Using weather forecasts to optimally issue severe weather warnings

Warning systems play a major role in reducing economic, structural and human losses from natural hazards such as windstorms and floods

The challenge

A weather warning system is a tool by which imperfect forecasts about the future are combined with potential consequences to produce a warning in a way that is deemed optimal.

A warning system is only useful if well defined and thus understood by stakeholders. The challenge here was to improve the current severe weather warning system used by the UK Met Office, by making it more transparent and tailored for the various end-users.

What was achieved

Based on sound mathematical theory, we produced a tool that combines predictions of future weather with user-attitude towards false alarms/missed events to produce bespoke warnings that are optimal for each user.

Below are examples of rainfall warnings during 15-31 October 2013 for two such users: 1) an end-user who is tolerant towards false alarms (left), and 2) a forecaster who issues warnings and thus less happy about false alarms as they might affect their credibility (right). There are 4 increasing levels of warnings: green, yellow, amber and red, and 4 rainfall intensity categories: very low, low, medium and high. The height of the bars indicates the forecasted rainfall intensity (1 for no rainfall,
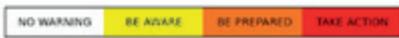
8 for high rainfall) whereas the symbols at top of each bar indicate what actually happened. Clearly the end-user and the forecaster have very different views about what warnings they want to see, which is what our framework is designed for: bespoke warnings to all end-users, with minimal user input regarding false-alarm appetite.

> *"Weather forecasts and warnings are only useful if people use them to make decisions which help to protect lives, livelihoods and property. As forecasts become more sophisticated and include information on probability and risk they are potentially more valuable, but interpretation needs to be tailored to the vulnerabilities of particular decision-makers. This project has significantly advanced our capability to apply this in the field of severe weather warnings and opens the possibility of warnings tailored to the needs of individual users."*
>
> **Ken Mylne**
> Met Office

Note: This is a first guess warning for the NSWWS.
For official warnings see www.metoffice.gov.uk

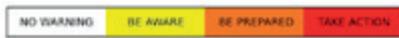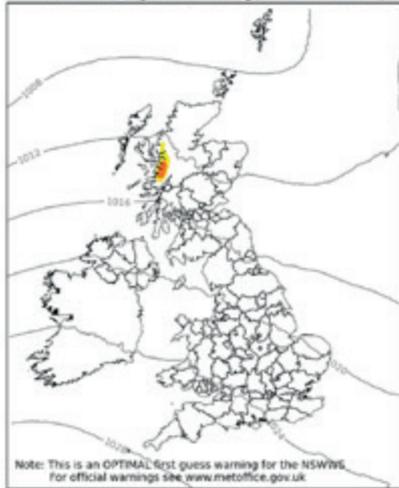| NO WARNING | BE AWARE | BE PREPARED | TAKE ACTION |

Overall Warning Status

This warning area is most similar to the areas issued by the forecasters.

Met Office first-guess warning
Minimising loss for a forecaster

Valid 21Z Wed Aug to 21Z Thu 11 Aug (0 to 24 hour lead time)

Note: This is an OPTIMAL first guess warning for the NSWWS.
For official warnings see www.metoffice.gov.uk

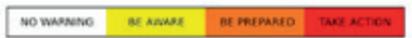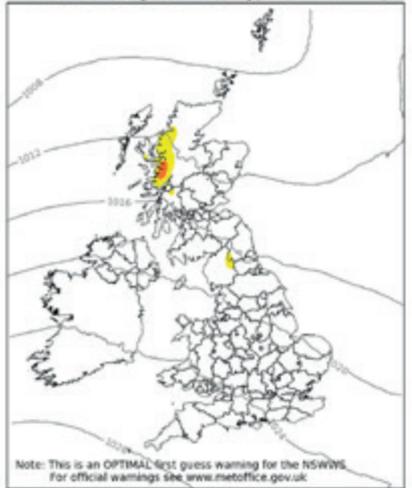| NO WARNING | BE AWARE | BE PREPARED | TAKE ACTION |

Optimal Warning Status

This is the smallest warning area. Forecasters want to minimise loss from too many false alarms.

Met Office first-guess warning
Minimising loss for a householder

Valid 21Z Wed Aug to 21Z Thu 11 Aug (0 to 24 hour lead time)

Note: This is an OPTIMAL first guess warning for the NSWWS.
For official warnings see www.metoffice.gov.uk

| NO WARNING | BE AWARE | BE PREPARED | TAKE ACTION |

Optimal Warning Status

Similar to the Met Office rule but with a larger amber area. Householder is happy to receive a higher magnitude warning.

BAYES' WARNINGS, END-USER
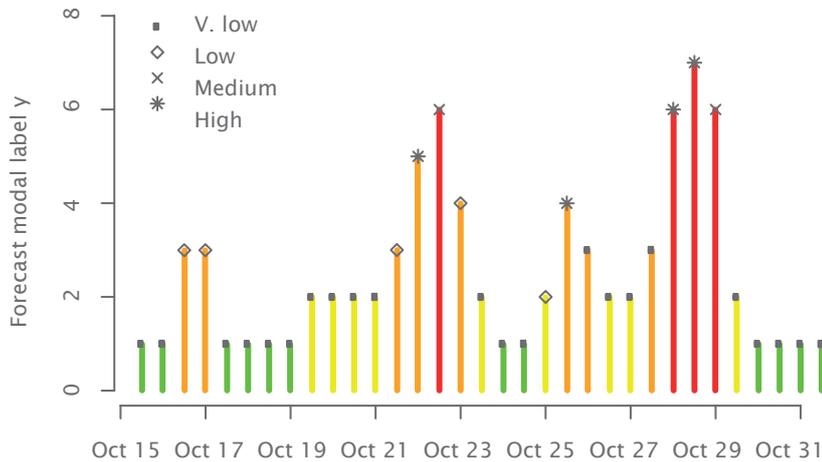
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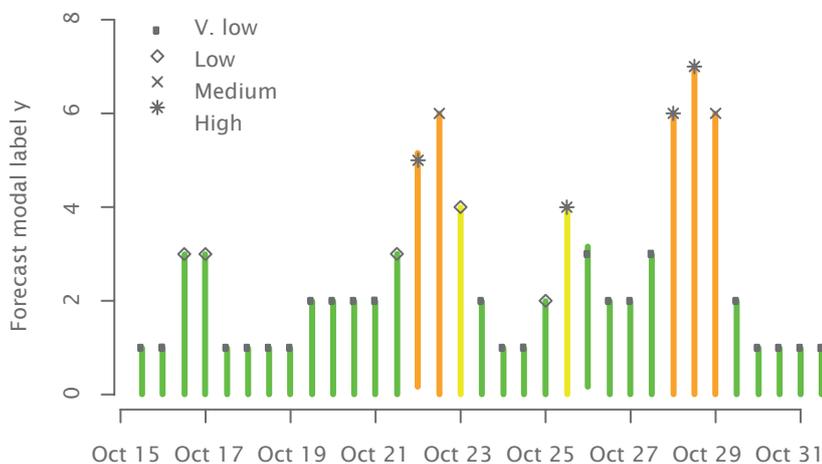
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BAYES' WARNINGS, FORECASTER