahoma, with a dry-line bulging through the southwestern portions of the state towards Mustang. This boundary blew through our town about 1130 hours, quickly dropping our dew-points as fierce southwestern gales replaced the humid south-east airflow. Fifty to sixty miles-an-hour wind gusts were measured! A subtle yellow-brown veil dirtied the turquoise of the expaans overhead. Another Duffliff day!!!

By early to mid-afternoon, the surface low-pressure had strengthened further as it moved east to a position north-west of Alva with a dry-line curving south-eastward to east of Oklahoma City to just past Shawnee. The wind profile throughout the atmosphere displayed an immense amount of directional shear. This meant that there was a good likelihood that any storms rising into this environment would rotate and produce tornadoes! East of the dry-line, lifted indices were indicative of great instability, being in the range of 8 to 10. Dew-points stood in the 21 degree Celsius range in this part of the state, while across the western part of Oklahoma, dew-point values were close to -7 degrees Celsius. The contrast really highlighted the battleground that was shaping up in central Kansas and eastern Oklahoma.

Accordingly, the outlook for the threat of severe weather called for a moderate risk of severe thunderstorms and damaging tornadoes to be possible. This prospect cheered Adrian and I a bit, because we were ready for another chase, only a few scant hours after our epic journey to Laverne (see J. Meteorology, vol. 16, no. 161, 232-6, and no. 163, 508-312). Around 1400 hours, the first towers of cloud began to effervescce in crisp though distant mounds, and Adrian and I decided that it was time to head north. However, we spent some time in Mustang to gather up Matt and Greg and his maps . . . and his radios . . . and his cameras (the disposable kind of course!).

It was 1600 hours before we left Mustang, and motoring towards the Kansas border at a speed rather in excess of the legal speed limit we continued to observe a tremendous storm taking shape on the northern horizon — a genuine super-cell, all by itself, with over-shooting tops furiously spuming through the main anvil. The thin wispy cirrus composing this structure of the storms was already being swept along many miles to the north-east. What really captured our attention, as we drove through a sun-drenched farmland, was the hard, compact convection percolating into the south-western corner of the cell. As it grew and continued its intensification, Adrian and I began to wish we’d left at 1500 hours because we would probably be underneath this mammoth storm by now.

As we crossed the state line into Kansas, we were advised by radio reports of a large and strong tornado afflicting McConnell Air Force Base; this base had received a direct hit from a large tornado on 26 April when a mobile home park was destroyed with much loss of life. The journey ahead seemed to be interminable, but by 1830 hours we had reached the southern suburbs of Wichita, the pavement glistening with the dampness of rainwater from a shower just ended. Just ahead to our north and east, an enormous anvil spread back from the main body of the giant cumulonimbus; lightning discharged repeatedly into the ground, often with explosive fury. As a foreboding contrast, the dusky light at the surface, created by the ebony clouds which were tinged with an odd-green, made the atmosphere seem almost diaphanous.

1900 hours: The flanking line of this storm extended south-westward from the main body of the storm, its billowing cumulus decreasing in size as it tailed off into a whisper of cloud. The sun’s rays cast long, amber colors upon the ragged edges of the cloud bases while the depressions of the irregular cloud deck were cast with a vie-appearing Stygian gloom.

There was one problem with chasing storms in this part of Kansas: a lot of the highways here did not run in true east-west or north-south manner, so in order to pursue our quarry, we would have to detour miles out of our way if we wished to play it safe. However, if we wished to be at the scene of our quarry’s crime, it was necessary to motor under the flanking line and ultimately the wall-cloud. This maneuver could prove foolish for us and gratifying for the tornado. A carload of chasers meandering just beneath its circulation could be too much for any mesocyclone to resist! To follow the storm, we decided to run under the wall-cloud and test our fortune.

Above us there were many areas of cyclonic eddies wrapping quite tightly, making our vehicle seem fragile and puny. “That’s an interesting folding going on up there . . . this may not be a good place to be . . .”, I commented on the obvious. We eventually pulled into a parking lot of a convenience store to observe these heavy dark clouds of an indigo hue highlighted with a cream color where the tattered bases were lit by a few rays of sun that were able to radiate beneath the cloud deck. I found myself wondering what it would be like to be pulled into the mouth of a twister. I also decided that I did not wish to experience this effect, and was of the opinion that our group should relocate eastward out of harm’s way.

To my dismay and the frustration of Adrian — “Oh heck, let’s not talk about it . . . let’s do something (that being getting out of this exposed parking lot)” — Greg ran off to the store to warn the “uninformed” people there. He disappeared into the establishment leaving the rest of us to muddle unwholesome words civilized society would find offensive. Greg returned and we left the store’s parking lot, thankful that we’d not been on the receiving end of a tantric maw! Our Oldsmobile headed west into the center of El Dorado, a sizeable town with a substantial shopping district comprised of multi-storied, deeply-hued brick buildings dating from the 1910’s. However, given the menacing aspect of the cloud base, it was not surprising that there was a death of shoppers out on the street at the moment.

We were not comfortable with our position under this cell, and urged Greg to step on the gas to extricate ourselves from a potentially dangerous location. “Greg, there are no speed limits in Hell!” It seemed to us that a speeding ticket would be a minor problem compared to being mangled into ground meat if our car was set upon by a tornado. Greg pulled into a parking lot of yet another convenience store and stopped with his car facing into the store. We thought
that it would be best to park headed out for a quick get-away, if we had to stop at all. “Use your brain, Greg, use your brain... THIS is your brain...”, Matt instructed, pointing to his head. “SHUT UP!!!”, an exasperated Greg snapped, probably feeling thoroughly badgered by all of us ‘back-seat’ drivers in the car.

As we continued through El Dorado, Kansas, we spotted what seemed to be large balls of ice, from golf-ball size up to unbelievable diameters of soft-balls (four inches)! These were randomly scattered on the greenery of the lawns along our route, and as we looked down intersecting streets, we could see leaves lying in thick carpets underneath trees lining the side streets. They had been torn off by large hail hurtling to earth! Except for the fact that it was May and the leaves were a tender green, it resembled an autumn scene. Eager to examine these stones close-up, we pulled on to the grounds of the El Dorado Water Works (1930 hours). Adrian had been especially eager: “Let’s pull up, eh?... let’s have a look at these buggers!!!”

The moment we got out of the car, we were entranced by what we saw: “Oh my God... Darn... look at these... I don’t believe it!!!” yelled an excited Matt. The first chunks of ice we found were rounded masses of opaque ice the size of baseballs, and I was able to collect five of these together, holding these like one would hold a bunch of ice cubes! A few minutes later, these became paltry in size, as Adrian found an absolute giant. It was a piece of ice, more or less rounded, but with blunt knobs protruding from its glistening, slick surface, taking up the entire area of his palm (four inches across and deep), a mass of ice big as a softball! “Now this is what you call a stone... eh?!” Adrian queried. “Can you believe this? Can you believe that (motioning to the ice in his hand) came from up there?”

We continued north for a bit, but by 1935 hours, the sun seemed to be gliding inexorably towards the boundary of firmament and ground, which appeared to extend with monotonous regularity in a linear fashion along the western border of our vision. It seemed time to consider returning home, especially since we were beginning to feel the strain of the previous two days, and found little longing for arriving home in the small hours of the morning. Matt also had a final exam in Physics the following day. We decided to turn around for home, but our road, a two-lane sectioned concrete affair with no shoulder, would have something to say about that. From the edge of the road, wet mud and grass tamped down into a bar ditch in which water from the rains had collected.

“Be careful, don’t drive too far off the road!”, admonished Adrian, as Greg began to turn around. He pulled the vehicle on to the softened shoulder. “Don’t Greg, don’t...”, began Adrian, but his words trailed off as our maroon Oldsmobile surrendered to the wet ground and slid sickly into the ditch. It was almost immediately apparent that Greg’s efforts in flooring the accelerator pedal were for naught, unless one was interested in carving cavernous ruts in tar-colored Kansas mud.

We crawled out of the car into the sodden grass and surveyed our predicament, not one destined to put us in a cheery humor. The tires were half-sunk into the tarry mire as the car sat skewed slightly upscale towards the road.

its diesel softly chugging as the soft light of evening weakened into night’s deep shadow. To our north, eruptions of electrical fury ripped incessantly through the numerous folds of the expanding convection in the nearby storm. It became a matter of some anxious speculation, as I stood in the wet grass forming a spongy carpet beneath me, as to whether my body might prove the terminus for an errant streak of electrical energy arcing from the clouds – the waterlogged ditch would make an excellent conductor.

Visions of being strangled in the middle of a Kansas prairie in a satiated depression and waiting to be tried to a crisp by a million volts of electricity flashed through my thoughts in more ways than one. This vision moved us to get behind the car and push while Greg gave the car a little bit of gas. We rocked the car, pushed the car, pleaded with the car and finally cursed the car. It hadn’t shifted itself, but the Oldsmobile had deposited a liberal quantity of mud upon Adrian’s khaki pants. Adrian was not a happy fellow at this point.

Fortunately, with the aid of a cowboy in a red pick-up towing a horse-trailer, we were hauled out of the ditch with a lariat tied to our undercarriage. Ride em cowboy! We returned home around 0100 hours, tired and ready for some fair weather so we could catch our breath!

DEATHS IN BRITAIN FROM THE WEATHER IN 1991

This month-by-month list contains all known deaths directly attributed to weather hazards, i.e. thunderstorms, blizzards, floods, gales etc. Indirect deaths such as road accidents due to fog, ice, etc., are also tabulated for each month, but only important groupings are specifically mentioned; maritime casualties are also included. For details of how deaths are tabulated, see J. Meteorology, vol. 1, No. 5, pp168-169 (1975-76).

January: There were six direct deaths this month, all in gales, four of the deaths occurred on the 5th, one at Ruthfield, Co. Down, N. Ireland, when a tree fell on a car, one at Stretford, Manchester, when a lorry was blown into the Manchester Ship Canal, a wall was blown down at Gilfach Goch, Mid Glamorgan, Wales, killing a 12-year-old boy, the fourth death was a man swept away by high seas at Girvan lifeboat station, Clydeside, in Scotland. The fifth death of the month was on the 8th when a 70-year-old man was blown over by strong winds and died. The final direct death of the month, on the 11th, was when a man was blown off the roof of the Great Dunes Hotel, Hollingbourne, Kent, whilst doing repair work. There were 9 indirect deaths during the month, mainly in road accidents due to icy roads, but on the 17th two children died when they fell through ice on the Leeds-Liverpool canal at Bramley, Leeds, W. Yorkshire. Maritime deaths totalled 11, one on the 5th when the wheelhouse was blown off the trawler Greenland in gale 290 km west of Galway, Eire, the following day, the 6th, the Mt. Kinny sank in a gale force 11 winds off the north Wales coast leaving 10 crew dead.

February: There were three direct deaths this month. It was reported on the 4th that an avalanche in the past eight days had left one person dead in Glencoe,
Scotland, an avalanche on the 10th left one person dead on Kinder Scout in the Peak District and on 21st an avalanche left one dead on Creag Meagaidh peak, Scotland. There were nine indirect deaths reported during the month, including three people who fell through ice on ponds. There were no maritime deaths reported during the month.

March: There were no direct deaths reported this month, but there were 10 indirect deaths, all on the 13th, when 45 vehicles were in collision during dense fog on the M4 near Membury, Berkshire; a further 25 were injured. Again, there were no maritime deaths this month.

April: There were no direct or indirect deaths this month; there were six maritime deaths on the 10th when the fr. Wilhelmmina sank after a collision in dense fog on the M4 near Membury, Berkshire; a further 25 were injured. Again, there were no maritime deaths this month.

May and June: There were no direct, indirect or maritime deaths.

July: The one direct death this month occurred on the 6th when a person was struck by lightning at Leigh, Greater Manchester. Also on the 6th three vehicles collided in dense fog on the A1 outside Macmerry, near Edinburgh, leaving five dead and six others injured. There were no maritime deaths this month.

August: On the 1st, one person was killed by lightning at Sevenoaks, Kent, in the only direct death of the month, there were no indirect or maritime deaths.

September: There were no direct deaths this month; there were 5 indirect deaths, all on the 27th in a five vehicle pile-up in heavy rain on the M25 near Brentwood, Essex. There were no maritime deaths this month.

October: There was one direct death in the month, the 18th, when a wave swept a man off a car in South Shields, Tyne and Wear, during a gale. There was one indirect death this month. Maritime deaths totalled 17, 16 of which occurred on the 1st when the mv. Frank C sank in a storm some 225 km west of the Hebrides, the other maritime death was on the 18th when a huge wave hit the drilling rig West Standrill in the North Sea 160 km north-east of Shetland, during a gale, hurling a container across the deck, killing a man.

November: There were two direct deaths during the month, one on the 1st when a flash flood swept along a river at Dolgarrog, Snowdonia, north Wales, the other was on the 12th when a farmer was killed when the gable end of a barn collapsed during a gale in Lancashire. There were no direct or indirect deaths during the month.

December: The two direct deaths during this month both occurred on the 23rd, one when a lorry was blown over on the M11 near Harlow, Essex, during a gale, the other was a canoeist who was drowned in the flood-swollen River Wharfe, near Grassington in the Yorkshire Dales. There were eight indirect deaths this month, all in road accidents. On the 10th, five people died and 67 others were injured in multi-vehicle pile-ups in fog in West Yorkshire, on the 15th two people died and six others were injured when six vehicles collided in fog on the M56 near Preston Brook, Cheshire. The four maritime deaths reported during the month occurred on the 18th when a huge wave hit the M. Stern-trawling fish factory Kaylili during gale 14.5 km off Islay, western Scotland.

The total number of direct deaths in 1991 is therefore 16; indirect deaths totalled at least 47; maritime deaths amounted to 38. The number of known direct weather-related deaths in the last 11 years are as follows: 1981, 28; 1982, 44; 1983, 21; 1984, 32; 1985, 10; 1986, 39; 1987, 27; 1988, 13; 1989, 13; 1990, 56; 1991, 16. For previous year's totals see J. Meteorology vol. 9, No. 90, p.178 [1984].

May I take this opportunity to thank all people who have sent me newsaccounts via Dr. Meaden for World Weather Disasters and especially D. A. Holmes, who sent many valuable cuttings from Indonesia, and the proprietors of Lloyd's List for permission to quote extensively from their newspaper. Additional correspondents are always welcome and may write to me direct at 94, St. Andrews Road, Bordesley, Birmingham, B9 4LN.

ALBERT J. THOMAS

LETTERS TO THE EDITOR

HIGH FREQUENCY OF THUNDERSTORMS OVER CENTRAL AND WESTERN EIRE IN LATE MAY AND JUNE 1992

Many areas of western Ireland saw frequent thunderstorms in late May and early and late June this year. Worst affected were Counties Galway, Mayo, Roscommon, Longford, Leitrim, Sligo and Donegal. North County Tipperary and County Clare were marginally affected. On some days parts of Munster, Leinster and Ulster were affected too by localised severe storms. Mr. Martin Sweeney of Stradbally (County Laois) experienced seven days with thunder from 24 May to 30 June, five of them in June. By contrast, my total was one in June (plus two others with distant sheet lightning) and two days in May.

The thunderstorm spells began on 24 May when heavy storms moved north-west over central Eire,

Fig. 1. Strike points resulting from a single forked stroke at Efin, County Limerick, 1255 B.S.T., 31 May 1992.
having broken out over Wales in the later afternoon and then being reinvigorated by storms forming over eastern Eire some 50 to 80 km inland from the east coast. Heavy thunderstorms moved west and north-west over central Eire and affected many parts in the small hours as they crossed into Connaught. A vicious storm also formed over west County Waterford and moved west over central County Cork. Although rain was heavy locally, many areas only had small rainfalls.

26th May saw storms affect parts of County Galway and Clare, moving west in the early hours. On 31st May with a low off western Ireland there were widespread showers and thunder again. Lightning struck houses and disruped power and telephone lines in County Limerick at Effin Village. 17.4mm rain fell at my station (Fig. 1).

Cooper conditions brought a fall from thunder until 7th June when with the arrival of warm continental air vicious storms broke out around 1700 B.S.T. over the midlands. Moving north-west over Counties Clare, Galway and Mayo in the subsequent 4-5 hours, intense lightning activity at the peak of the storms caused some damage and power cuts over County Galway. A herd of cattle scared by a bolt of lightning ran on to the railway near Athenry, County Galway, and several were struck and killed by a Dublin-bound train. Further storms developed over eastern Eire and parts of Ulster on 8th June, and next day more thunderstorms moved west and north-west over central Eire.

On the 10th the continental air moved west across all Ireland, and with cool air aloft widespread thunderstorms developed from 1530 onwards. Massive cumulus congestus andCb cells formed on the western sides of many mountain ranges in eastern, central and southern Ireland, these ranges uplifting the humid warm east wind into the cold upper air. The storms became self-propagating cells moving west over all Irish counties. Intense rain and hail were reported in many places and lightning damage was widespread. I observed rapid thunderstorm build-up west of the Galway mountains at 1400 B.S.T. Heavy storms subsequently moved west giving very heavy rainfalls in Brie, Patrickswell and Limerick City. Further storms reached County Clare, giving several hours of activity in the area up to 2100 B.S.T. Mr. Sweeney at Seadna reported heavy storms in Mayo and Galway. Power cuts were widespread and there was flooding in Ballyhousan accompanied by large hail. Four cattle under a tree at Gowel, Kilkevin and a heifer at a farm near Nephin were killed by lightning. Mr. Sweeney counted over 30 lightning strokes hitting the slopes of Largyan Mountain. A squall line passed over Mr. Sweeney's house bringing gusty winds and a temperature drop from 22°C to 15°C. Only 0.6mm rain fell at his station but there was flooding half a mile along the road.

After this, an anticyclonic spell dominated, bringing dry, cool northeasterly winds until 29th June when the weather again broke down as temperatures reached 26°C in Bally, County Offaly. Thunder was again widespread over the midlands and the west, with heavy rain in places. Severe flood damage occurred in County Donegal on the 30th and

nattle were also killed by lightning in that county. At my weather station a spectacular cloud burst dumped 49.8mm of rain and small hail between 1705 and 1830 B.S.T., but without thunder activity.

I wish to thank Mr. Martin Sweeney for the helpful information he gave me.

Mount Russell, Ardpatrick, Killarney.

DAVID MEEKS

County Limerick, Ireland.

AN EQUATORIAL WATERSPOUT, INDONESIA, 1688

While reading D. V. Nalvinkin's epic Hurricanes, Storms and Tornadoes (translated from Russian), I came across a report of a waterspout (pp. 324-325) observed in Indonesia, which reminded me of Derek Holmes' recent letter (Holmes 1982) on the rarity of hail and the apparent lack of tornadoes in Indonesia.

"In their popular scientific work, Zurcher and Margolle (1983) described a number of waterspouts observed in different regions and at different times. The first was in the 17th century and was observed by the well-known explorer Dampier. The tornado was observed in 1688 over Celebes Island in Indonesia. A dark thunderstorm cloud appeared. At places in the sea, over an area 100 steps across, the water started raging, the splash became higher and higher and suddenly a high, sharp cone formed. A funnel descended where it met the cloud and the two joined up. The tornado started moving slowly along (Fig. 164). It could be seen distinctly that the water in the funnel of the tornado was lifted into the cloud. The cloud became larger and darker. Several tornadoes were formed. A bird flew out of one of the tornadoes. After almost half an hour the tornado ended and the large amount of water from it dropped into the sea with a thunderous noise and a fountain of splashes".

Nalvinkin confirms tornadoes and waterspouts, although it is clear he is describing a waterspout, which apparently did not make landfall. References to additional 'tornadoes' may be to waterspouts, or perhaps more likely to funnel clouds. Fig. 164 in Nalvinkin (1983) (Fig. 9 in Zurcher and Margolle, 1983, a reference which I have not seen and which would appear to be in French) is reproduced here as Fig. 1.

Celebes (Sulawesi) lies between 1°S and 7°S, and 120 and 125°E.

REFERENCES


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FURTHER COMMENTS ON POSSIBLE BALL LIGHTNING IN AUSTRIA

I have inspected the view expressed by Mr. Crew in his letter to the editor (1992) trying to find a useful hypothesis for the origin of the light track on the Vorarlberg photograph (Keul, 1992). Being no meteor specialist, I sent expert witness Dr. Coplecha, an experienced meteor astronomer, a copy of Mr. Crew's comments. He did not like the explanatory construction of Mr. Crew and found it counter-empirical according to his own scientific experience with meteors. He replied as follows (Coplecha, 1992):

"I cannot say anything about ball lightning (call it fireball, if you want), about scientific hoaxes or about fireworms. I cannot say anything about meteoric firesails. I did it in my letter I sent you in the year 1990 (Coplecha, 1990). Mr. E. W. Crew describes what a meteor body should do; but this is only his hypothetical wish, having nothing to do with the reality. I photographed, and I saw photographs and TV images of several thousands of meteors from magnitude +9 to +2. There was nothing similar to what Mr. Crew describes.

From the field investigator's point of view, I have to add that the meteor hypothesis needs a cloudless sky to be of value in this case. The photographer, Werner Hunger, repeatedly told me there was a thunderstorm approaching within the field of view of the camera, lightning was flashing and rain followed. To suggest a bright fireball (bright meteor — sorry for the ambiguity of words, but I did not invent the expression “fireball” which is conceptually near to “ball lightning”) in front of the thunderstorm clouds producing special effects that Dr. Coplecha never saw on his photographic roll is not the economic way — remember Goethe! to solve this case. It requires plenty of secondary ad-hoc-hypotheses not necessary for a hour or a ball-lightning hypothesis. However, both hypotheses remain open for further scientific efforts.

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A. G. KEUL

LITERATURE REVIEWS AND LISTINGS

Book Reviews


In a review of Fein and Stephen's book Monsoons (J. Meteorology, December 1987) comments were made about its high price (over £70 at the time of publication) and about the desirability of providing a shorter version, concentrating on essentials, such as would be of value to those with a limited budget and/or less specialist interest. This book by Chatterji essentially provides what was being asked for in those comments. Priced at under £10 and offering a brief, lucid, non-mathematical and wide-ranging view of monsoons, cyclones and floods, it can be strongly recommended not just to meteorologists, but to anyone who wishes to know more about India. An undergraduate or a pupil at school could be expected to read it in a couple of hours and gain much profit and pleasure thereby. Here one can find a concise account which ranges from the nature and origins of the problem, through forecasting its occurrence, to a discussion of its impact and of the responses produced, all covered in an up-to-date fashion (e.g. there is mention of the devastating cyclone on 29 April 1991). Unfortunately, the quality of paper and of the illustrations is rather poor, there is no index and the bibliography is only a page long. If, however, such things are regarded as unimportant, then the reader can sit down and enjoy a good overview of this key aspect of Indian life without having to invest in an undue amount of time.


SUNSHINE IN WESTERN EUROPE AND SCANDINAVIA. By Richard A. Beck, 47 Curzon Avenue, Stanmore, Middx., HA7 2AL, 1992, 40pp., £3.25 (including postage).

Some may feel it curious that these books are being reviewed together. Yet, they do have one important thing in common, viz. that both have been published by their authors, a piece of enterprise for which they not only deserve congratulations but also support in the form of recommendations to libraries and purchases by individuals. As to underline this advice, Weardeside Weather proves to be a model of its kind. The value it has for people who live in the area or who are interested in UK weather is at least equal by the stimulus it could provide for those who have considered doing a similar book for their own locality and by its demonstration of the high standards possible. The quality of its paper and of its 23 illustrations certainly exceeds that of Chatterji's book and its clear, indeed elegant style makes the contents accessible even to those with little weather knowledge (technical jargon is minimal and there is a glossary to explain the small amount used). Among its many thoughtful touches is the inclusion of 17 tables of figures which will be of value to teachers looking for "hard facts" to help with the national curriculum's meteorology component. However, the thing most likely to fascinate readers is the body of 'unexpected' facts - that Sunderland can be grouped with places such as Kendal and Carlisle which have long weather records; that the city is one of the sunniest places in northern England and experiences hail less often than almost anywhere else in the country; that in the 1980s September has been warmer than June; etc. 'Unexpected' facts also occur in Beck's Sunshine in Western Europe and Scandinavia (eg. Nice gets around 19% more sun than nearby Monaco). Indeed, a recurrent theme of this book is that sunshine can vary markedly, not only throughout the region as a whole, but even within short distances. By discussing this, the author covers a rather neglected topic and also aims to provide data "for many applications" (agriculture, tourism, architecture, etc.). While he is
successful in a general sense, the value of his book would have been greater had he included far more sunshine statistics (cf. Wheeler’s use of tables). To quote an example: visitors to the western Alps would surely wish to know about the differing sunshine regimes of tourist centres like Chamonix, Zermatt and Crans Montana. As it is, the only place mentioned in this region is Genava. Furthermore, the reader is given no insight into how information of local topography influence sunshine (eg. within the canton of Valais). Readers may also feel that the book should have discussed year-by-year variations of sunshine (cf. Wheeler’s interesting remarks on this subject), as these are often of great practical importance. However, the author will not be able to produce an enlarged version of his book, incorporating the additions suggested, if readers do not purchase copies of his first attempt. There is here, after all, a useful overview of sunshine throughout large areas of Europe, together with some details from specific localities.

TORRE A TORNADO DIVISION: REPORT
September and October 1991

The first 20 days of September 1991 were mainly warm, dry and anticyclonic; there were no tornadoes reported during this period. The rest of September was much more unsettled, with one report of a probable tornado, one of three funnel clouds, two of waterspouts. October was rather unsettled, except from 19th to 25th: one probable tornado, one waterspout and one funnel cloud were reported.

LD1991 September 6. Landguard Point, Felixstowe, Suffolk (TM 2831)
Dust devil passed approx. 75 yards E.S.E. of this station at 10:39 GMT
(COL, September 1991, p.30).

An anticyclone covered Britain at 1200, with little cloud; maximum temperature in the area was 19°C.

LD1991 September 7. Near Wool, Dorset (c SY 8285)
Mr. Stuart Dapp saw a land devil between 12 and 13 GMT. It was raising chalk dust from a chalk/gravel drive on the north side of the A352 west of Wool. The weather was sunny, with a light breeze.

All areas were covered by an anticyclone at 1200, and most of England was almost cloudless. Maxima in the area were about 20°C.

LD1991 September 12. Somerford Mill Farm, Brewood, Staffordshire (SJ 895089)
At exactly 1330 GMT David Reynolds saw a land devil form at the edge of a silage pit covered with black polythene and tyres. “A small rotation of dust and straw with an internal diameter of about one metre moved under a cart holding round bales, resulting in much more straw being drawn into the circulation, which was rendered visible for about 10 metres in height and about five metres in external diameter on the far side of the cart”. The land devil decayed rather rapidly, after travelling about 25 metres from south to north in about 15 seconds. The rotation was probably, but not certainly, anticyclonic. The wind was south, force 2; cloud 2/8 alto cumulus and 1/8 cumulus. Most of the British Isles were under the influence of a high, centred off N.E. England, 1024mbar, at 1200. The maximum temperature was 20.3°C at David Reynolds’s station at Wolverhampton, 14 km to the S.S.E.

WS1991 September 26/1. 26 km S.W. of Llanbedr, Gwynedd (c SH 3908)
WS1991 September 26/II. Pendine, Dyfed (SN 2307)

The Monthly Weather Report for September 1991 mentions waterspouts at these two locations. It is not clear whether a single spout was seen at each place.

A gentle northerly airstream covered all areas, with a low, 997mbar, centred over N.E. Germany at 1200. At 300mbar a trough covered Britain. Showers were widespread, with thunderstorms over south and central England and a few in Wales.

Mr. Barrie Brumpton was walking along New Road, Colden Common, at about 2130 GMT when he saw “a mass of mist” rolling towards him and making a noise “like very heavy rain pounding the road”. The mist was clearly visible in spite of the darkness, suggesting that it may have been luminous. The mist was about 150 metres away when first seen and vanished when just a few metres away. The evening was generally very wet and stormy, but a lull occurred during which the rain ceased and the wind dropped to a light easterly breeze. The event occurred during this lull. The mist “filled the highway”, which had a width of eight metres.

3FCI1991 September 29. Stansted, Essex (TL 5322)
Three funnel clouds were observed from Stansted (information from David Reynolds). At 1200 the low of the previous day was over east Biscay, 989mbar; a shallow centre of 996mbar was near the coast of Norfolk. The 300mbar chart was similar. It was a showery day, with thunderstorms in south-eastern counties.

TN1991 October 17. Ham Dingle, Stonebridge, West Midlands (c SO 9182)
A T1-2 tornado followed a path 4-5 metres wide; the direction of travel was from west to east (COL, October 1991, p.27). The time was 0931-0935 GMT.

At 1200 a strong west to north-west airstream covered England, with a deep low, 964mbar, off S.W. Norway. The 500mbar chart was similar. There were showers of rain and hail.

WS1991 October 18. Alderney, Channel Islands
“Waterspout reported N.N.E. of Alderney 1630 GMT” (COL, October 1991, p.29).

The low of the previous day was near Stockholm, 976mbar, at 1800. A northerly airstream covered all parts of Britain. The Channel Islands had showers of rain and hail.

FC1991 October 30. Guernsey, Channel Islands
“Funnel cloud N.N.W. of Guernsey 0615 GMT” (COL, October 1991, p.29).
A cold front had passed the Channel Islands about midnight, with a west to south-west airstream behind it. The 500mb chart was similar. There were showers of hail in the Channel Islands in the morning.

Waterspouts worldwide


WS911September. 3°42'N., 99°42'E., Tor Bay, A. P. Talbot et al.

WS911October8. 32°01'N., 31°01'E., Osaka Bay, D. J. Robertson et al.

WS911October12. 23°58'N., 81°46'W., Lincolnshire, observer not stated.

WS911October20. 8°40.5'N., 109°11.6'E., Arm, observer not stated.

WORLD WEATHER DISASTERS: December 1991

7: Avalanche at Sumba, Kashmir state, India, left five people dead. Daily Telegraph.

7-9: Cold, snow and rain storms in many areas of Greece, the heavy snows cut off more than 120 villages and small towns in mountainous areas, temperatures fell to -10°C in some areas, heavy rains caused flooding in Athens, the storms left at least 15 dead. D.T., International Herald Tribune.

7-10: Severe storms in many areas of the Middle East, brief details below:

TURKEY: Winds and rains in western and central areas of country, winds gusting to 100 km/h in Izmir, a minaret was blown down, leaving one dead and three injured, high winds blew down trees, telephone booths and electric power poles and rain flooded roads, more than 70 villages in western Turkey cut off by heavy snow, on the 10th heavy snows cut off 200 villages in the eastern provinces of Van, Bitlis and Hakkari, two people froze to death.

JORDAN: Torrential rainstorms left two people dead.

ISRAEL: Heavy rains and floods left five people dead, floods two metres deep in Ashdod.

EGYPT: Thousands of people trapped by floods around Alexandria, in city itself the port was closed, no casualties reported.

CYPRUS: Heaviest three day rainfall since 1936, rivers fed by rain and melted snow flowed for the first time in years.

IRAN: Torrential rains and snow hit towns and villages in five provinces, setting off destructive floods which left at least 22 dead. Lloyds List, D.T., I.H.T.

8: Mv. Scaleti sank in storm about 260 km east of Sicily, Italy, one crew man died, nine others were missing and 12 others survived. L.L.

8-11: Cyclone "Val" hit Western and American Samoa with winds gusting to 260 km/h, torrential rains and heavy seas, with waves of up to 15.25 metres high, on American Samoa "eye" of cyclone took nine hours to pass over, the cyclone caused enormous damage, estimated at $330 million, including agricultural losses, thousands of people made homeless, 12 deaths reported from Western Samoa and one from American Samoa, L.L.

9-11: Blizzard in Romania, snow four to five metres deep blocked roads in south-east of country, severe disruption to air traffic, in the southern Carpathian mountains three climbers died and two others were missing when they fell during a blizzard. L.L.

10: Series of multi-vehicle pile-ups on roads in West Yorkshire, England, leaving five people dead, at least 67 injuries reported, three people died in a 60 vehicle pile-up near Polewark on the M62. Near Ferrybridge two people died in an accident on A1, just south of the M62, there were a number of other multi-vehicle pile-ups, all in dense fog, in area, but no serious casualties reported. D.T.

11-12: Cyclone "Wasa" hit French Polynesia with high winds and heavy rains, the rains touched off a mudslide on the island of Moorea which left two people dead, record rainfall was recorded in the Tahitian capital of Papeete, where widespread damage was caused, island of Bora Bora badly hit, but main island of Tahiti not hit by cyclone. L.L.

13-14: Torrential rains off small flash floods on Hawaiian Island of Kauai, up to 300mm fell in a 24-hour period ending late on the 14th, flooding large portions of the island leaving three people dead, at least five homes destroyed and 50 others damaged by the floods and mudslides, damage put at $7.1 million. L.L., D.T., I.H.T.

14: Huge avalanche of ice and rock plunged 6.5 km down east face of Mt. Cook, New Zealand, the avalanche was up to 3.2 km wide in places, the avalanche was so huge that some of the debris went up the other side of the valley, avalanche described as 'an event of the century'. D.T.

15: Monsoon rains, floods and landslides in Banteng province, West Sumatra, Indonesia, left six people dead, three others missing and eight others injured, hundreds of people evacuated, two days of heavy rains caused floods along nine rivers which flooded homes in 67 villages. L.L., Jakarta Post.

17: Freezing rain in Germany contributed to hundreds of accidents on the roads, including a 30-car pile-up on motorway outside Munich, in which one person died, another person was killed in a crash in Baden-Württemberg. I.H.T.

18: M. stern-trawling fish factory Kaitli hit by huge wave during gale while 14.5 km off Islay, western Scotland, four crew killed, others of 51 crew injured or suffered from hypothermia. L.L., D.T.

18-31: Monsoon rains caused severe floods in Riau and Jambi provinces, western Sumatra, Indonesia, at least 131,000 people fled homes from 202 villages in Riau province, where at least seven deaths reported, widespread damage to crops and property and at least 20,000 cattle...
drowned, floods reported to be between one and four metres deep. Floods in Jambi province left at least three dead and floods along the Batanghari river forced thousands of people to leave their homes, at least 200 villages flooded. On the 30th a landslide blocked the Trans-Sumatra highway at Bukit Tigara Dara in West Sumatra, floods in Jambi hit towards end of the month. J.P.

18-31: Heavy rains and widespread floods in Texas, U.S.A., left 15 dead and widespread damage, floods along the Trinity, Colorado and Brazos rivers, hundreds of people forced from homes, damage put at least $75 million, towards end of month floods spread to San Antonio and Guadalupe rivers. Between late on the 18th to the 22nd more than 280mm of rain fell on San Antonio. L.L.

19: Ferry Liptap sank in stormy seas some 32 km off northern coasts of Antique province central Philippines, leaving 19 dead, three missing. L.L.

21: Heavy thunderstorms brought traffic to a standstill in Jakarta, Indonesia, roads flooded and traffic disrupted. J.P.

21-22: Heavy snow in French Alps and Austrian Tyrol, in Austria many roads blocked and at least 10 deaths in road accidents, in French Alps heavy snows and avalanches blocked roads, one avalanche, in La Plagne, left one person dead, other avalanches left a number others injured, more than one metre of snow fell in the Alps, which was followed by heavy rain. D.T., I.H.T.

21-23: Gales of up to 113 km/h hit many areas of Great Britain, gales accompanied by heavy rains, on the 21st roads closed in Scotland by floods, and the Saltersbrook Bridge, on the cross-Penneve Woodhead road, collapsed after rain weakened structure, widespread floods in Sheffield when river Don overflowed. Areas of west Yorkshire flooded, including Huddersfield, Holmfirth and Halifax, on the 23rd trees uprooted in the Midlands area, the West Country and the north, two direct deaths reported, one on the M11 near Harlow Essex, when a lorry was blown over, the other was a canoeist who was drowned in the river Wharfe, near Grassington, in the Yorkshire Dales, squalls gusting up to 121 km/h hit London, forcing closure of the public gallery in the Houses of Parliament. D.T., L.L., Birmingham Evening Mail, Sunday Telegraph.

24: Storm in Arabian Sea sank three fishing vessels off Karachi, Pakistan, leaving 30 crew dead. L.L.

24: Two non-motorised ferries sank on river Ganga, in the Maldah district of West Bengal State, India, during bad weather, 29 persons missing. L.L.

25: Motorised ferry sank on river Ganga, in the Maldah district of West Bengal State, India, during monsoon storm, 42 persons missing. L.L.

25-31: Cold weather in northern Bangladesh, at least 21 died as temperatures fell to 8°C, cold accompanied by rains in areas. I.H.T., D.T.

26-29: Storm hit provinces of Quang Ngai and Quang Nam-Da Nang, Vietnam, leaving 139 people dead, with another 81 missing; most of dead were in fishing vessels sunk by the 70 km/h storms which moved north along the coast, many houses also destroyed or damaged, at least 400 people were also injured, 77 fishing vessels were sunk and 162 others badly damaged. L.L.

31: Vessel, the Michael, sank in heavy seas and strong winds off Cebu, Philippines, leaving three people dead, 17 others rescued. L.L.

31: Storms in the Rosanna, Doncaster and Ballarat areas of Victoria, Australia, up to 80mm of rain fell at Kew and Heidelberg, homes flooded and damaged, with insured losses believed to be in excess of $10 million. L.L.

31: Vessel, the Mayur, sank in storm in the Mediterranean sea some 113 km north off Egypt, off the Israeli coast, leaving four crew missing, two others rescued. L.L.

ALBERT J. THOMAS

WORLD WEATHER REVIEW: December 1991

United States. Temperature: warm almost everywhere; +2degC from N. Montana to C. South Dakota. Cold in N.E. Utah, S.E. Wyoming, W. Colorado; most of Maine; -2degC in S.W. Wyoming. Rainfall: an extreme month, Wet in a triangle bounded by S. California, S. Wisconsin and N.W. Louisiana; N.W. Louisiana to W. New York and Delaware; N.W. and S.E. Hawaii. Over 200% across a very large area from extreme S. California and all of Texas to S.W. Sowa. E. Tennessee to S.W. West Virginia; S. Arkansas, Over 500% in much of Texas, where it was by far the wettest December since before 1895. Dry elsewhere; under 50% from C. Washington and N. California to extreme S.W. Minnesota (much of this area under 25%); Florida (S. half under 25%); C. Hawaii.

Canada and Arctic. Temperature: warm from S. Alaska and British Columbia to S. Manitoba and S. Ontario, Spitzbergen, Franz Josef Land; most of Greenland (except N.E. and E.) and Iceland; +5degC in C. Canadian Rockies. Cold elsewhere; -2degC in S. Labrador. Rainfall: wet from Pacific coast of Alaska and Canada to C. Alberta; Victoria Island to N. Quebec; Regina to Winnipeg; Baffin Island, Greenland, Franz Josef Island, Bjornoya. Over 200% fairly widely in all these areas except perhaps Franz Josef Land and from Regina to Winnipeg. Dry elsewhere; under 50% in N. Alaska, S. British Columbia, S. Alberta, near L. Winnipeg.

South and Central America. Temperature: warm in N. Chile, W. Bolivia, extreme N.W. Argentina, E. Paraguay, S. Brazil; most of Uruguay; most of Mexico to Honduras; +2degC locally in coastal S. Brazil, S. Uruguay and S. Mexico. Cold in E. Bolivia, W. Paraguay, N. and C. Argentina; parts of N. Mexico; -2degC at least locally in all these areas. Rainfall: wet in S. Brazil, S. Paraguay, N. Mexico, Yucatan to most of Honduras; most of N. and C. Argentina, Uruguay and C. Chile. Over 200% in N. Mexico, Yucatan, N. Belize; much of Uruguay; parts of N. and C. Argentina, C. Chile and Honduras; very locally in S. Brazil. Dry in and near N. Chile, Bolivia, N. Paraguay, S. Buenos Aires province, S.E. Uruguay, Minas Gerais (Brazil); much of S. Mexico to El Salvador. Under 50% at least locally in all these areas except perhaps Uruguay.

Europe. Temperature: warm in Scandinavia, European Russia (except E. and S.), N. Poland, N. Germany, Netherlands, Spain, Portugal, Ireland, W. Scotland; parts of England, mainly in W; +3degC in N. Sweden, in an near N. Latvia. Cold elsewhere; -2degC in E. Bulgaria, much of Greece and in and near N.W. Romania; -3degC in S. Greece. Rainfall: wet in Norway, Germany, N. and W. Poland, W. Czechoslovakia, Austria (except S.) and S.E. Switzerland, N. and E. Finland to Ural; parts of S. Scotland. Over 200% W. of N. Ural; locally in Austria and near S. Ural. Dry elsewhere; under 50% in S. Bulgaria, Hungary, S. and W. France, Wales, S. Ireland, S. England; most of Sweden, Greece, Italy and Portugal; much of Romania, Yugoslavia and Spain; parts of Ukraine and adjacent areas and E. coastal Scotland. Provisional spot number 141.
Africa. Temperature: warm in S. Morocco, N.W. Algeria, coastal Natal, N. Transvaal; most of Cape Province; 26-28°C in S.W. Morocco. Cold in interior N. Morocco, N.E. Algeria, S. Transvaal, and in an area near Orange Free State; most of Tunisia; 22°C locally in first two areas. Rainfall: wet in S. Morocco, extreme S. Tunisia, S. Orange Free State, S. Natal; most of Namibia and Boiswana; much of Cape Province. Over 200% at least locally in all these areas except perhaps Natal, especially Namibia. Dry from most of Morocco to most of Tunisia; W. and central S.E. Cape Province; and around Transvaal. Under 50% fairly widely in all these areas except perhaps S.E. Cape Province.

Asian U.S.S.R. Temperature: warm from Kazakhstan southwards; E. Turkestan Peninsula to lower Amur basin; 43°C in E. Kazakhstan; 41°C in lower Lena basin. Cold elsewhere; 38°C in lower Ob basin; 36°C in upper Amur basin. Rainfall: mostly wet; over 200% widely in N. Kazakhstan and lower Amur basin. DRY E. of R. Lena and in lower Ob basin; under 50% locally near Amur Sea and Sea of Okhotsk.

Asia (excluding U.S.S.R.) Temperature: warm in E. Arabia, Pakistan, N.W. and marginally in N. and S.E. India, coastal and W. China, Korea, Japan, Thailand, Malaysia, Laos, Cambodia, Vietnam; 31°C in much of Korea; 41°C in N.W. China. Cold from Turkey to W. Arabia; interior E. China; parts of India (mainly in W. and N.E.); 38°C in parts of Turkey. Rainfall: wet from most of Turkey to N. Arabia; N. India, Korea, S. Japan, N.C. and part of S. Thailand, S. Laos, N. Vietnam; S. Malaya; most of Sumatra; much of Bangladesh and China. Over 200% from S. and E. Turkey to N.W. Arabia; N. and E. India, Beijing area, S. Malaya, N.E. Thailand to N. Vietnam; much of Korea; parts of Bangladesh. Dry in S. Arabia, Pakistan, W., S. and part of N.E. India, S.E., N.W. and part of N.E. China, N. Japan, N. Thailand, S.C. and S.E. India to S. Vietnam; and in S.E. Sichuan, S. and N. Malaya; most of Borneo. Under 50% readily in N.E. and S.E. China and widely in the other areas except perhaps Borneo.

Australia. Temperature: warm in much of N.; locally in extreme S.W., W. Victoria and S. New South Wales; 26°C near Darwin. Cold elsewhere; 31°C of Perth and in part of S. Queensland and S. South Wales. Rainfall: wet in much of S.W. and S.E.; over 200% in S. Western Australia and N.E. New South Wales. Dry elsewhere; mostly under 50%. M.W.R.

WEATHER SUMMARY: May 1992

Despite a few wet days, May was a very sunny and warm month; it was the warmest May of the century over central England, completing a spring that was one of the warmest of the century in many parts of the British Isles. Rainfall in May was variable; over twice the normal fell just to the north-west of London, while parts of southern and north-east England had a very dry month.

The month began with high pressure not far to the south-west of Britain; north-west winds brought some rain to the north, but it was largely sunny in the south. The days soon became quite warm, although there were local night frosts. The temperature reached 23°C at Cromer and Lowestoft on the 7th, but the anticyclone was retreating well to the west by then and a brief disturbed spell of weather ensued with much lower temperatures. Snow fell in some of the showers over Scotland on the 8th, while southern Britain had a wet Saturday on the 9th as a depression crossed from the west.

A complete change in the weather during the 12th set the pattern for the rest of the month, as warm air invaded the country from the south-west; on the 14th the temperature reached 29°C at Edinburgh. Although a weak cold front brought colder air from the north-west that night, it soon warmed up again under sunny skies as a very strong anticyclone built across the north of Scotland towards Scandinavia after mid-month. Temperatures were consistently in the mid-twenties over much of the country for the rest of the month, with the anticyclone anchored over Scandinavia. However, complex weather conditions also played a part in the British weather from the 19th. This thundery spell, which continued until 10th June, will be described in some detail in the routine TORRO thunderstorm reports in a later issue of the Journal. Briefly, the main events on the 21st, sharp storms over parts of England and Wales on the 23rd and 24th, and rather localised but severe storms with torrential rain on the last four days of the month, especially affecting areas just to the north-west of London; over 100 millimetres of rain fell in places here between the late afternoon of the 28th and the end of the month.

Announcement

PROCEEDINGS OF THE FOURTH TORRO CONFERENCE:

BALL LIGHTNING

held at Oxford Polytechnic, July 1992

Editor: Mark Stenhouse. Contents: 'The possibility of recording ball lightning', Dr. Eric Wooding, Emeritus Reader, Dept. of Physics, Royal Holloway College, University of London; 'Tales of attribution to ball lightning', A.J. James, Archives Director, 'TORRO Ball Lightning Division; 'Does ball lightning exist?', Stuart Campbell, Edinburgh; 'Concerning the assessment of ball lightning reports', Prof. Roger Jennings, Emeritus Professor, The Electronics Laboratories, University of Kent at Canterbury; 'Physical evidence for the existence of ball lightning', Mark Stenhouse, Scientific Director, 'TORRO Ball Lightning Division; 'Statistics and structure of ball lightning', Dr. Gerhard Ljubkis, Zellenraum College and Convection NV, Terneuzen, The Netherlands; 'Electromagnetic field energy models – some recent developments', Dr. Geoffrey Frankland, School of Engineering and Computer Science, University of Durham; 'The long life of ball lightning' Dr. Xue-Hong Zheng, Dept. of Engineering, University of Cambridge.

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Product News

COMPUTER SOFTWARE PACKAGE FOR WEATHER ENTHUSIASTS

Persons who keep weather records may now analyse them on computer without the need for tedious programming, thanks to a new easy-to-use software package.

"The software is ideal for weather enthusiasts who do not wish to get involved in programming," says its author, Peter Wright. "It will enable them to enter their daily observations, store them, find monthly averages and totals, put years in order, and do numerous other analyses".

Data are stored in ASCII format, so that they may be exported to graphics packages or spreadsheet programs, and exchanged with the records of fellow weather observers. Peter invites anyone who might be interested in using the package to send for a free leaflet which gives full details. The package is published by Westwind Services at 14 Shrewsbury Road, Edgmond, Newport, Shropshire, TF10 8HT. Their telephone number is (0952) 811561.

Cumbria Rainfall: Carlisle, 135.0mm (60%); Appleby 129.6mm (59%); Gateshead, 124.2mm (90%); Coniston, 130.9mm (104%); Windermere, 72.8mm (74%); Grange-over-Sands 59.0mm (82%).
TEMPERATURE AND RAINFALL: MAY 1992

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