EDITORIAL

ON the Friday morning after the storm, a colleague acidly commented "just because a few stockbrokers from Leatherhead couldn't get to work, it makes the national news!" It was the north-south divide all over again. However, most of us who lived on the fringes of the hardest hit areas soon had our own stories to tell; it became clear that it was more than a tale of a few stockbrokers! I hope that those who still think that there was too much ado will find, in this issue of *Weather*, enough discussion, maps and statistics to convince them that this storm was indeed a rare event.

In this issue we see the enormous breadth that makes meteorology such a fascinating subject. We see established methods mingling with new technology and we see pointers to the future of the subject. We are reminded of the passionate popular interest in the weather, an interest which is, alas, not always accompanied by much appreciation of modern meteorology; this is something that should concern us all. We see the pressures on forecasters, who often have to contend with conflicting information. We see both the power and fallibility of numerical weather prediction, and the treasures available from a careful analysis of satellite data. Advances in meteorology are, however, not only dependent on advances in technology. British meteorologists are at the forefront of the development of new ways of representing the atmospheric circulation. One quantity that is attracting particular attention is potential vorticity plotted on isentropic surfaces, which Hoskins and Berrisford discuss in this issue. Such quantities, although they will still be unfamiliar to a good many readers, seem destined to play a growing rôle in our understanding of the atmosphere in the future. In this issue we also see the importance of careful study of historical records, which allows us to put present day events in a proper perspective.

Weather thanks all the contributors to this issue for responding so quickly to the events of last October. In two or three hundred years time they may be looked on as latter-day Daniel Defoes!

Photo by courtesy of the Sevenoaks Chronicle

At Sevenoaks, Kent, six of the seven old oaks associated with the town's name were blown down in the storm: replacement saplings have since been planted at the site

THE STORM, THE MEDIA AND THE ENQUIRY

By J. T. HOUGHTON

Director-General, Meteorological Office, Bracknell

ON the morning of Friday, 16 October 1987 people living in the South East and East Anglia woke up to a scene of extensive devastation. During the night trees had blown down and damage caused on a scale greater than any experienced in living memory or indeed for a number of generations.

As early as the previous weekend the Meteorological Office had been forecasting severe weather on the following Thursday and Friday. The farmers' forecast just before 1 pm on Sunday the 11th had a summary caption "becoming very windy later in the week". Forecasts of stormy weather in the outlook continued until Wednesday. As Thursday approached however, as is explained by Morris and Gadd (this issue), guidance from the numerical weather prediction models became equivocal. Later on Wednesday and Thursday as explained by Morris and Gadd, the computer guidance concerning inland gales became less clear, with some runs suggesting that the severe gales would not penetrate further north than the Channel and coastal districts of southern England.

For all parts of the English Channel gale warnings were issued early (0630 GMT) on the 15th; at 1030 GMT these were changed to severe gales for most areas. At 2235 GMT on that day warnings of storm force 10 were issued for all areas and at 0135 GMT on the 16th these were increased to force 11. Special warnings were also issued to customers operating offshore. In particular, one major offshore forecasting contract began at midnight on 15/16; a severe weather warning was issued within minutes of the contract starting. Warnings for the sea areas were both timely and adequate.

For land areas the main means by which the Meteorological Office informs the public is through the radio and TV. During the daytime and evening of 15 October, although the radio and TV forecasts all mentioned strong winds, apart from some local broadcasts for the South and East from Southampton and Norwich, they gave emphasis to the likely rain associated with the depression rather than to the winds. By the time most people were in bed no warnings of unusually strong winds had been given through the national TV or radio.

In order to inform the public of the likely occurrence of very severe weather which may cause considerable inconvenience to a large number of people and/or present a danger to life, the Office has arrangements for messages known as FLASH weather messages for dissemination via the media. These are to be issued within 3 hours of the onset of the severe weather when there is virtual certainty of its occurrence. Such messages are of great importance during the day when avoiding action, particularly by those intending to travel, can be taken. Although relevant to many fewer people at night they still giving warning to those who are out and about during the night hours. A FLASH weather warning of severe gales was issued at 0120 GMT on the 16th, and broadcast on the radio services which were operating at that time, giving between one and three hours warning of the strongest winds.

Particular warnings of severe weather are issued to agencies and emergency authorities with whom the Meteorological Office has special arrangements. The most important of these is to the Ministry of Defence under circumstances such that aid from the military may be required by the civil community – such a warning was issued at 0135 GMT on the 16th. Other warnings were issued to British Rail Eastern Region at 1730, to the London Fire Brigade at 2150, to the East Anglian Police Forces at 2305, to the BBC Motoring Unit at 2315 on the 15th, again to the London Fire Brigade at 0140 and to all Police Forces in the South-East at 0145 on the 16th. Warnings were also issued to civil and military airfields from midday on the 15th, warnings that were acted upon in time with the result that there was little damage to aircraft.

By daybreak on Friday, 16 October the South and East of England were hit by major communication problems. The majority of TV and radio services were in chaos with only skeleton services being transmitted. The Meteorological Office at Bracknell had its own problems being almost completely isolated through faults on telephone lines. During the day radio and TV began to pick up many of the issues regarding the weather forecasts of the previous day and began to repeat mercilessly Michael Fish's statement on his lunchtime BBC TV forecast that there would not be a hurricane and Bill Giles' deliberate understatement on the late night BBC2 presentation that "it will be very breezy up through the Channel". Saturday's papers were emblazened with reports concerning the Storm. "Why weren't we warned?" was a typical headline. *The Times* printed a report that the Meteorological Office had disregarded information from the European Centre for Medium Range Weather Forecasts (ECMWF) and that the French and Dutch had got the forecast right. This point was subsequently taken up by many newspapers as a key issue.

By Sunday the papers, still looking for a scapegoat to blame for all the damage, were looking for stories which concentrated on the personalities involved. The TV weathermen, notably Michael Fish, and I were besieged at our homes by reporters and cameramen. The *Sunday Telegraph* reported the Environment Secretary's statement condemning the Office's "unbelievable failure to get it right". Headlines on Monday continued to blame the Office, the *Guardian* attacked the Office's computer, the *Sun* called for my resignation. The only paper with a truly accurate account of events and of an interview with me was the *Financial Times.*

On Monday evening I, together with my Director of Services and my Director of Research, gave a press conference at the London Weather Centre. This was well attended and lasted for the best part of an hour during which we explained the forecast problems and emphasised that, in fact, during the week taken as a whole the Bracknell numerical products gave more consistent and more reliable guidance on the storm than any other centre's. I pointed out that, despite allegations to the contrary in a number of newspapers, none of the meteorological services on the continent had produced forecasts of the severe weather over the land areas of southern England although all had been giving, as we had, severe gale warnings for all the relevant sea areas. At the conference detailed questions were asked concerning the meteorology of the Storm, about how unusual it was, and about the need for observations over the ocean areas to the west of the UK, in particular whether the reduction in the number of weather ships during recent years had affected our ability to forecast such events.

On Tuesday, the whole tone of the press was more favourable towards the Office, many papers giving a fairly full account of the press conference. Some still looked for a trivialising of the Office's position, for instance by emphasising that I had said it was not a hurricane.* On the whole, however, by then the press realised that the accusation that other meteorological services had got it right while Bracknell had got it wrong could not be made to stick. They also realised that, in any case, had warnings been given on the evening of the 15th they could have had little effect on the amount of damage. It was even suggested that the effect of warnings might have been a greater loss of life.

Later on Tuesday the Secretary of State for Defence, to whose Department the Meteorological Office belongs, announced that I had set up an enquiry within the Meteorological Office into the forecasting of the storm and that he had asked two outside assessors, namely Sir Peter Swinnerton-Dyer and Professor Robert Pearce, to review the results of the Office's enquiry and make recommendations as appropriate to him.

The Office's report and the report of the assessors were published in February 1988. The main conclusions of the report concerning the analysis and forecasting of the storm

*In answer to a question "was it a hurricane?" at the press conference I had explained that 'hurricane' was a meteorological term for a tropical cyclone, that hurricane force winds are defined as being greater than 64 knots in mean wind speed, a speed which had not in fact been reached, according to the available records at the time at any inland location.

are essentially described in later articles in this issue (see especially the article by Morris and Gadd).

The recommendations of the Meteorological Office report first concern the observing system and the development of models. It is recommended that:

(1) A continuing and enhanced effort should be made to improve the observational situation, especially in the Atlantic Ocean to the south and west of the United Kingdom. In particular it is necessary: (a) to ensure the quality and early receipt of ships' observations; (b) to increase the number of accurate aircraft wind observations; (c) to consider the advisability of deploying additional observation platforms (e.g. drifting buoys) in the area to the south-west of the United Kingdom, (d) to develop techniques for interpreting and using satellite data in numerical weather prediction models; (e) to introduce satellite-borne microwave sounders, observations which can provide data on atmospheric structure under cloudy conditions.

(2) Further work should be carried out: (a) to determine optimum parameters for the various Meteorological Office models, bearing in mind the particular time-ranges and purposes for which they are used; (b) to introduce higher-resolution models at an early time and, especially, to press ahead with developments aimed at making the mesoscale model fully operational for a larger area; (c) to complete testing of the analysis correction assimilation scheme with a view to replacing the existing scheme within the next few months.

(3) In view of the non-synoptic observations that are now available from aircraft and satellites, the fine-mesh model forecasts should be increased in frequency from two to four per day (for 0000, 0600, 1200 and 1800 GMT) as soon as possible.

The Meteorological Office report goes on to make recommendations regarding the way in which warnings are provided to emergency authorities and regarding the content and style of TV presentations. It recommends that:

(1) A review should be made of the procedures concerning warnings of severe weather which are provided to emergency authorities. This review should address the appropriate threshold for the warnings, their dissemination and the actions which should be taken by the emergency authorities on receipt of the warnings. The review should address, in particular, in the light of experience of the 15/16 October storm (including consideration of what the situation would have been had the storm occurred at a different time of day), warnings of severe gales over land. The Meteorological Office should take action to initiate this review.

(2) A review should be initiated of the meteorological content of TV presentations, in particular of the way in which the Senior Forecasters and media presenters select the emphasis that needs to be given to various factors in the time available.

(3) There should be further discussions with the BBC about the 'style' of the TV presentations. While the more relaxed style of recent years provides a more entertaining product with increased attention from the general public, there may be a case for a specific 'slot' in which details of 'significant weather' (e.g. strong winds, ice, frost, snow, rain, fog) are given.

The final recommendation in the Meteorological Office report is that the Office should review its procedures for dealing with the Press and the Media and for training its personnel in matters concerning the media.

The report to the Secretary of State for Defence by Sir Peter Swinnerton-Dyer and Professor R. Pearce supports the conclusions and recommendations of the Meteorological Office report. It states that the failure of the Office's forecasters to forecast the storm is defensible and that no blame should be attached to them. Their report also makes a number of additional recommendations, the most important of which is that the training of forecasters should be reviewed with particular regard to improving their ability to cope with extreme situations. Action is being taken to follow up the recommendations of both reports.

The storm of 15-16 October 1987 demonstrated how rapidly severe weather can develop and catch us relatively unawares. The storm in the media which followed also demonstrated the intense interest the weather has for the British public and their expectation and demand for accurate and timely weather forecasts. Having established that given adequate observations, technology and scientific understanding such a storm is forecastable, the challenge to the Meteorological Office is to work towards a standard of forecasting and of the dissemination of forecasts which will be able to deal confidently with even such unusual events as the 1987 October storm.

FORECASTING THE STORM OF 15–16 OCTOBER 1987*

By R. M. MORRIS and A. J. GADD

Central Forecasting Office, Meteorological Office, Bracknell

THE Senior Forecaster in the Central Forecasting Office (CFO) at Bracknell is responsible for the issue of centralised guidance to all public service forecast offices throughout the country. His responsibilities include advice to the dedicated shipping forecaster, who is also located in CFO, and on the issue of gale warnings for all sea areas around the United Kingdom continental shelf. The senior forecaster also gives advice to the medium-range forecaster. In association with a subjectively drawn 24 hour surface forecast chart, the senior forecaster issues a descriptive textual guidance routinely four times daily, although updates and amendments can be issued at any time. Each issue of the guidance, which is termed a 'synoptic review', is put into two or three parts. The guidance is designed to add value to selected numerical model products which are received directly by the outstations from Bracknell as well as containing the definitive guidance on the forecast to be followed by all regional offices.

Centralised guidance for periods 2–5 days ahead is provided by the medium-range forecaster in CFO twice daily. This guidance consists of a set of forecast charts for T+48, T+72, T+96, T+120 hours which display isobars of mean sea-level pressure (PMSL) with fronts and superimposed 1000–500 mbar total thickness isopleths. The PMSL and total thickness are more or less identical with the output from the Meteorological Office global numerical weather prediction model. The fronts are added from a consideration of the thermal field in some detail including the 850 mbar wet-bulb potential temperature forecast charts. The medium-range forecaster also issues a textual guidance in association with the charts in which he describes the technical aspects of the forecast evolution as well as the details of weather to be expected over the United Kingdom throughout the period. An important aspect of this guidance is the emphasis and degree of confidence placed by the forecaster on particular developments. In this respect he will take into account the consistency of the numerical model guidance from run to run, and also the consistency in comparison with other numerical model products.

BRIEF DESCRIPTION OF THE DEVELOPMENT OF THE STORM DURING THE 15 OCTOBER

At 0000 GMT 15th (Fig. 1) an elongated trough of low pressure was located over a distance of about 600 miles (960 km) extending from north-west of Corunna westwards. There appeared to be two distinct centres, one 983 mbar just north-west of Corunna and the other at about 43°N 19°W. There was a strong pressure gradient on the warm side of the frontal trough but not on the cold side. By 1200 GMT (Fig. 2) the broad surface trough advanced north-east to lie from north France across Finistere. The central

*Editor's note: A number of the charts presented in this article are as used by the Central Forecasting Office. We apologise that some of these do not reproduce too well. They are, however, adequate for noting the position and intensity of the storm, and for illustrating the points raised in the text.

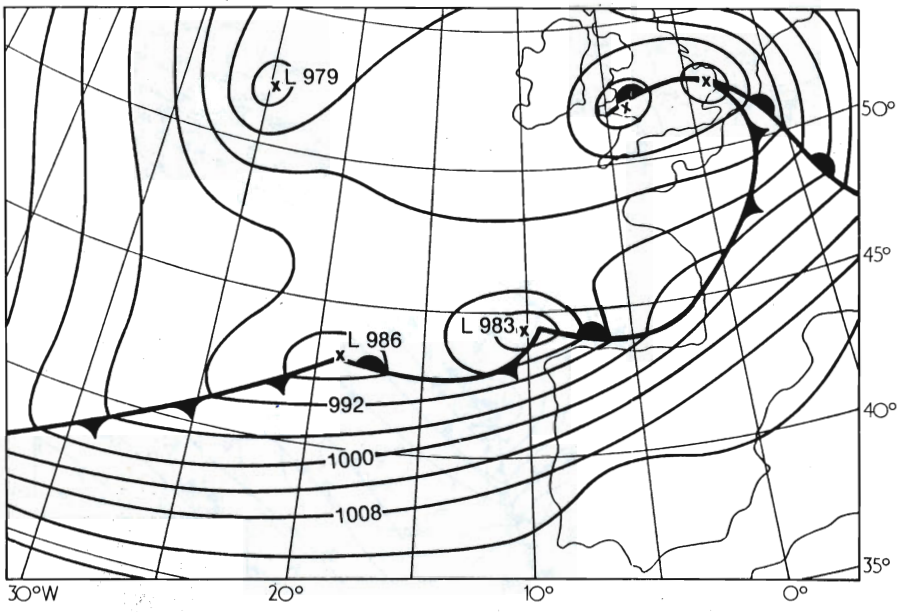

Fig. 1 Surface analysis for 00 GMT 15 October 1987

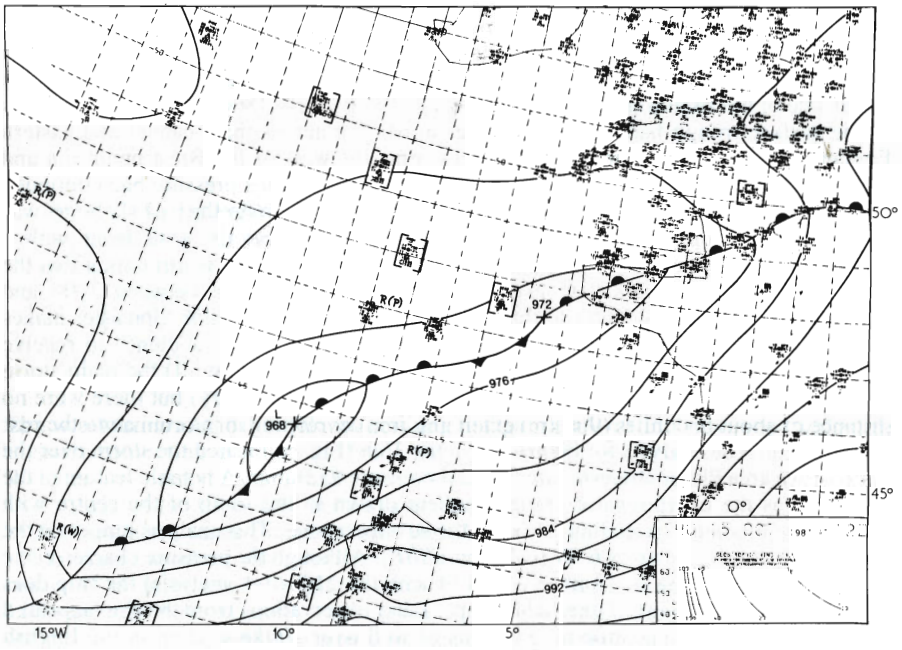

Fig. 2 Surface analysis for 12 GMT 15 October 1987