NERC SCIENCE OF THE ENVIRONMENT

NERC PURE Associates

Can we improve heatwave and cold weather warnings?

EXPANDING AND IMPROVING ENVIRONMENTAL HEAT AND COLD-STRESS FORECASTS

Public Health England / MetOffice / University of Reading

The need

There are clear links between extreme weather conditions and human health. For example, during the 10 day, 2003 August heatwave, there were over 2,000 extra deaths compared to the same period in the previous year. The UK also has one of the highest levels of excess winter mortality in Europe. For example, during the December to March 2013 there were 32,000 more deaths than the rest of the year.

Public Health England delivers warnings of extreme heatwave or cold conditions to the public with a range of different warning levels, aimed at reducing the risk to the public of these extreme events. The aim of this project was to investigate how the communication of these warnings could be improved using operational Met Office forecast systems.

What we have achieved

We have proposed a revised health forecasting system for the UK which, in line with the National Severe Weather Warnings Service, produces colour-coded warnings of periods in which the impact of extreme weather on human health is predicted to be high.

The revised system produces warnings based both on the potential impact of the extreme weather conditions and on their likelihood. By adopting this 'risk-likelihood' approach we have been able to explicitly incorporate the uncertainty inherent in weather forecasts into the health warning system. The revised system also offers users a detailed view of regional variations in alert levels, to allow them to plan resources more effectively. Initially, users are presented with a UK map showing a single warning level for each of 11 regions. By clicking on a region with a given warning level, they are then able to examine variation in the alert level at much finer resolution.

We have tested the new system for three recent cases studies (two hot, one cold) which had significant health impacts. Discussion of these cases with users has suggested the additional information provided by the new system would be of operational benefit. To begin to test this, we have started a follow-up project to implement the new system at the Met Office.

"We have found the NERC PURE Associates project immensely useful in exploring how we might increase the usefulness of hot and cold weather alerts, and so better protect health during adverse temperature."

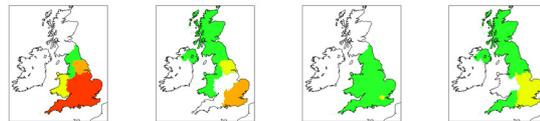**Dr Angie Bone, Public Health England**

How we did it

Our re-design of the health forecasting system focussed on producing two risk matrices for heat-wave and cold weather as shown in the figure on the right. The risk matrix is made up of thresholds for the impact of extreme weather on the x-axis and thresholds for the likelihood that those conditions will occur on the y-axis. Thresholds for the impact part of the matrix are derived from papers in the epidemiological literature (Armstrong et al. 2011, Hajat 2013) which derive relationships between temperature and the mortality risk ratio for 11 regions in the UK. The temperature thresholds for the risk matrix are then derived for fixed risk-ratios from these studies as shown by the figure on the top right. The likelihood axis is derived by considering the lead-time of the forecast for the case studies considered in this project (assuming that forecasts with longer lead time have less skill
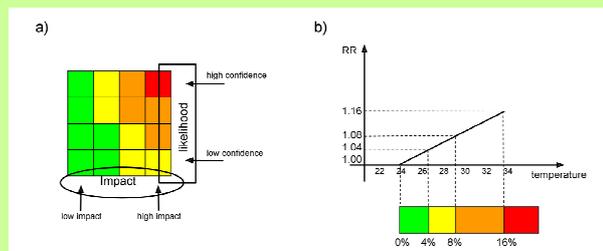
and hence lower likelihood), but we have also tested a case where a full probabilistic ensemble forecast is used to assign likelihood.

An example of the new system's output is shown below for July and August 2013, where the panels show forecasts, 1-4 days prior to the event.

Meet the team

From left to right:
**Dr Giacomo Masato, Dr Andrew Charlton-Perez,
University of Reading;
Prof. Virginia Murray, Dr Angie Bone, Public Health England**

"This project has been a real personal success, it has been very instructive to see how the expertise I developed in my research career can be successfully applied (and be relevant) to an real-world problem."

Dr Giacomo Masato, University of Reading

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NERC is the UK's main agency for funding and managing research, training and knowledge exchange in the environmental sciences. Its research contributes to a strong UK economy and improves people's lives.

PURE is a Knowledge Exchange Network and Research Programme funded by NERC to increase the impact of Natural Hazard research and to take a national leadership role in changing the way in which uncertainty and risk are assessed and managed across the Natural Hazard community.

Project Details

Partners
Public Health England
Met Office
University of Reading

Project dates
November 2013 —
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