Synoptic chart for 12 March 1785 prepared by Mr. J. A. Kington.
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HISTORICAL DAILY SYNOPTIC WEATHER MAPS FROM THE 1780s

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Abstract: The need to extend daily weather mapping into the historical-instrumental period is emphasised. Reasons for selecting the 1780s as a starting point for this research are given with a discussion of the various sources of qualitative data which are available for this period. The investigation of climate change by weather types and circulation patterns is discussed with particular attention to anomalous situations which occurred in the 1780s. The relevance of this research to synoptic climatology and weather forecasting by extending the search potential for analogues is considered.

As is evident from recent extremes, we are living in a climate epoch of great interest. More than ever the weather provides us with a lively topic of general conversation; but of greater importance is the fact that the behaviour of climate is causing economic and political concern throughout the world.

In order to have a better understanding of past climates, and to be aware of possible changes which could occur in the future, we need to improve our knowledge of past climate. For temperature it is possible to examine records over the past 300 years and for rainfall, less confidently at the moment, for 250 years. But for our investigations of circulation patterns using daily weather maps we can only go back about 100 years or so, which is not long enough to determine whether fluctuations in atmospheric circulation are merely random oscillations in a general trend or are themselves part of a more or less regular cyclic pattern. The preparation of daily weather maps from 1781 forms part of the research programme of the Climatic Research Unit, the project being sponsored by the Meteorological Research Committee of the U.K. Meteorological Office. This project was producing the earliest series of daily charts to be constructed in the historical-instrumental period and is making a synoptic record available for the eastern North Atlantic-European sector back in time nearly 200 years.

WHY START WITH THE 1780s?

The 1780s were selected as a suitable starting point for this project not only from the practical consideration that adequate sources of daily meteorological data were known to exist from then onwards but also because evidence derived from previous investigations had indicated that the climate of the latter part of the eighteenth century had been notable for some
interesting anomalies. Then, as today, an increasing variability of climate was causing great concern.

success or failure of the agricultural economies of most European states.

Thus, at the close of the eighteenth century meteorology was becoming more carefully studied and systematically organized than at any previous period and it was reasonable for the French scientist Antoine Lavoisier to suggest that with improved means of communication it should become possible to make daily weather forecasts.

However valuable individual meteorological registers might be, it is essential for the synoptic analysis of weather that networks of observing stations be organized with reports being made at the same time using standardized procedures and instruments, and for this material to be collected and sent to a central office for subsequent analysis. Several such efforts had already been attempted in the seventeenth and eighteenth centuries, but the most successful of these early efforts was that organized by the Meteorological Society of the Rhineland Palatinate in 1780. This network extended from eastern North America and Greenland in the west across Europe to St. Petersburg and Moscow in the east. Observations made by the correspondents of this society were sent to the headquarters in Mannheim.

Another important eighteenth century network was organized by the Royal Society of Medicine in France with the aim of investigating possible relationships between climate and epidemics. Observations made by doctors were sent to Paris for analysis.

Important contributions to the development of meteorological instruments were made by scientists such as Daniel Fahrenheit in central Europe and Anders Celsius in Sweden and networks of meteorological stations were being organized by universities and scientific societies.

Then, as now, scientists wrote about and discussed their work, which encouraged other people to keep meteorological registers. In the British Isles observations of the weather were made on a more individual basis by a dedicated group of amateurs mostly drawn from the medical and clerical professions and country squirels. During the eighteenth century it was fashionable to keep diaries and journals and, although these may not contain instrumental readings, they can still be valuable, as they add descriptive detail which can often be verified by other reports. Ships’ logbooks provide information about wind velocity and state of weather over sea areas. Thus, it can been seen that meteorological observations for the 18th century are in a variety of forms, units and languages, all of which need to be reduced to standard terms before they can be used for plotting synoptic charts.

FIRST ATTEMPTS AT SYNOPTIC ANALYSIS

Although a large number of meteorological observations were made and collected during the latter part of the eighteenth century, particularly from about 1780 onwards, the key factor for their synoptic analysis and interpretation, namely, the relation between wind flow and the pressure field, had not been realized. It is usually claimed that the first series of daily synoptic weather maps constructed with meteorological data collected over Europe in the 1780s was made by the German meteorologist H. W. Brandes between 1816 and 1820, and some years later the Swedish meteorologist H. Hildebrandsson used Brandes’ method of synoptic analysis to reconstruct a sample daily weather map for 6 March 1783.
there was a decline in the frequency of Westerly winds days in the period 1781-85, and that in many respects this 5-year period provides better matching features of circulation with the present climatic epoch than any comparable period in the synoptic record back to 1861.

The climatic record of the British Isles over the past 250-300 years shows that an outstanding number of overall extremes occurred during the latter part of the eighteenth century. For example, from the temperature series 1659-1973 for central England compiled by Manley, we have in 1782 the coldest November, in 1783 the warmest July, in 1785 the coldest March (with 1674) and in 1786 the coldest autumn (with 1774 and 1676). From the rainfall series for England and Wales compiled by Nicholas and Glasspoole, we have in 1781 the driest October, in 1782 the wettest spring and in 1788 the driest December (with 1780 and 1799) and the driest period of any consecutive twelve months (August 1784-July 1785) in the record to 1976. Now that daily weather maps are becoming available for these years it is possible to determine the circulation patterns that gave rise to these anomalous situations.

Since the synoptic analysis on these historical weather maps covers a wide area of the eastern North Atlantic-European sector it is also possible to apply the "Grosswetterlage" principles of classification to the daily circulation patterns being obtained. The term "Grosswetterlage", derived from the German, refers to a large-scale weather situation in which the positions of the primary pressure centres, that is, the anticyclones and depressions controlling the main features of the circulation, remain essentially the same for several days. A classification of 25 "Grosswetterlage" types for the eastern North Atlantic-European sector was established by the German meteorologist Professor P. Baur in 1947. This scheme has been further developed into a system of 29 types by his co-workers P. Hess and H. Brezowsky. A daily catalogue of "Grosswetterlagen" from 1881 is kept up to date by the German Weather Service.

ANALOGUES

One of the methods used in medium and long-range weather forecasting is to predict synoptic developments on the basis of a past model or models, that is by means of the analogue method. However, a major drawback is the difficulty of finding analogues sufficiently close to the actual situation to be of value. The requirements are stringent, that is, close similarity of circulation patterns and a reasonable fit with regard to time of year, mainly on grounds that radiation processes, solar and terrestrial, should be comparable. Statistical investigations of large-scale weather patterns have shown that the matching of analogous "Grosswetterlagen" should only be made from dates in previous years not more than five days apart. Because of this restriction, it is only on rare occasions that good analogues can be found from the present catalogue of "Grosswetterlagen" back to 1881 and it would appear that many more years of daily synoptic weather maps are required before the analogue system can be usefully applied to routine long-range forecasting. Professor Baur suggests that the problem will only be resolved when a series of daily weather maps for 150 years becomes available. The catalogue of "Grosswetterlagen" from 1881 is approaching a 100-year series. The research project under
discussion is demonstrating the possibilities for establishing a long series of daily weather maps from 1781 which could eventually lead to a "Grosswetterlagen" catalogue extending over a period of 200 years, which in turn would have prospects of considerably extending the search potential for analogues.

CONCLUSION

The classification of weather types and circulation patterns is a most interesting field of research. The theory of fronts and air masses as conceived by the Bergen school of meteorologists under Bjerknes was developed during the period of vigorous atmospheric circulation with zonal wind flow patterns which occurred during the first half of the present century. Are the atmospheric circulation patterns which are being experienced today of a different type, and more like those of the latter part of the 18th century? Has our prevailing wind regime changed since 1950? Do we need to modify our ideas of blocking situations to take into account an increased tendency towards meridional flow patterns similar to those which occurred in the late eighteenth century? Is our climate becoming more continental with greater extremes? The historical daily synoptic weather maps now being prepared at the Climatic Research Unit will provide us with further evidence to answer these questions with more certainty.

MARCH 1785 — Example of a synoptic case study from the 1780s

Cold Marches were a notable feature of the climate of the British Isles and continental Europe during the 1780s. In both the temperature series for central England from 1659 compiled by Manley and central Europe from 1761 compiled by Bauer there were seven cold Marches during the decade: 1782, 1783, 1784, 1785, 1786, 1787 and 1789. The four coldest of these seven cases had been preceded by cold winters over England, namely: 1783-84, 1784-85, 1785-86 and 1787-88.

The atmospheric circulation over the eastern North Atlantic-European sector in March 1785 was exceptionally meridional in character; a marked increase in northerly patterns was associated with persistent blocking action over the western half of the sector.

The charts for 12 March, 20 March and 31 March 1785 have been selected to illustrate daily weather situations which occurred more frequently than average during this month. The chart for 12 March 1785 is reproduced as Fig. 1, and the others are given in Figs. 2 and 3.

REFERENCES


THE EAST COAST STORM AND FLOODS OF 11-12 JANUARY 1978

By P. RICHARDS
Penryn, Cornwall

On 11-12 January 1978 there occurred one of the worst floods since the East Coast flood disaster of 31 January-1 February 1953 when the synoptic situation was broadly similar to this last occasion.

To see the beginnings of the storm we have to look back to 1200 G.M.T. on 10 January 1978, when a small wave depression formed at 54°N/15°W in a trough extending from a depression of 980 mb 150 km from the south-east coast of Iceland. By 1800 G.M.T. the new low had deepened to 999 mb and
was centred close to Valentia (where the wind was west at 17 knots and continuous slight rain was falling). Meanwhile, the previous low near Iceland had moved south-eastwards, and eventually the two depressions merged to produce a centre of 986 mb near the Isle of Man by midnight. By 0600 the next day, the cold front had cleared most of southern England, and was lying from East Anglia to Biscay. The depression centre had reached a position near Wittering in Cambridgeshire, where the pressure was 981.2 mb at 0600. Winds were fairly light near the centre of the low, but were increasing steadily at Scilly and along the western coasts of England and Scotland.

At 1200 G.M.T. a strong ridge was approaching from the Atlantic, and an unstable maritime airstream gradually became established with showers of rain, hail and snow, and some thunderstorms over Scotland. The pressure gradient continued strengthening throughout the day, and by the evening of the 11th the low was at 51° 30N/3° E. To the rear of the low, the air continued to be convective with scattered thunderstorms. Culross (Cowlwood) had a thunderstorm at 1800, and a farmhouse near Penzance was struck by lightning. Winds were high everywhere, but especially strong along the English north and north-east coasts where they blasted away relentlessly. Together with extremely high tides, this formed a fatal combination as on many occasions in the past. During the evening many incidents occurred, some of which are listed below.

The North Norfolk Flood Control Centre in London was put on the alert as tides rose to within 25 cm of the critical emergency level in London.

At Whitby (Yorkshire) the winds gusted to beyond 80 knots.

At Cleethorpes (Humberside) part of the railway line was washed away by the sea, and 150 people were stranded for four hours until coastguards and police got through.

Wisbech (Cambs.) was seriously flooded by the surge up the river, and the power was cut off at King's Lynn (Norfolk).

The West Norfolk General Hospital was under a metre of flood water, and much electrical medical equipment was destroyed.

The 100-year-old pier at Margate (Kent) was seriously damaged, probably beyond repair, the steel being twisted and broken. A £250,000 lifeboat, housed at the far end of the pier, was left stranded. Next day (12th) the boat was brought to safety with the help of a R.A.F. helicopter which lowered the crewmen to the lifeboat.

At Deal (Kent) fishing boats were flung into the streets, and shingle was deposited a metre deep on the coast road. Sheerness was also flooded.

At least 12 lives were lost at sea during the night.

By midnight (of 11th-12th) the low had reached North Germany, with the winds in the North Sea continuing to blow at gale to storm force, and occasionally hurricane force. As the low continued to fill rapidly, the ridge of high pressure crossed Scotland and winds moderated gradually over England during the 12th.

CONCLUSIONS
I feel that at least some of the risk to life and property would have been lessened had an adequate warning system been in operation along the north and north-east coasts. The main cause of the very high winds was not so much the intensity of the depression (which was only fairly deep by British winter standards) but the strength of the pressure gradient behind the centre. This was caused by the quite intense ridge moving across Scotland, the effect of which was probably underestimated. The storm was rendered all the more devastating because it made the high tides even higher. Moreover, it is known that the east coast of England is sinking, so that an improvement of the sea-defences would obviously be a great advantage for the future.

SOME EFFECTS OF THE NORTH-SEA FLOOD ON THE LINCOLNSHIRE COAST 11-12 JANUARY 1978

By P. C. SPINK

These notes are written within a week of the sea-flood in January 1978. There is much more detail to come and analysis to be made known during the next few months, but the evidence already is that the weight of the surge was greater than in 1953. The generation of a bore effect up east-flowing rivers causing disastrous floods in towns on the way was a feature of the recent surge.

It is almost a quarter of a century since the great sea-surge of 31 January 1953. Four minor ones have affected the east coast of England since then, and they caused damage of varying degree. These were on the night of 20-21 March 1961, 19 February 1969, 29 September 1969 and 2-3 January 1976. At the time of writing I have no first-hand knowledge of the effect of the surge of 11-12 January 1978 on counties other than Lincolnshire. I attach for Press reports of the flood at Blyth, Spennymoor (River Nene) and that of King's Lynn from the Ouse. Both these rivers terminate in 'cuts' into the Wash, which suggests a bore effect caused by the north-east surge. On the Norfolk coast we read of the destruction of the pier at Hunstanton. It is clear there has been severe flooding at Wells, Blakeney, Salthouse and Cley where the saltings were inundated and cattle drowned. Wells also has a north-east-oriented 'cut' to the open sea, and the flood was particularly severe in the waterway except for the only sector which did not have this type of wall. As a consequence there was a complete inundation of about a metre along this bank. Cleethorpes, as recently as 1976 badly affected with the railway destroyed, was again subjected to a similar but worse pounding because the sea-defences had not been strengthened or heightened since 1976. Once again, hundreds of houses had their lower rooms flooded; water rushed down the streets, which stand at right-angles to the sea-wall, and flooded houses as far as a kilometre away. The railway line was undermined in one section by scour action (I was able to walk about under two of the four tracks), and in another section the rails were torn up and unbelievably contorted. The North Quay of the Fish Docks was flooded in places; the miserable little defence wall has never been raised and is the same as before 1953.
On 14 January 1978 I visited places which suffered severely in the 1953 disaster, such as Mablethorpe, Sutton-on-Sea, Sandilands and Skegness. Of these Sandilands had suffered the worst. The surge, as in 1953, was particularly strong here, despite a splendid new wall. Dozens of beach chalets were smashed to matchwood and thrown down the bank. The beautiful sandy beach was scouried to the underlying boulder clay, as in 1953, but this will be restored by tidal action by Easter. Also, as in 1953, I noted a similar scouring on the sands at Sutton where the old Roman salt evaporation pans were again exposed. (Proof, if necessary, of the rise in sea-level in 1800 years!) Skegness pier was a sorry sight. Now broken into three sections, after 97 years, the fine Victorian ironwork is in a twisted mess. The effect of the surge must have been enormous to twist the framework into such contorted masses. In Boston the famous fourteenth century church of St. Botolph (The Stump) was flooded from the Wash to a depth of one metre in the nave. I am informed that no such flood has been experienced here before. Once again a bore effect up the river must have occurred.

Opinion is that the weight of water during the 1978 transgression was greater than in 1953, and the fact these piers were wrecked is a possible proof since all three withstood the 1953 ordeal. The tide at Cleethorpes was estimated as 3-5 metres (10-15 feet) above the normal for the date. Unfortunately, the flood warning system was not very effective. Many people told me they were not warned until shortly before high water on the night of Wednesday 11th.

CAUSES OF MARINE TRANSGRESSIONS

Melting of ice at the poles is responsible for an increase in sea-level of the order of 4 metres, say 12-14 feet, relative to the east coast since Roman times. There is also the isostatic effect of a simultaneous sinking of the eastern coastal regions of the order of 1-2 millimetres per annum. Conversely, there is a compensating emergence in Scotland demonstrated by the many raised beaches to be seen on the west coast. The cause is thought to result from the relief of the immense weight of the great ice cover of Pleistocene times. So there are two potent adverse factors affecting East Anglia and the east coast as far south as Kent to an increasing degree.

One has only to read the history of East Lincolnshire to come across repeated references to marine transgressions from the thirteenth century onwards. The story of the lost ecclesiastical settlements on islands in the Humber east of Hull makes macabre reading, and the fact that no less than five medieval parish churches have been lost to the sea during the past five centuries, those at Mablethorpe, Trusthorpe, Sutton, Chapel St. Leonards and Skegness, underlines the severity of the erosion threat.

A shallow soothing wave
Sobbed in the grasses at our feet
The feet had hardly time to flee
Before it brake against the knee
And all the world was in the sea.

These poignant words from Jean Ingelow’s poem ‘High tide on the Lincolnshire coast’ (1971) sums up the menace and power of a marine transgression.

METEOROLOGICAL FACTORS

Basically there are several simultaneous conditions which must occur before a sea-surge takes place in the southern part of the North Sea.
(1) A spring tide; (2) A northerly gale, including a prolonged northwesterly fetch of wind which has the effect of ‘piling up’ the sea-level in the North Sea; (3) Low atmospheric pressure (a one-inch fall of pressure (mercury column) raises the sea-level by about 13 inches (32 cm). It is, moreover, interesting to note that spring tides occur after 1½ days of the new and full moon (Bowden’).

During the 1978 storm my micro-barograph recorded a pressure of around 986 mb, against 998 mb in January 1976. The 1978 storm tracked to the southern North Sea, hence the damage in Thanet and the Thames Estuary and a very marginal escape from a London flood disaster of the first magnitude. Indeed, had late-December and January produced high rainfall to set the Thames and other east-flowing rivers (such as the Nene and the Ouse) in flood, one shudders to consider the consequences (particularly in London).

In the 1953 disaster, pressure here fell to 991 mb, and the storm track was similar to the 1978 one, except that it was a little further east—hence the severe Dutch flooding in 1953.

I am surprised that the warnings of the 1978 flood seemed so inadequate. The government report on the 1953 coastal floods, published in 1954, deals with this important service (p. 33); from it, one would assume that from then onwards a very efficient system of warning would be set up. This report is filled with interesting information, and those responsible for our sea-defences should pay particular attention to Appendix C (p. 40) where there is a note on the progressive change of mean sea-level relative to the land. It is a cautionary tale indeed.

REFERENCES

Useful references regarding the 1953 and earlier marine floods include the following:

THE EURYDICE TRAGEDY AND THE LINE SQUALL
OF 24 MARCH 1878

By CICELY M. BOTLEY

H.M. frigate Eurydice 26 guns, 921 tons, built about 1843 had been reckoned in her day the smartest ship of her class in the fleet, and the previous year had been recommissioned as a training ship Captain Marcus Here. After a successful cruise in the West Indies, she had lingered after her consorts had sailed in order to take in army personnel, increasing the crew of 323 officers and ratings to 368. She left Bermuda 6 March 1878 and on the 24th was sighted off Benchurch, I.O.W., by the coastguard. The barometer was falling and there was a heavy bank of clouds coming from the north-west. The wind was westerly and to port; she had all sails set and the lee ports open.
The southern waters of the Isle of Wight give calm water in such conditions owing to the 150 metre high line of downs as far as Ventnor. At about 1540 hours the **Eurydice** had just passed the limit and was rounding Dunnose Head when over the hills appeared a long black cloud 'like a torpedo'; the wind suddenly veered and increased, and a blinding snow squall came down from the hills through Langcombe Chine. Taken flat aback before sail could be shortened, she went on to her beam ends and the sea rushed in through open ports. To the horrified spectators on Ventnor parade and on the schooner **Emma**, in the safe zone to westward, all this was veiled by darkness, but when it became lighter again, only her upper parts could be seen protruding upright from the shallow sea (11 fathoms or 20 metres deep). She must have sunk like a stone. The Ventnor lifeboat went out under the **Emma** also went to help, but only two men were picked up, Able Seaman Cuddiford and lad Fletcher.

It was then the responsibility of the amateur meteorological observer and the dawn of technological meteorology, five self-recording stations having recently been opened including Kew, Stonyhurst (Lancs.) and Plymouth. From the mass of data thus available, the Rev. Clement Ley was able to produce a classic paper on what was then the Meteorological Society and give the scientific world the first picture of a line squall.

At 2345 on 24 March there was a moderate depression apparently centred over Denmark, with the isobars over Britain showing an incipient secondary with a trough running from the Wash to the Severn. During the day the secondary deepened and appeared to wheel round the primary at a point near Denmark. At 1500 the V-depression had intensified and the wave motion caused differential motion, the East Anglian end moving at about 8 km/hr while the Cornish end was travelling at 77 km/hr; the section that struck the **Eurydice** was moving at 61 km/hr. Ley further showed that the front of the precipitation area coincided with the trough. By 1800 the southern part of the area had passed into Normandy while the northern end lingered in East Anglia.

Readers whose libraries include bygone runs of **Illustrated London News** for 30 March and 7 April would do well to consult them, especially for the graphic illustrations including an artist's impression of the final scene, based on the lucid account of A. B. Cuddiford. Such drawings, not necessarily accurate, seem much more vivid than modern photographs. Some further details, with weather maps, are given in R. Abercromby's book **Weather** (London 1982, pp 242-244).

MORE EXAMPLES OF MAGNIFYING MIRAGES

I attach two items from recent issues of the **Essex Countryside**, which seem to be magnifying mirages similar to that described in **Journal of Meteorology** September 1977.

Mirage produced under the classical conditions of horizontal plane-parallel stratification cannot give rise to magnification of an image in a horizontal direction of comparable magnitude to that possible in a vertical direction. Magnification in the vertical of any significant degree is thus accompanied by distortion. Compensation for the curvature of the atmospheric layers consequent upon that of the earth does not affect this conclusion. Nor does any hypothesis based on tilting of the layers seem viable for the terrestrial range of refractive indices, for magnifications of 30 times. It is possible to devise refractive index distributions having the requisite properties, but they are certainly not of the classical type.

The first item was written by Mrs. M. S. Earll, and appeared in the September 1977 issue of **Essex Countryside**:

> I remember seeing a strange phenomenon from Clacton sea-front just over 60 years ago, when the sea front opposite Clacton (presumably Margate) was thrown up in colour in the sky above the horizon. All the lights and movements were very clear. It lasted quite a time, then eventually faded away. It was midsummer, and the sea front was packed with holidaymakers all watching this unusual sight.

> [The distance between Clacton and Margate is 45 km.]

The second item, from Mr. Frederic Vanson, was in the November issue:

> I have been wondering what Mrs. Earll's letter, re: the Clacton sea front phenomenon reminded me of. She refers to an apparition of a seafront (presumed to be that of Margate) in the sky above the horizon. Something like this but even stranger was recorded by the late Neil Bell in **Modern Writing** 15 (1947) in the course of his account of "The Strange Occurrences connected with Captain John Russell." Russell was a Suffolk sea captain. I quote from Bell's account.

> "There was for example the city in the sky over Jibacoa in Cuba. It was a large city, larger than Norwich, and seemed to be a mile up in the sky. Everything in the heavenly city was perfectly clear to the innumerable eyes watching over it in Jibacoa: streets, houses, churches, shops and certain movements in the streets, but whether of people or traffic it was too distant to see. The people of Jibacoa told him that this was no new visitant to their sky but had been seen half-a-dozen times in the past ten years."

> Captain John Russell may have been a parramander and certainly many mysteries have seem to have surrounded him. Yet I think there may be truth in this story. The city in the sky referred to by Russell would have been in the middle years of the last century. Russell also claimed to have seen an 'air vessel' off the coast of Florida.

**Richard White**

**Woodford Green, Essex.**

SHETLAND'S VIOLENT BLIZZARD OF 9 DECEMBER 1887

By S. G. IRVINE

Midfield, Brough, Whalsay, Shetland

One of the most severe blizzards to sweep Shetland since weather records were first kept occurred on 9 December 1887, and 17 Shetlanders lost their lives in it on sea and land. On the 90th anniversary of this event an article on it by Shetland author James R. Nicolson appeared in the **Shetland Times**. I have picked out the main points from this article and have made some additions on the weather situation.

After a week of unsettled weather with gales and frequent snow showers, Friday, 9 December 1887 dawned calm in parts of Shetland while in other places there was a very light south-westerly flow. Everywhere there was a hard frost. All over Shetland small boats were launched as fishermen sought to take advantage of the break in the weather. These small open boats which
were only about 18 feet long were crewed by four men and were propelled by a square sail and two pairs of oars.

On Whalsay the boats belonging to the north and east ends of the island were quickly afloat and put to sea early in the forenoon. Men from other parts of the island generally stayed ashore because, it was said, they were suspicious of the high seas running and the heavy breaking waves around the shore. I consider this of the greatest importance for I have often seen those huge breakers on a north-facing coast during light winds being followed by gale to storm force winds from between north-west and north-east—the swell ahead of the storm.

Some of the Whalsay boats went to fishing grounds to the north of the island while others went to the south of it. About 2 p.m. the sky became overcast and great masses of cloud piled up in the north-west. Then about 3.30 p.m. the wind freshened from the north and snow began to fall. Suddenly the wind veered to the north-east and increased rapidly to hurricane force while the snow became so thick that a man in the stern of the boat could not see the bow. Almost immediately the fishing lines were cut and the boats set a course for the shore. The first Whalsay boat reached safety about 6.30 p.m. and an hour later all the boats that had gone to the north of the island were accounted for although in some cases a difficult landing had to be made on the rocky northern shore.

The Whalsay boats fishing to the south of the island were not so fortunate. One of them was crewed by four young men aged between 21 and 30, all strongly built who had the reputation of being one of the smartest crews on the island, but they were never seen again and a week later wreckage from their boat was found.

The boat skippered by Laurence Moar of Whalsay was crewed by three brothers, Andrew, Laurence and Thomas Anderson. This boat also tried to reach Whalsay by rowing against the wind and sea but the task was impossible. Around 11 p.m., Andrew Anderson, a man of about 60, succumbed to the cold and a short time later Laurence Anderson collapsed. The two remaining men knew their only hope of survival lay in running before the tempest. Around 4 a.m. on the following morning Laurence Moar brought his boat into Hay's Dock at Freefield—how he made it through the north entrance of Lerwick Harbour we shall never know. By this time Andrew and Laurence Anderson were dead and Thomas Anderson was lying unconscious beside his brothers. To add to Skipper Moar's difficulties the boat had sprung a leak and only continuous bailing kept it afloat.

In all, 13 Shetland men lost their lives at sea that terrible night and four women died in the blizzard on land. Three of these women were elderly. The fourth, a young woman named Jeannie Nicolson from Moosbank, was walking from Lerwick to Tingwall carrying in her arms her young infant and accompanied by a male friend. They had reached Dale when the blizzard struck and they struggled on as far as the Windy Grind at which point the woman declared that she could go no further. She handed the baby to her friend who hurried with it to safety at the nearest home. He returned as soon as he could to assist the mother but by the time he reached her she was dead.

Today Laurence Moar is still remembered as one of Shetland's most outstanding heroes. Also, in Tingwall churchyard there is a tangible reminder of that terrible night. Just inside the main gate on the left hand side of the path is a tombstone with the following inscription. "In memory of Jeannie Nicolson, late of Mosbank, Delling, who perished in the vale of Tingwall on the night of the snowstorm, 9th December, 1887. Aged 27 years."

As there had been a week of unsettled weather with gales and frequent snow showers and the wind had become very light south-westerly on the morning of the 9 December, 1887, it was probably a polar low coming down from the Norwegian Sea in conjunction with a high pressure in the Iceland area which caused this outstanding blizzard. A polar low did, in fact, give a 136 mph northerly gust at Kirkwall Airport, Orkney on 7 February 1969.

THE COTSWOLD BLIZZARD OF 8-9 JANUARY 1968

By E. M. WEBLEY
Longlevens, Gloucestershire

A triple-point depression moved south-eastwards across S.W. Wales and S.W. England during the night of 8-9 January 1968 causing widespread snow across N. Ireland, N. Wales, N.W., Central and S.E. England. Its effect at R.A.F. Little Rissington in the Cotswolds is described in this article.

SYNOPTIC DEVELOPMENT

Following a deepening depression that had moved south-east across southern England to the Continent by the 7th, a cold north-west airstream spread across Britain. As the next depression moved steadily eastwards towards N.W. Ireland, the forecast was that the depression would continue its eastward progress, with snow turning to rain over most of Britain (Fig. 1). As it was, however, the greatest pressure falls were occurring over Wales and central southern England, and it appeared more likely that the depression would turn south-eastwards towards this part of England (the Cotswolds). It seems that it was not until about 2000 hours on the 8th that the

Fig. 1. Synoptic charts for 1800 on 8 January and 0300 on 9 January 1968.
They started popping out of parked cars as the pressure inside rose with the excessive heat (from Evening Argus, Brighton, sent by L. S. Laskey).

BOY Lifted Seven Metres BY A KITE
13-year-old Patrick Street of Thorpe, Norwich, was taken to hospital on 5 January after being lifted 7 metres into the air by a kite which then suddenly plunged to the ground at a Norwich recently in ground. Another boy, the owner of the kite, said: 'Patrick looked frightened when the kite lifted him up although I was holding on to a rope. The rope burned right through my gloves, cutting my hand, and the main rope which was attached to a tree was ripped away. (Daily Telegraph, 6 January).

WHEN NOT TO SEED CLOUDS
The possible social and legal dangers of cloud-seeding were raised in California in mid-February when storms occurred which killed 20 people and left $45 million of damage. Silver iodide cloud-seeding had been taking place in the area hours previously. Floods developed quickly following a fall of 90 mm rain, and some of the worst flooding was near the seeding machines. The case is of interest for its social and legal aspects. Although the wind was said to have been in the wrong direction for the crystals to have had any effect, there are people who are ready to blame the rainmakers. In happier circumstances than these, the rainmakers may have been more ready to assume the credit.

G.P.O. TELEPHONE STRIKE
The telephone at Mr. Black's house in Stirling Road, Airdrie, Scotland, was struck by lightning in January while the telephone was in use. Snow was falling at the time. After the incident a jagged zig-zag line could be seen down the building's snow-covered gable end. According to the press report (Sunday Post, Glasgow, of 15 January), the telephone of the other telephone user, Mr. Black's friend who was a 'few miles away in Plains', was damaged at the same time that the telephone went dead. The report said that 'the phone was in pieces', possibly because it was dropped upon hearing 'the terrific bang'. (Press cutting sent by S. D. Burt).

SIX DIE IN CHURCH
Six people were killed and 12 injured when lightning hit a church in the Nishango township 100 km south of Durban, South Africa. (The incident occurred, 12 February, during a 30-minute hailstorm, which also caused the Umbudusi River to burst its banks and flood a part of the town. (Daily Telegraph).

WORLD-WIDE WEATHER DISASTERS
December 1977 - January 1978

December 2: 200 km wide bush fire raging in N.W. Queensland, Australia. 5: Blizzard hit N. Indiana and Ohio with up to 30 cm of snow.
5: Heavy seas sank the trawler Boston Sea Ranger, 170 tons, 7 km off Gwennap Head, Cornwall; 5 dead.
6–7: Blizzard hit Norrkoping, Sweden; over 50 cm of snow in 24-hour period. Int. Her. Tribune.
7: High seas broke the ship, Baltic Eagle, in two, some 450 km east of

forecasters realised this, and gave revised snow warning of falls of up to 30 cm on high ground.

The depression duly moved south-eastwards to reach the south of Germany by the next evening. Pressure rose quickly over the British Isles as an anticyclone formed over N.W. Scotland.

THE WEATHER AT RAF LITTLE RISSINGTON
Light snow fell from 1300 on the 8th with the temperature near —2°C and a light southerly wind. After 1800 hours the snow became moderate, with the wind rising to 15 knots causing slight drifting. Conditions worsened with heavy snow by midnight and winds 20-25 knots. Until near 0600 on the 9th there was no improvement, when the snow eased to become slight by 0800 z and ceased by noon. The wind continued fresh, near 20 knots, for most of the day. The temperature had risen to near —0.5°C at the height of the blizzard, then fell steadily to —7°C near midnight.
Snow accumulated to nearly 30 cm, with considerable drifting to 150 cm or more. Traffic was completely disrupted, and there was no flying for a week. Milder weather was heralded by gales and rain on the 13th and 14th.

ICICLES AS MISSILES
A death from a falling icicle happened in Moscow during the weekend of 7-8 January. For some time giant icicles had been hanging at great heights from the city's massive blocks of apartments, the result of occasional lapses from the bitter cold weather. One such icicle was reported as having struck a pedestrian in the central area of the city, causing serious head injuries and later his death. (Daily Express clipping sent by A. J. Thomas).
Such dangers arise whenever heavy winter snowfalls are interrupted by partial thaws, and are not unknown in Britain. In 1776 the son of the parish clerk of Bampton, N.E. Devon, was killed by an icicle which plummeted from the church tower. The event is recorded on a tablet inside the church.

Bless my eyes
Here he lies
In a sad pickle
Kill'd by an icicle.

VARIOUS HAPPENINGS
HUGE U.S. DROUGHT BILL
The worst drought in the American West since the dust-bowl days of the 1930s broke in December, leaving an estimated $2000 million in losses in 21 states. From the middle of December, repeated storms from the Pacific had half-filled California's reservoirs by the end of January, after the reservoirs had been almost empty. About half of the estimated losses were in California—including $300 million in crop losses and $500 million in livestock, most of it in the past year.

GREAT HEAT IN WESTERN AUSTRALIA
For five successive days the temperature in Perth exceeded 100°F (38°C). It culminated in a mid-afternoon high of 112.5°F (44.8°C) on 12 January 1978, and broke two 45-year-old records—for the hottest day and longest hot spell. Not only were records shattered, but so were car windshields.
31: 22 vehicles piled up in fog near Taipei, Taiwan; 5 dead, 19 injured. I.H.T.

January 1—3: Heavy rain caused rivers Yuna and Camu, in Dominican Republic to flood 6250 hectares severely damaging the rice crop; 2500 families evacuated. L.L.

3: Widespread gales over Britain; 115 knots at summit of Snowfell, Isle of Man; tree fell on car at Birdwell, near Barnsley, Yorkshire, killing driver. Several tornadoes developed on a vigorous cold front, causing severe damage in some towns especially Newmarket and Hull; two injuries. Lightning over North Sea put a ship's radio out of action in the morning. D. Tel L.L.

Gales, hail, and tornadoes hit the Netherlands too; road and rail traffic disrupted; farm buildings destroyed. Times.

Gales and thunderstorms hit West Germany; up to 30 cm snow in Harz Mountains, cars trapped in drifts. Int. Her. Tribune. 2 dead, 80 injured.

3 (reported, date of occurrence not known): Avalanche in the Steinberg range on Austro-German frontier; 6 dead, 2 missing. D. Tel.

4—5: Cyclone between Tonga and American Samoa; the vessel Tokomea and all hands aboard missing. L.L.

5: The motor bulk carrier Chandragupia broke up in seas 10—13 metres high about 1600 km north-west of Honolulu; 69 dead.

6—7: Gales, reaching force 11—12, hit parts of Greece, with blizzards and thunderstorms in Transylvania; m.v. Kyra Elefni sank near Cape Sounion. L.L.

8—9: Severe storm in Gulf of Alaska caused high seas north of Los Angeles; waves up to 4 metres high; houses damaged and mobile homes overturned. L.L.

9—12: Up to 40 cm snow in Appalachians and around Great Lakes; nearly 30 cm snow in Indiana and Michigan, heavy rains preceded snow in areas; frost in C. Florida and other S.E. parts of U.S.; about 20 dead. Gales capsized tug at Fort Royal Sound, S. Carolina; 2 dead, 1 missing. L.L.

9—20: Severe floods in S. Iran; 142 villages and hamlets affected, roads washed away; 20,000 families homeless; 10 dead, scores injured. L.L.

11—15: Severe winter storm from Texas to Grant Lakes and New England; heavy snow in Arkansas, S.E. Kansas and Missouri.

11—12: Gales in France, Austria and Belgium; dredger capsized in gales at Dieppe, N. France; one dead.

11—12: Fierce gales and high seas battered E. England, with winds to 80 knots; heavy snow in Scotland and N. England blocking roads; floods on the East coast claimed one dead (in Wisbech, Cambs), but in the North Sea the storms sank several ships with the loss of 17 lives (also a man died at East Runton, Norfolk, when blown from his motorcycle).

12—13: Roads in N. Spain blocked by snow. About 50 cm snow fell in Tressin Canton, Switzerland. Heavy snow and rain on 13th in N. Italy disrupted road and rail traffic.

13: Ice on M6 motorway near Thelwall viaduct (U.K.) contributed to 16 vehicle pile up; one dead and several injured.

13—16: Rain and flash floods hit the states of Minas Gerais, Rio-de-

Angrado, Heroismo, Azores; 5 missing. Lloyds List.

9: Snow-blocked roads in U.S. Middle-West (Wisconsin, Illinois, N. Indiana, Ohio, Michigan); 5 dead in traffic accidents.

10 (approx.): Severe weather in Black Sea; m.v. Lorna I passed Istanbul on the 10th but never reached Sulina; wreckage found by the 20th; 4 bodies recovered, all 21 crew believed lost. L.L.

10: Floods in S. England; many minor roads cut; 1 dead when a car was swept into flood at Farway, near Honiton, Devon.

11—13: Gales in Ionian Sea; rain, snow, gales in N. Greece; heavy rain on 11th flooded 500 homes in Athens; 5 dead. L.L.

13: Tornado near Houston, Texas, uprooted trees, unroofed houses, crushed mobile homes, and blew vehicles from roads; path length 8 km; one dead. D. Tel.

14: Gales, high tides swamped towns along south coast of Iceland; at Stokkseyri; fishing vessels thrown into streets. L.L.

16 (approx.): Torrential rain and hurricane-force winds hit Brisbane, Australia in a freak storm; scores of homes unroofed.

16—19: Fierce bush fires W. and S.W. of Sydney, N.S.W., Australia (especially in Blue Mountains area), 70 houses destroyed, along with other property, including an entire vintage car collection; 3 dead. L.L.

17—18: Rain, snow blocked roads in N. Greece; heavy snow in suburbs of Athens; gales in Aegean and Ionian Seas. L.L.

17: 70 vehicles piled up on icy, fog-bound autobahn near Munchen, W. Germany; 16 injured.

18—20: Dense freezing fog over wide areas of France led to two big pile ups: (1) on 19th, two mass collisions near Lyon involving 250 vehicles, 3 dead; (2) on 20th, 200 vehicles in a mass collision 40 km west of Paris on autoroute in 5 metres visibility, 7 dead. I.H.T.

20: 40 vehicles piled up in dense fog on M62 between Windy Hill (Lancs border) and Outlane, Huddersfield (S. Yorks); one dead, 7 injured. D. Tel.

21: High winds hit Vera Cruz, Mexico; trees uprooted, power and telephone lines brought down; 21 houses unroofed. L.L.

21—22: Fierce windstorm hit wide areas of California, U.S.; winds gusted to 90 knots or more; buildings wrecked, trees uprooted including giant redwoods, and many power lines and transmission towers demolished; much crop damage in San Joaquin Valley; dust storms in some areas cut visibility and blocked roads; 3 dead following a gale-lashed bush fire at Van-de-Berg Air Base. At Sacramento rain mixed with dust fell as mud. Altogether 9 dead. L.L.

22: Death toll in Gothenburg landslide (30 Nov.) rose to 9. I.H.T.

24: A coaster, Lady Kamila, sank in gales and rough seas off N. Cornwall; 7 dead.

25: Flash floods in N. suburbs of Hobart, Tasmania; roads and homes flooded, lightning hit T.V. transmitter at Luina, W. Tasmania, blacking out all programmes.

25—27: Floods following several days of rain in Jawa, Indonesia; 8000 homeless. L.L.

27: Trawler Conqueror grounded in heavy seas off Moushole, Cornwall; loss - £1 million. L.L.

29: Up to 13 cm snow in Madrid and other parts of Spain.
Janeiro, and Sao Paulo (Brazil); 1400 homeless, 26 dead. L.L.
14: Avalanche, after nearly 2 metres of snow; 1800 dead, 26 dead. L.L.
15—23: Huge bush fires in Victoria, Australia, especially 15th-17th; thousands of sheep and cattle lost, some 26 houses destroyed, 2 people dead. L.L.
16: Flash flood in a part of New South Wales, Australia; 5 dead.
16: Winds gusting to 50 knots hit California, U.S.A.; roofs blown off houses in Sacramento and a baseball park in Tracy.
16—20: Gales and flooding along south coast of France 16th-18th; one dead, 1000 homeless. Heavy snow 18th-20th in Lozere Department and adjacent areas, and generally in W. and C. France; train marooned overnight (J. Met., 3, p. 34); 3 dead in the snow and cold.
17—19: Another severe storm in U.S. Middle West; enormous snow drifts in Illinois, Indiana, Ohio and Kentucky; frosts in Florida.
18—21: Two more severe winter storms hit the U.S.; many states from Texas to Maine affected including New York City (J. Met., 3, pp. 33-34); on 19th, thunderstorms and at least 11 tornadoes in Florida. From 14th to 20th 152 cm snow fell on Oswego, N.Y. State. 2 dead at Jaffett City, Connecticut when factory roof collapsed; other deaths, direct and indirect from snow and bad weather, reached at least 36. L.L.
19—20: Many accidents on ice or snow-affected roads and pavements in U.K. with at least 9 deaths.
21: The Watan sunk in a storm off Kyushu, Japan; one dead, 3 missing. L.L.
21: Avalanche at Lochmiller, Aberdeenshire; one dead.
25: A landslide at Drammen, Norway, swept 6 houses into Oslofjord, besides destroying part of a lumber factory. L.L.
25—27: One of the worst blizzards of the century hit the U.S. Middle West and N.E., and southern Canada; thousands of km of roads blocked trapping innumerable cars, trucks and buses; also tornadoes in Florida and Alberta; some 100 dead in the blizzards either directly or indirectly. L.L.
27 (reported): Floods in Lusaka, Zambia; township of Kenyana worst hit; hundreds homeless; 3 dead. L.L.
27: The motor stern trawler Marbel disabled by engine room explosion driven onto rocks by heavy storm near Cies Island, Spain; 27 dead.
28—29: Severe Scottish Blizzard, see J. Met., 3, p. 34.
28—29: Heavy rain, up to 240 mm, in and around Pictoria and other areas of Transvaal, S. Africa; hundreds homeless, 11 dead.
28—29: Five dead in avalanches in Swiss Alps; and another on the 31st (near Wolfenschiessen).

ALBERT J. THOMAS

Book Review

THE GUINNESS BOOK OF WEATHER FACTS AND FEATS

by Ingrid Holford.


In this, Mrs. Holford's third book, she has again succeeded in producing a well-thought-out book aimed at the general market. It contains an interesting and considerable collection of facts and figures relating to 'weather' over most of the globe, in addition to elementary theory, historical background and many excellent photographs. Many of the items featured are so obscure that one has to admire Mrs. Holford for the amount of research that must have gone into it!

The book consists of 17 chapters, an appendix and an index: the chapters range across the whole spectrum of 'weather' from 'The Radiating Sun' through 'The Nature of Wind' to 'Flood and Drought', and 'Snow' and 'Hail'. The general format is for each chapter to begin with a brief historical introduction concerning that subject—for instance, chapter 5 gives an interesting account of early anemometer designs. All of these historical notes are original and well-compiled, but few of the chapters bring the reader up-to-date and a few diagrams and notes relating to present-day instruments would be useful. For instance, the description on p. 25 of a 'bent-stem soil thermometer' would have been clarified by a photograph or sketch: the section on barometers could have mentioned the Kew barometer.

The chapters then move on to discuss weather notes and world weather records, some elementary theory, or even a mixture of the two. In places the theory is very simplified indeed, perhaps understandably so considering the audience at which it is aimed; but this does not excuse sweeping statements as 'wind is often light in a trough' (p. 76), 'cumulonimbus arcus cumulus clouds which are large enough to produce showers' (p. 122) and 'very hot summers in Britain are inclined to be moist' (p. 104). The description of the Camelford storm on p. 172 contains something of an understatement—'It had been wet all day, total rainfall 7.1 in (180 mm). The last chapter gives more attention to 'weather lore' than to modern forecasting science.

There are quite a few spelling and printing errors throughout the text, although not at the level of annoyance. Imperial units, with metric units in brackets, are used and in places this makes awkward reading. One or two of the tables are slightly incorrect—on p. 30 the now-discredited reading of 36.0°C at Plumpton, Sussex on 28 June 1976 is quoted, and on p. 15 the August sunshine record for Great Britain is given as Guernsey's 325 hr in 1899; Ilfracombe had 335 hr in 1976. Some of the diagrams are rather confusing too—for example, the cross-sectional diagrams of fronts on p. 125 are very poor, with no indication of scale, cloud types, weather (other than dashed lines presumably representing rainfall) and barely any mention of the types of front represented. The 'uninitiated' reader would be little informed from perusal of these diagrams or a reading of the accompanying text on even the most basic frontal theory. Other sticking points include the statement on p. 52 that 'average pressure over Central Asia in July is about 960 mb'; on p. 184 the Hampstead storm is dated 4
August 1975. The Arc of Lowitz was reportedly seen from Berkshire at 2015 G.M.T. on 11 May 1965—surely the sun had set by then?

These defects apart, the book makes enjoyable if slightly 'jumpy' reading—more suitable for dipping into than reading from cover to cover perhaps. It is full of interesting snippets on a wide variety of topics. For example, did you know that Greenland's highest maximum is 30.1 °C and that Greece's lowest minimum is -25 °C; that Bogor, Indonesia has 322 days of thunder per year (p. 187); that Cherapunji had 22,454 mm of rain in six months of 1861, Beloue on La Réunion had 1092 mm in 9 hours on 28 February 1964, or Holt, Montana had 305 mm in 42 minutes on 22 June 1947 (p. 135). The book also contains many photographs, about a quarter in colour, the latter having been reproduced extremely well, but no doubt at the cost of putting the book over the £5 barrier. Everyone will find something to interest them in this book—and barring the relatively minor omissions raised, I can recommend it wholeheartedly.

Bilton, Rugby, Warwickshire.

S. D. Burt

[ A useful addition to this book, which could be made at the time of reprinting, would be a comprehensive bibliography to enable the sources of the author's facts and feats to be followed up by interested readers and students. This could take the form of references, gathered together chapter by chapter at the end of the book as in Frank Lane's The Elements Age. —Ed. ]

LETTERS TO THE EDITOR

A POSSIBLE RELATIONSHIP BETWEEN JET-STREAMS AND VORTICITY

During the past 30 years a large number of papers have appeared about jet-streams but little has been written on the reason why they occur where and when they do. The few articles that deal with the problem invariably start by invoking the Coriolis force before plunging into the innumerable mathematical equations which leaves the average reader little wiser. Even the otherwise lucid book by Reiter is unable to provide a straightforward explanation.

In a recent letter, I proposed a mechanism for cyclogenesis by drawing attention to the vorticity frequently observed in a river in the different region immediately behind bridge pillars. By following the trajectory of a leaf or twig the careful observer will also notice that water, upon entering the region between the pillars, tends to increase speed owing to the constriction these columns provide to the flow. A more marked jet of water is produced in Norwegian fjords where naturally-produced narrowing of the water channels can produce speeds exceeding 15 km/h, and subsequently vorticities may develop. These vortices may later develop into a jet stream. As it increases in size, an upwelling flow occurs when the current pushes itself against a coastline. Another example is the Gulf Stream where warm water moving northwards becomes sandwiched between itself and the colder water of the southwestward moving Labrador Current. Initially the velocity of this open ocean jet rarely reaches 10 km/h, areas of weak but long lasting vorticity are observed to develop after lee-like protuberances appear.

When considering the general circulation of the atmosphere, we find that the region of maximum winds also blows along the converging boundary between warm poleward moving and cold equatorward moving air masses and I propose that these jets are produced by a similar squeezing process. On a much smaller scale I have myself observed a marked speeding up of warm air just ahead of an approaching squall-line or thunderstorm gust-front with occasional incipient vorticity when a local section of the squall-line begins moving ahead of the rest.

Sceptical readers are invited to repeat an experiment which I have described briefly elsewhere.

REFERENCES


Santhanur, Berkshire.

J. M. Heiges

THE CANTERBURY NORTH-WESTER

R. A. Crowder's report of New Zealand's dramatic temperature and humidity changes made very interesting reading (J. Meteorology, 3, 13-15). Results of the heat of 4 February 1973 were described, and one wonders what these extreme variations had on human activity and behaviour. One day's heat of 42.5 °C followed by the next below 20 °C must surely have had some effect. It is well-known that in southern Germany and Austria the johm raises the incidence of suicides. Are similar effects experienced in New Zealand?

The report would have enjoyed these great variations, but, doubtless, daily extremes exceeding 40 °C with low humidity can be tolerated after a period of acclimatisation.

Pottery Bar, Herts.

C. G. Holmes

'SEEN' HOAR FROST DEPOSITION IN A FROST HOLLOW NEAR DOVER

My morning walk is usually between 0700 and 0735. From early November to late February these times are close to sunrise. On most occasions this is the coldest time of day, so that occasionally I see spectacular formation of radiation fog or deposition of hoar-frost.

My walk takes me alongside the small River Dour which flows south-eastwards in a steep-sided chalk valley, just north-west of Dover. I then walk into a recreation ground which contains an old river terrace, and thence up some steps to a road built on what was probably a second river terrace and is now about 25 feet (8 metres) above river level, as shown in Fig. 1.

On a recent clear morning (probably 21 December) I noticed the first signs of hoar frost on the grass just above river level. As I went along the first river terrace, there was little frost in the field below me, but on my return five minutes later the whole field was white and hoar frost was starting to appear on the grass about me. Upon reaching the road at the second terrace, I could see a good covering of white frost on
the field which I had just left and which had been free of frost five minutes previously. The 'black ice' which was then forming on the road caused a spate of accidents later on.

This part of the Dour valley is a prominent local frost-hollow. To the south-east the valley is crossed by a railway embankment which impounds cold air on clear nights so that remarkable inversions are experienced. Just below our house is a field at river level which is bounded by hedges. Until 1974 it was used by a market gardener who planted runner beans and potatoes in it! On two occasions that I know he lost his whole crop in June frosts although we are as far south as latitude 51° N.

I have never exposed a thermometer at this place, but the following tables may be of interest.

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<td><strong>TEMPERATURES, °F DECEMBER 1962</strong></td>
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<td>1961</td>
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<th>TABLE 2 — FIRST AND LAST FROSTS</th>
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32, Valley Road, River, Dover.

F. G. THOMAS

SHETLAND'S COLDEST NOVEMBER OF 1952

The following interesting item appeared in 'Notes From 25 Years Ago' in the Shetland Times dated 2 December 1977: 'The lowest November temperatures since records were started in 1921 were recorded at Lerwick Observatory. There were fifteen nights of ground frost during the month, the temperature falling to 9°F on the 30th, the most severe ground frost for many years.' This is rare for much more often than not November is a quite mild month in Shetland with the farm animals still grazing in the fields.

Whalsay, Shetland.

S. G. IRVINE

AN OLD WEATHER PROVERB FOR MARCH

When I was engaged on my snowstorm research, I came across an unusual version of the adage about March coming in like a lion and going out like a lamb. It was in the Caledonian Mercury in 1843 that the writer stated that 'March has come in, according to the old proverb, with an "adder's head" and it remains to be seen if it will go out with a "peacock's tail".' I wonder whether you or any readers of the Journal have come across this version. It was certainly new to me.

M. G. PEARSON

Meeting Information

INSTRUMENTS FOR AMATEUR OBSERVERS

The meeting on 'Instruments for Amateur Observers' previously announced in this journal (issue 24, page 368) will take place on Saturday 6 May 1978 in the Chemistry Auditorium, Department of Chemistry, University College of London, Gower Street, London WC1. Many of the talks will be by amateurs and others will be by speakers experienced in instrumentation. There will also be an exhibition of amateur and university-built instruments. The organisers hope that the meeting will help amateurs to broaden their perceptions regarding worthwhile observations and experiment about the atmosphere, and will help them to get more from the measurements they take. The meeting is open to everyone, but the registration fee of £3.50 is reduced to £1.50 for members of the Royal Meteorological Society.

Applications for attendance should be made to the Executive Secretary, Royal Meteorological Society, James Glashower House, Grenville Place, Bracknell, Berkshire, and forms returned by 15 April 1978.

The programme is as follows:

1000 - 1100 Registration, collection of badges, coffee and exhibition.

FIRST SESSION

Chairman: Dr. J. R. Milford

1100 Introductory remarks by Chairman

1110 Dr. J. S. Foot (Meteorological Office) SPECIFYING THE CHARACTERISTICS OF AN INSTRUMENT

1150 Mr. G. J. Day (Meteorological Office) OBTAINING GOOD OBSERVATIONS

1230 Lunch and Exhibition

SECOND SESSION

Chairman: Mr. D. E. Pedgley

1400 Dr. G. T. Meaden THE QUANTITATIVE MEASUREMENT OF FOG AND RIME DEPOSITION USING FOG GAUGES

40 Mr. K. Mortimore A SIMPLE HAILGAUGE

1.45 Mr. P. R. Jennings A TIPPING BUCKET RAINGAUGE AND CUP COUNTER ANEMOMETER

1510 Mr. D. Hatcher AN ELECTRONIC SUNSHINE RECORDER

1540 Mr. S. D. Burt KEEPING AMATEURS POSTED—CLIMATOLOGICAL OBSERVERS LINK

1600 Tea and Exhibition

THIRD SESSION

Chairman: Dr. J. R. Milford

1630 Mr. J. Warner TODAY'S WEATHER REVEALED BY RADIO FACSIMILE

1655 Dr. J. S. A. Green/Dr. K. J. Bignall (Imperial College) SIMPLE INSTRUMENTS FOR THE STUDY OF THE ATMOSPHERE AND EXPERIMENTS
THAT CAN BE DONE USING THEM

1735 Mr. D. E. Pedgley (Centre for Overseas Pest Research)
STUDYING THE METEOROLOGY OF
NORTH WALES USING SIMPLE INSTRUMENTS
AND AMATEUR OBSERVERS

1800 Summing up by Chairman
1810 - 1845 Exhibition.
1845 Meeting ends.

TORRNO THUNDERSTORM REPORT: NOVEMBER 1977

By KEITH O. MORTIMORE
77 Dicketts Road, Corsham, Wiltshire
Tornado and Storm Research Organisation

November was an unsettled and frequently stormy month, and thunder was reported on 21 days over Great Britain and the continental countries of Denmark, Belgium and the Netherlands. Activity was frequently restricted to coastal areas and often in association with the passage of frontal and non-frontal troughs.

On the 1st thunderstorms occurred in the morning on exposed south-western coasts of south-west England and Ireland, and on the continent, Belgium and Holland were similarly affected. On the 4th thunderstorms were reported from Atgaston at Machrihanish and during the afternoon another thunderstorm was reported from Huddersfield, while in the evening lightning was observed from Prestwick and in the Wash area. On the 5th a deepening depression moved north-east to the west of Scotland and, as the cold front crossed northern and western areas, thunderstorms developed in places, affecting Straide (Eire) during the early afternoon and central and southern Scotland later in the evening. Another cold front crossed the U.K. during the morning of the 7th followed by showery troughs; one such trough produced quite widespread thunderstorm activity during the evening.

First to be affected was Valley (Anglesey) around 1800, the storms then moving across the country to reach south-east England soon after 2100. With the westerly airstream persisting on the 8th thunderstorms again developed, but this time mainly in Ireland and Scotland, they were accompanied by hail at times. In the south, Heathrow reported an isolated storm during the early hours and lightning was observed from Edgbaston (Birmingham) at about the same time, probably from a source in Ireland. The storms in Scotland continued into the early hours of the 9th but the only reports of fresh activity on this day were from Belgium.

The 11th and 12th were very disturbed days and with a deep depression centred between Iceland and Norway, troughs moved south-east across the British Isles. On the 11th, morning thunderstorms were reported from Anglesey and Eire, during the evening, as a developing cold front moved south-east across the British Isles, thunderstorms broke out over central and eastern England and there were additional reports of hail and severe squalls from some parts. There were also reports of lightning damage. At Burton Joyce (near Newark) a cricket pavilion was completely demolished after being struck by lightning, and the roof of a bungalow was ripped off at Watchet (Somerset). The storms on the 12th were associated with showers in the much colder polar airstream and there were widespread outbreaks over much of Britain and the low countries; many were accompanied by hail, and sleet or snow fell in places. Showers or thunderstorms were prolonged at times as troughs developed and moved south-east over the area, and during the passage of one trough, in the late afternoon, lightning struck the BBC TV mast at Crystal Palace. In the Netherlands the passage of a cold front resulted in widespread storms and there were reports of hailstones 15 mm in diameter and squalls to 60 kt. The U.K. was free from storm activity on the 13th although isolated showers were reported from Belgium and Holland. The 14th was another showery day and thunder occurred in southern Scotland, northern England and the Netherlands, while on the 15th isolated outbreaks were reported on exposed coasts around the British Isles and the near continent. On the 16th further showery troughs brought thunderstorms to Wales, Northern Ireland and the Isle of Man, and during the evening there were reports of lightning off the south-east coast of England, probably associated with storms in Holland. Continuing northerly winds brought further thunder to exposed coasts of Britain and the Netherlands on the 17th; during the early hours activity was mostly restricted to eastern and north-eastern coasts but later in the day they also affected south-west Wales and Cornwall, where during the evening Sthouth (Cornwall) reported a severe thunderstorm accompanied by bullet-shaped hailstones which measured 15 mm in diameter at the wide end and there was a 50-minute power failure. Storm activity continued through the night of the 18th, the 19th, in the U.K. during the evening of the 20th a small depression moved south-east across south-west England into the English Channel, accompanied by heavy rain. Thunder was reported from the south coast from the Isle of Wight to Portland, and in the Channel Islands.

The very cold northerly airstream continued to affect the country on the 21st and early morning thunderstorms developed quite widely, occurring over northern and eastern parts of the country. A severe cell produced 5 cm of snow and a house was left in ruins after being struck by lightning; at about the same time a storm occurred at Culdhouse (Cornwall). A little later, around dawn, thunderstorms developed in Kent and Sussex and during the evening the coasts of north-east England and Norfolk were affected while evening storms in extreme south-west Wales were accompanied by hail. The U.K. was free of storm activity on the 22nd, although there were reports of storms in Belgium and the Netherlands, but during the evening of the 23rd, as an active cold front moved across northern and eastern England, there were numerous reports of hail and a thunderstorm occurred in the Northampton area. Thunderstorms were also reported from Holland on the 23rd and there were further storms in the Low Countries on the 24th and 25th.

CANADIAN WEATHER SUMMARY. JANUARY 1978

Western and northern Canada were drier than usual, but the east had above-normal precipitation as a result of a series of late winter storms which crippled much of eastern North America. The whole country was deep in snow by the month's end except for the B.C. coast. Temperatures were below normal from Alberta to Labrador but well above normal over most of the Arctic.

On the 25th a blizzard lasting 10 hours, with wind gusts to 80 km/hr struck southern Manitoba, cutting visibility to zero in blowing snow. Southern parts of Ontario and Quebec were also affected by severe storms late in the month which
claimed 12 lives in Ontario and caused enormous losses to property. Windows popped out of skyscrapers in Toronto, and travel on all highways became impossible. The pressure in Toronto fell below the previous record set in 1870. Wind gusts exceeded 115 km/hr. Kingston had a record January precipitation at 187 mm (300% of normal), and was the second consecutive month with a new monthly precipitation record. In New Brunswick Moncton (273) and Fredericton (247 mm) had their wettest months in January and one of five stations set new January rainfall records. Storms in the Atlantic Provinces, three of which struck in less than a week, disrupted life everywhere. Strong winds, intense rain, abundant snow, freezing rain, high tides and floods were the elements which combined to stall transport and close schools and businesses. Major events were the collapse of the second longest wooden covered bridge in the world at Upper Dorchester, N.B., and a large concrete span across the Codroy River in Newfoundland. Halifax, with 13°C on the 26th, had its highest ever January temperature. Canada’s lowest temperature was 21°C on the 7th at Mayo, in the Yukon. (Summarised from the Canadian Weather Review.

NEW ZEALAND WEATHER SUMMARY: DECEMBER 1977

Winds were predominantly westerly in December, as a result of which temperatures were below normal in most districts. Departures exceeded 1.5 deg. C in some cases. Crop growth was retarded in many areas, but generally the rainfall was adequate for good pasture growth. Most of the rain was associated with 3 or 4 major troughs of low pressure, giving an uneven distribution throughout the month. On the 11th 223 mm fell at Stratford Mountain House (altitude 866 metres), and on the 14th 120 mm at Waitora. Extremes temperatures included a maximum of 32.5°C on the 4th at Waitaki and a minimum of -4.3°C on the 22nd at Fahaneri Dam.

[Scott Base, Antarctica: Mean maximum -4.0°C, mean minimum -10.9°C; extremes -0.2°C on 15th and -15.6°C on 1st.]

WEATHER SUMMARY NORTH-WEST EUROPE: JANUARY 1978

January was a changeable month which will be remembered for some notable gales and blizzards, particularly in the north and east of Britain. Mean temperatures were generally not far from the long-period averages, but rainfall was mostly above normal in Britain, Scandinavia and the Low Countries.

The weather began mild, and the 1st was the mildest day of the month for many stations in Holland, Denmark and Germany. Braemar, in the Grampians, had a high of 11.3°C on the 1st (and Penryn, Cornwall, 11.7°C on 3rd). During the air spread to Scotland, and winds rose rapidly next day over Britain and the North Sea as depressions crossed Scotland to southern Scandinavia. A vigorous cold front, on which a wave depression formed during the night of 2nd-3rd when near southern Scotland, brought thunder and severe squalls during the morning to Eastern England. A dozen tornadoes broke out on the cold front as it moved south from Yorkshire to Suffolk and the front was responsible for thunderstorms and tornadoes in the Low Countries too. The air in the subsequent ridge was very cold and temperatures fell below -10°C in the Scottish valleys, e.g. -15.2°C at Inverdruie, Aviemore, and -25.3°C at ground level (this air minimum was lower than the January minima at Trondheim and Tromso). Braemar’s minimum on the 5th was -15.0°C. By next day the quiet subsiding air of this anticyclone had moved south-eastwards to Central Europe, and Munich reported -14.7°C on the 6th. Fog was fairly widespread on the 8th and 9th, and lasted throughout the day in some eastern areas. The 9th and 10th were rather showery in the west and north, with isolated thunders; 75 mm diameter hailstones were reported from Cheltenham Barron in Devon. Rain was very heavy on the 10th in South Wales, Somerset, Avon and West Wiltshire (e.g. 43.0 mm at Maundown) from a small depression which later merged with a deepening one further north. This deep depression crossed Scotland to eastern England, and led to the North Sea tidal surge of 11th-12th, as described in the special articles of this issue of the journal. 82 knot gusts were reached at St. Abbs Head (S.E. Scotland) and Whitby (Yorkshire). Pressure rose swiftly to the north and west, but winds veered in (for example, at Burton-on-Trent the pressure rise was 50 mb in the 36 hours ending 2100 on 12th). A quieter, colder period then ensued for some days, with rain or snow at times. The maximum at Great Dun Fell (Pennines), altitude 848 m, on the 17th was -4.1°C, but it was nearly as cold next day in the freezing/riming fog of certain low-lying areas (e.g. there were 12-hour daytime maxima of -3.1°C at Corsham, -2.5°C Trowbridge and -2.2°C Braunston, Leicester). Low minima on the 18th included -11.1°C at Kleider Castle (Northumberland). There were falls of snow in some areas on 19th and 20th, ahead of milder air, as an occlusion over England and a depression over Scotland moved east. The unsettled weather persisted, but the south became very mild on the 23rd (11.7°C at Penryn and 11.5°C at Codford St. Mary). After this the weather turned colder, especially in the north. The arrival of a deep and complex depression, 27th-29th, brought heavy rain and severe gales to much of Britain on 27th-28th and heavy drifting snow in the north. The pressure in N.E. England on the 28th fell to 962 mb. It was estimated that 68-72 cm of fresh snow fell in 50 hours, 27th-29th, at Inverdruie, near Aviemore, and that the depth of level snow on the 29th was 84 cm. In the Cairngorns 110-120 cm fell in the same period, following 45-47 cm on 24th-25th (there was another 40-45 cm 31 January to 7 February, making 205 cm in 15 days). Braemar had an estimated 120 cm snow 27th-31st. It was certainly North Scotland’s heaviest snowfall since 1955, with the formation of drifting snow in which tens of thousands of sheep and four travellers died. More snow fell on the 31st in Scotland and on the Welsh and English hills to a depth of up to 25 cm.

RAINFALL BULLETIN: JANUARY 1978

ENGLAND. Devon: Plymouth, Mt. Batten, 129 mm, 120%; Henleyock, 122.9 mm. Dorset: Dorchester, 115.3 mm; Corfe Mullen, 111.9 mm. Somerset: Sutton Bingham, 124.5 mm, 151%; (99.9 mm/27th); Maundown, 156.2 mm (49.4 mm/24th); (35.5 mm/31st); Dursley, 113.1 mm, 149%; (37.4 mm/10th); Woolavington, 108.9 mm (33.9 mm/27th); Fulwood, 127.8 mm, 152%; (37.0 mm/27th); Gurney Slade, 161.8 mm (28 mm/23rd). Avon: Kingston Seymour, 126.2 mm (34.2 mm/10th); Midsomer Norton, 143.1 mm (35.4 mm/10th); Long Ashton, 130.1 mm (40.9 mm/10th); Midsomer Norton, 123.1 mm (23.2/10th); Petts Wood, 114.0 mm. Wiltshire: Lyneham, 91.1 mm (18.2/23rd); Codford, 108.3 mm (31/27th); Petersfield, 114.3 mm (30.5/27th). Berkshire: Bracknell, Holmwood, 70.9 mm; Hemel Hempstead, Lyndhurst, 127.6 mm, 96%; Brockenhurst, 100.8 mm; Otterbourne, 99.6 mm; World’s End, 94.1 mm; Romsey (H.R. and W.D. Stowers), 106.0 mm; Bishop’s Waltham, 88.5 mm, Wight: 106.5 mm (17/15), 95.1 mm (10th-21st and 27th); Horse Eye, 103.0 mm; Barcombe, 134.4 mm; Ardingly, 142.1 mm; Beeding, 126.1 mm; Fernhurst, 120.9 mm; Arundel, 98.4 mm; Chichester, 99.4 mm; Surrey: Epsom Downs, 112.6 mm (21.2 mm/11th); Worpleston, Merrit Wood, 90.5 mm, (65.0 mm/17th, 80.8 mm/27th and 28th); Hampstead Observatory, 84.9 mm (25.0/11th); Ealing, Brentway, 77.5 mm (20.4 mm/11th); Weather Centre, 59.0 mm. Herts: Royston, 83.4 mm, 165%
### TEMPERATURE TABLES: JANUARY 1978

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*Note: Data for selected locations only.*
LATE NEWS

The great West Country blizzard of 18-19 February 1978 will be reported in detail in a forthcoming issue of this journal. Snow fell to depths exceeding 50 cm in Somerset and Devon. At Exton the snow fall was 70 cm (28 inches) deep. Persistent high winds drove the snow into drifts up to 20-30 feet deep (6 to 10 metres). Would readers having experience of the West Country blizzard kindly send us whatever details of the weather that they can (for possible publication).

On 15 February the maximum temperature at Brumbar was —9.0°C. Minima were —20.5°C (—4.9°F) on the 15th and 16th, and —20.4°C (—4.7°F) on the 18th. At snow level the minimum fell to —26.5°C on the 16th and 18th.

On the 21st much of southern and central England had freezing rain.

In France in mid-February temperatures fell to —24°C (70°F) at Chateauel-de-Randon (La Lozère). On the 19th 21°C (70°F) was reached at Nice, with 20°C at Montpellier, and 19°C at Nîmes.

BACK ISSUES AND SAMPLE COPIES

New and intending subscribers may be interested to know that previous issues of the journal are available. Sample copies will be sent free to anyone upon request. If you know of anyone, meteorological observer, school, institutional, or municipal library who could be sent a copy, please notify us.

ONE-DAY MEETING ON INSTRUMENTS FOR AMATEUR OBSERVERS

Saturday, 6 May 1978, at University College, London—see page 89 for programme details.

TORNADO AND STORM RESEARCH ORGANISATION (TORRO)

This amateur body of observers was formed in 1974 to systematise the collection of meteorological data on tornadoes, funnel clouds, waterspouts, and land- and water-devils occurring in Britain, Eire, and neighbouring countries (especially France, the Low Countries, Scandinavia, Denmark and Germany). The work now includes the study of damaging hailstorms, thunderstorms, and other severe storms as well. Anyone may contribute observations (including press cuttings) at any time; membership is free. For further details and observer report forms, apply to the Director, TORRO, Cockhill House, Trowbridge, BA14 9BG, England.
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