

# Crisis response and climate change – part II

In the second part of this discussion **Dave Robinson** explains the role of meteorological models in predicting and monitoring severe weather conditions and pollution, outlining how prediction and early warning can save lives



The Met Office's Environmental Monitoring and Response Centre also acts as the Volcanic Ash Advisory Centre, issuing guidance to the civil aviation community on volcanic ash clouds over the North Atlantic and north-west Europe. Meteorological models help in all manner of disaster prevention scenarios

photo: WMO

**T**HE NUMBER OF named tropical cyclones in the North Atlantic set a new record in 2005. The season saw 27 tropical storms of which 14 became hurricanes, including four major hurricanes, the most devastating of which was Hurricane Katrina.

Major or intense hurricanes cause more than 83 per cent of the damage from natural events in the USA; although they only account for 21 per cent of tropical cyclones which reach land. Most seasons see tropical cyclones somewhere which reach Category 5 (maximum sustained one-minute wind of over 156 mph), however few reach landfall like Katrina.

## Cyclone warnings

The Met Office provides input into the tropical cyclone warning process by sending forecasts of tracks (the direction the cyclones are predicted to take) to the National Hurricane Center in Miami every 12 hours. In the case of Katrina, Met Office forecasts three days ahead predicted the location of landfall to an accuracy of 60km.

Later, when Hurricane Rita threatened to cause even more devastation, the Foreign and Commonwealth Office; the Deputy Consul-General, and the British Embassy in Washington were just some of the organisations which followed our forecasts.

Tropical cyclones also cause devastation in countries such as Mozambique, which is highly vulnerable to natural disasters of a hydro-meteorological origin. In 2000 a cyclone hit the country, causing three weeks of floods in which 700 people died and more than 100,000 had to be evacuated. Every year at least three tropical depressions or cyclones, or at least one flood affect the country. Droughts occur every three to four years.

In the past, the country's weather service, INAM, used radio and newspapers to disseminate weather forecasts and early warnings, but following the 2000 disaster concerns were raised about their effectiveness. The quality of the radio signal is generally very poor away from major urban areas, and newspapers are only read by

a small fraction of the population. So INAM, in collaboration with the National Institute for Disaster Management, and with funding from USAID, created a Tropical Cyclone Early Warning System, providing information of lead-time and intensities of tropical cyclones.

INAM also set up a media weather studio, including a presenter and graphics, using a system donated by Met Office. The forecasts are broadcast daily on the national television station.

The new processes have proved effective. On January 5, 2006, a tropical depression affecting the Mozambique Channel threatened the southern province of Gaza. Because of warnings issued via TV forecasts, people in the town of Xai-Xai evacuated to safer areas and/or adopted measures to minimise impact.

The Met Office works closely with a range of impacts specialists at home and abroad to try to raise awareness of, and plan for, the impact of climate change. Through collaboration we are improving prediction of climate impacts by:

- Ensuring our climate model data is compatible with impact models;
- Developing a framework for the interaction between impact models as they evaluate climate change impact; and
- Where appropriate, incorporating the impact and their feedbacks on the climate system, eg deforestation, into our models.

The Met Office actively contributes to the World Weather Watch programme of the World Meteorological Organisation, the UN body that oversees meteorology and hydrology. Internationally we have participated in a large number of projects, including a real-time flood forecasting system in Poland and a cyclone tracking system in India.

Currently we are using our newest computer model, HadGEM1, to predict global river flow. The model includes the direct effects of climate change on rivers and the effect of CO<sub>2</sub> on plants. It predicts significant regional variation in the changes in river flow. For example, there could be large reductions in river flow in Europe, North Africa, mid west America and northern South America, while large increases occur in West Africa and northern China.

In the UK we have been working very closely with the Fire Service, the Environment Agency, and energy providers to offer services to improve their operational effectiveness, for example during times of atmospheric disasters or floods; or planning for a reduction in natural resources.

Last year when the Buncefield Oil Depot exploded, the Met Office was involved straight away. A computer model called NAME (nuclear accident model) was used to calculate how the smoke would behave, taking into account various

physical and meteorological factors.

Since the Chernobyl incident, the Met Office has become one of eight centres in the world responsible for forecasting the dispersion of contaminants resulting from large-scale chemical or nuclear accidents. These centres are called Regional Specialised Meteorological Centres (RSMC). The Met Office, in conjunction with Météo-France, the French weather service, has responsibility for all incidents within Europe and Africa, but could also be called upon to provide back up to other areas.

## Year-round response

The Met Office's Environmental Monitoring and Response Centre (EMARC), set up in 1998, provides a response, 24/7, 365 days a year, to emergencies throughout the world. In the UK we have a commitment to provide rapid and accurate advice in the event of a chemical release, enabling emergency services to safely deploy their staff at the release site and identify safe evacuation areas where appropriate. The roles of EMARC include:

- Forecasting the spread and deposition of radioactive or chemical pollutants;
- Forecasting the dispersion of volcanic ash;
- Forecasting the spread of airborne viruses, such as foot and mouth;
- Providing storm-tide forecasting for unusually high and low tides; and
- Providing forecasts for governments as part of the cold weather payments scheme.

■ **Chemical and nuclear pollution:** EMARC will respond immediately with a verbal forecast and follow it within 20 minutes with a written forecast, including an 'area-at-risk' map. The map is produced by an emergency version of the Atmospheric Dispersion Model System (ADMS), which can be run in a few seconds on a PC. The forecaster inputs basic wind and stability information and an area-at-risk plume is output on a 1:50K Ordnance Survey map grid.

If an incident, especially nuclear, proves serious enough and the emergency briefing rooms of the various government departments are opened, the EMARC forecaster would be deployed there to brief senior officials or ministers on the weather-related aspects of the radioactive dispersion.

Real nuclear incidents are fortunately very rare, so it is important that systems be exercised on a regular basis.

■ **Marine pollution:** In the event of pollution in UK waters – the grounding of an oil tanker, for example – the Met Office is involved in forecasting for the Maritime and Coastguard Agency (MCA). A forecaster is deployed to the emergency incident room, and EMARC

co-ordinate the dissemination of forecast information. Typical data for input into an oil dispersion model are wind speed and direction, and current, wave and swell information.

■ **Volcanic ash:** Another role of EMARC is as the Volcanic Ash Advisory Centre (VAAC). EMARC issues guidance to the civil aviation community on volcanic ash clouds over the North Atlantic and north-west Europe, primarily Iceland. EMARC also has the ability to provide backup to VAAC Toulouse, which covers Europe, the Mediterranean and a large proportion of Africa. When an eruption occurs, a statement is produced every six hours, containing forecast details and graphical output.

■ **Coastal flooding:** EMARC also forecasts sea levels and issues alerts to the UK's Environment Agency when tidal levels are expected to reach a concerning threshold. Waves can contribute significantly to the risk of flooding, both by overtopping coastal defences and by damaging the defences themselves.

■ **Severe weather impacts:** The Met Office's Severe Weather Impacts Model (SWIM) is designed to help local authorities, industry and emergency services prepare and plan for severe weather events. It provides information on the impact of severe weather on a range of UK infrastructures, down to the resolution of a postcode district. Used with other information SWIM can be an extremely valuable tool for policy development, scenario planning and emergency response training.

## Climate change

Climate change will present new opportunities and threats to the world, but the poorer communities are those that will be most affected. Information on the impact of climate change can help policymakers and local communities plan how to adapt their major infrastructure and development projects. Climate risk management strategies are needed to ensure that these projects achieve their long-term goals. In order to help we must work even closer with emergency planners; crisis response experts and aid agencies to:

- Develop capacity in developing countries – sustainable observations and applications;
- Develop national and local adaptation plans for specific sectors – agriculture, health, tourism;
- Identify key researchable issues for climate change; and
- Develop climate risk management strategies.

There is a feeling among many people that now that the message is clear (climate change is happening), perhaps it is time to move to adaptation rather than trying to stop the global rise in temperature.

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