

# Science & *the Public Affairs forum*

## Severe weather warning: communicating danger and disaster

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## Executive summary

Severe weather events can have a devastating effect on individuals and communities, causing both short- and long-term damage. Flooding is the most common type of severe weather event in Europe and the effects of climate change indicate that it is set to become even more of a problem.

Effective communication of the dangers of flooding is essential to raise the public's awareness of flood risk, especially among communities that have not previously been seen as at a high risk of flooding. Some people currently do not even know whether they live in a flood risk area and are not aware of the means to find out.

The Met Office plays an important role in providing accurate information, and other organisations such as the Scottish Environmental Protection Agency (SEPA) are taking a major part in alerting the public by implementing new initiatives and flood warning schemes.

Severe weather warnings have to be clear and accurate, conveying both the type of severe weather that is expected and the probability of its occurrence. The Met Office works alongside organisations like SEPA, and meteorological experts, to ensure that they have the latest information and can incorporate it into their awareness-raising and warning schemes for those who may be affected.

## Introduction

The United Kingdom experiences many different types of severe weather, from snow storms to gales, to freezing rain. But by far the most common natural disaster in the United Kingdom and Europe as a whole is flooding, and its impact on communities can be hugely complex and diverse.

Such events can have a serious impact on businesses and people's lives, their property, and their well-being. In the United Kingdom, the frequency and magnitude of severe weather, which can result in flooding, is set to increase as a result of climate change. Scotland, in particular, will experience double the risk of flooding in some areas by the end of the century.

Such extreme weather conditions highlight just how susceptible we are to the elements, and force society to question the risks associated with such weather and appropriate management. They also raise the important issue of how these risks can be communicated to different groups of people and who is ultimately responsible for ensuring that the messages have been heard and understood.

Effective weather warnings play a vital role in minimising the risks involved and the way the warnings are communicated can make all the difference to how people react and respond.

Members of the public and representatives from organisations involved with communicating severe weather warnings met to discuss these issues at a Science and Public Affairs forum, held on 6 May 2004. The forum was organised by the BA, hosted by Our Dynamic Earth and sponsored by the Met Office.

Speakers at the forum were Ewen McCallum, Chief Meteorologist at the Met Office, David Faichney, Leader of the Flood Warning Development Team at the Scottish Environmental Protection Agency (SEPA), and Irene Lorenzoni from the Centre for Environmental Risk, University of East Anglia. The evening was chaired by journalist Toby Murcott.

## Communicating severe weather information

The Met Office's role in reducing the risk of severe weather impacts by informing the public and relevant authorities is vital. The accuracy of forecasts is very important if they are to provide a reliable and effective way of communicating the probability of an event occurring.

The efficiency of a forecast depends on the quality of the meteorological data and its interpretation, both of which inform the forecast, and also how well the forecast message itself is communicated. If the message is unclear, then the effectiveness and therefore the impact of the forecast diminishes.

There are four essential elements to making severe weather warnings effective: predicting what will happen; interpreting the predictions; constructing a message to the public and relevant authorities; and carrying out protective steps. Being able to predict a severe weather event (or the probability of the event happening) is the first crucial step in severe weather communication.

Over the past 20 years, weather predictions have improved greatly due to the use of advanced technology like supercomputers. As Ewen McCallum suggested, the emphasis now clearly needs to be on effective communication as detailed forecasts alone are not enough to make the risks evident.

The Met Office not only has to provide information to the general public, but also more detailed information for agencies such as SEPA. This requires tailoring the message to suit the

audience, whether it be a member of the public with no technical knowledge of weather systems, or a highly skilled meteorologist.

It is also vital that severe weather warnings communicate the level of uncertainty within the forecast itself to ensure that people take notice and can prepare themselves, although this raises further difficulties of understanding how likely an event is and deciding upon a suitable course of action.

The Met Office uses ensemble forecasts to predict the weather from three to seven days in advance. Unlike traditional forecasts, ensemble forecasts give a range of possible predictions and the estimated probability for each one. Finding a suitable way to express this uncertainty is essential; the Met Office uses probability to present this.

This means that not only do severe weather warnings have to be clear in terms of the type of weather that the public and the authorities should prepare for, but also how likely it is that it will occur.

The way the probability of severe weather happening is expressed is important to ensure that the relevant audience understands it and can make appropriate decisions accordingly. For example, expressing probability as a percentage rather than using words such as 'may', 'might' and 'could' has more of an impact and presents a clearer message.

A major problem of issuing severe weather warnings is that the probability of the most extreme weather events occurring is very low; this means that warnings of severe weather that could cause the most damage are not always taken as seriously as they should be because they appear to be very unlikely. Therefore decision-making for events of this severity should be related not just to the probability of occurrence but to the impact of the event.

A simple example is to ask the question: if there was a 5% chance of rain would you play golf? Whereas if there was a 5% chance that the flight you had booked would crash, would you board the flight? The impact clearly is important to the decision.

Organisations like the Met Office must also be able to communicate these probabilities to the relevant authorities (for example local councils, emergency services, building and estate managers) to give them enough time to take the appropriate action. The Met Office takes an important role in the First Guess Early Learning Project which works with local authorities to try and give early warnings of severe weather, and is part of the National Severe Weather Warning System. The project uses the ensemble technique to build in the uncertainty to the severe weather warnings.

The project estimates the probability of severe weather up to five days in advance for the United Kingdom, dividing it up into 12 regions. This information allows individual areas to be better prepared. For example, depending on the probability given for a severe forecast, local authorities can have the right number of people on duty to deal with any emergencies that may happen.

The Met Office issues different types of warnings depending on the probability of the severe weather occurring and how far in advance the warning is, ranging from a few days to just a few hours: early warning; advance warning; flash warning; weather watch; and a motoring warning aimed at the emergency services and the general public.

One member of the audience raised the issue of what advice organisations such as the BBC receive to communicate a really serious event. Irene Lorenzoni commented that apart from alerting people, there are currently no structures in place to deal with this. But it is

acknowledged that as the frequency of severe weather events increases, weather forecasters will gain experience dealing with these.

Ewen McCallum explained that the Met Office works closely with the BBC and that programmes could be interrupted to provide a severe weather warning if it were necessary.

### Communicating flood risk

Severe weather such as heavy rainfall can lead to flooding, which can affect parts of Scotland and the United Kingdom. Some parts of the country already live with the risk of flooding on a frequent basis.

Irene Lorenzoni explained that floods are the most common natural disaster in Europe and can have a devastating effect on local communities, particularly on more vulnerable groups, such as the elderly, young children and the disabled. Flooding can also be particularly damaging if people are not prepared or do not understand the associated dangers.

The communication of flood warnings brings with it many complicated problems such as: the need to both reassure and warn the public; how the warning is interpreted; managing the public's reaction to false alarms; controlling unofficial weather communication; and the role of insurance companies.

But as the effects of climate change become visible, more parts of the country will be at risk of flooding and will need to be made aware of the necessary action to take in the event. This is where organisations such as SEPA's Flood Warning Development Team and the Centre for Environmental Risk come into play.

The risks associated with flooding include both environmental and social factors, and SEPA hopes to address these issues through four areas of flood risk management: awareness, avoidance, alleviation and assistance.

The process of interpreting weather forecasts and forming a flood warning brings with it elements of uncertainty, but the nearer a potential event is, the more certain the warning can be.

The Met Office and SEPA work with hydrologists and meteorologists to provide the relevant information. SEPA has an extensive river level data archive. By analysing this data with relation to weather events, SEPA can establish the relationship between precipitation and flooding. As a result of this information, individual rivers and lochs are given warning levels and local authorities and emergency services are alerted if necessary.

SEPA creates flood warnings by interpreting information provided by meteorologists and hydrologists. The role of the hydrologist is vital; they are on 24-hour standby and work with the Met Office to provide up-to-date information by constantly monitoring rainfall and water levels in lakes, rivers and canals. As a result of this information, individual rivers and lochs are given warning levels and the local authorities such as the police and councils are alerted if necessary.

SEPA recognises the importance of informing the public if they live in a flood risk area and they target these areas with advice and guidance on what to do in the event of a flood. They identify high-risk areas by using a variety of methods: looking at historical data; and using Geographical Information Systems (GIS) to create digital maps of areas at risk. SEPA is also building up long-term data for rivers and canals to help identify those areas most at risk of flooding.

From the audience discussion it became clear that very few people know whether or not they live in a flood risk area or even how to find out. The flood risk maps which SEPA is producing would therefore provide a vital communication tool, provided they are adequately explained and interpreted, to raise awareness in areas at risk from flooding.

For some people, knowing whether they live in a flood risk area may make it easier for them to relate to flooding information and potentially take decisions and adequate action to protect themselves and their property accordingly. SEPA is interested in encouraging people to be responsible for their own actions and help the overall management of flood risk. This applies not only to the general public but to planning authorities and insurance companies as well.

With regards to the issue of insurance, the panel members believe that initiatives such as the maps SEPA is producing will raise awareness of flooding risks and potentially help more accurately define insurance premiums, which will be based on this information and the action people may take to reduce the risks of flooding to their property.

People are also concerned about the future of planning permission and question whether local authorities should be responsible for making sure that permission is not given for building in the wider margins of flood risk areas, in order to reduce the future risk of flooding. In Scotland, SEPA takes part in flood appraisal groups with town planners which development applications have to go through.

People are aware and concerned about flood risk but we need to look at what people feel they can do about it and whether it is the responsibility of individuals or society as a whole. Management of risk communication is very important, it is especially important to see if the message has been effective by assessing how people have responded to it.

It is interesting that there are differences in the way other nations respond to such warnings. For example, in the UK, the public tends to complain if a warning is issued but the event doesn't actually take place, whereas in countries such as the Netherlands, people prefer to undergo the stress of evacuation following an early warning rather than face the possible consequences. This relates to cultural differences, to ways in which the warning system is operated, to trust in the institutions providing the warning and proposing action and to the expectations that communities or individuals may have regarding the safeguarding of their properties and their lives.

#### Effect of climate change on flooding

It is generally accepted by scientists that climate change is happening. Rising sea levels and increased winter rainfall in strong spells will contribute to increase flooding. This, coupled with more land in use for housing and other purposes, means that more people will be at risk more often.

As flood warning is a key part of flood risk management, more time and effort will need to be spent on this in order to address this increased risk. At the same time, the alternative is to limit expansion to areas known to be at high risk from flooding, in order to reduce the likelihood of this happening.

David Faichney demonstrated, using figures from the UK Climate Impact Programme (a government-funded organisation to help businesses and organisations prepare for climate change), that it is predicted that there will be an increase in of up to 30cm in average sea level by 2080, and similarly an increase of up to 4°C in average daily temperature (under the medium-high scenario of UKCIP).

Current theories on climate change predict that the UK annual rainfall distribution will change. Winters in the east of Scotland, for example, will be wetter if predictions are correct. Summers will be generally drier but due to the predicted increase in temperature summers could see an increase in rainfall amounts associated with thunderstorm activity, perhaps leading to an increase in summer flooding events. This, combined with the predicted rise in sea levels, will result in increased flooding.

In response to a question from the audience, the panel agreed that climate change is a very real issue which requires serious consideration. Despite this, it would seem that many members of the public view climate change as a very remote issue both in terms of time (being so far in the future) and in space (that it is more likely to affect some countries more than others).

One possible way of overcoming this view is to focus on the local aspects of climate change, by linking the message of other local issues such as car use and traffic, which currently affect more people and which can be related to more easily.

The issue of responsibility for tackling the predicted effects of climate change is very important. There is a great need for people to begin to recognise and accept that climate change is a real threat, not just a scientific theory.

Philip Wright, the head of the Air, Climate and Engineering Unit (Scottish Executive) was at the forum and highlighted the fact that they are extremely concerned about climate change and have several initiatives already in place.

Ewen McCallum believes that in order to tackle climate change, it is necessary to look at the bigger picture. Namely that countries such as the United States and Russia need to be realistic about their role in cleaning up the planet and sign up to the Kyoto agreement to cut down on greenhouse gas emissions.

The increased risk of flooding as a result of climate change has increased the need for communicating flood warnings and means that agencies such as SEPA should continue their awareness-raising programmes, while providing the means for people in areas at risk to find out about the threat of flooding to themselves and the action they can take.

SEPA runs a number of flood warning initiatives such as Floodline (giving information and advice about potential flooding), flood warning schemes and the new and improved flood maps for Scotland, scheduled for introduction later in 2005.

The National Flooding Framework was launched in 2003 by the Scottish Executive to improve public awareness of flood risk by providing better information and introducing more flood warning schemes. The national framework is striving to bring together all partners in Scotland associated with flood management issues and has sustainable flood management at its core.

In addition to environmental factors affecting flood risk, it is also important to acknowledge social factors. Flood awareness, the resilience of a community, social disruption, response and whether the public trust the institutions there to help them are all important elements in increasing the awareness of flood risk and its management.

It is essential that the increasing threat of floods is addressed now, in order to minimise the amount of disruption and distress to communities in the future. With the UN warning that the number of people at risk of major flooding will double to two billion within the next 50 years, flood risk management should be a priority for the United Kingdom.