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K.C. Wright, GNS Science, PO Box 30368, Lower Hutt,

D. M. Johnston, GNS Science, PO Box 30368, Lower Hutt

J. S. Becker, GNS Science, PO Box 30368, Lower Hutt

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ABSTRACT

The New Zealand MetService provides severe weather outlook, watch and warning advisories. These advisories are given for a range of weather event types, including heavy rainfall, strong winds, snow, storm surge, heavy hail, and more recently for thunderstorms. Outlooks, watches and warnings are differentiated by the time period between impact of a particular event and the time of prediction. MetService and GNS Science have produced a collaborative survey which assesses the recognition and understanding of severe weather advice provided by MetService prior to extreme weather events. The survey was conducted over three days in Christchurch at the annual Agricultural and Pastoral Show and has a response rate of n = 160. This data report summarises the results of the survey.

KEYWORDS

Severe weather, watch, outlook, warning, survey, MetService, Christchurch, awareness, understanding.

1.0 INTRODUCTION

MetService is New Zealand's official severe weather information service with its status designated through the Meteorological Services Act (1990). The role of MetService is to provide a range of weather-related products including daily forecasts, medium and long range forecasts, mountain and marine forecasts and severe weather forecasts for New Zealand. MetService is also contracted to provide forecasting services to Pacific Island nations.

One of the key services MetService provides is the provision of severe weather outlook, watch and warning advisories. These advisories are provided for a range of weather event types, including heavy rainfall, strong winds, snow, storm surge, heavy hail, and more recently for thunderstorms also. Outlooks, watches and warnings are differentiated by the time period between impact of a particular event and the time of prediction. For most weather types outlooks are provided for up to ten days in advance, except thunderstorms, which have a three day outlook. Severe weather watches are provided two to five days in advance, except for severe weather thunderstorm watches which have a 24 hour watch period. Severe weather warnings are provided 24 hours in advance for all weather types except thunderstorm warnings which have a three hour warning period.

Alongside the varying timeframes for different types of severe weather advice, a probability of occurrence or confidence level (in the prediction) is associated with outlooks, watches and warnings. In general, the shorter the timeframe until expected impact of a severe weather event the higher the confidence level will be regarding location and magnitude of the event (e.g. rainfall intensity and duration, or average and gusting wind speed).

The MetService website states:

“Warnings for severe weather are in the national interest since in most severe weather events, if sufficient warning is given, some actions can be taken to mitigate the effects and the total cost of storm damage reduced.”

Metservice has been providing severe weather advice to the public in the outlook, watch, warning format for a number of years now, and is interested in whether the public recognise the difference between the terms used, and understand what these differences are.

To improve our understanding of the public's awareness and use of weather warnings a survey was undertaken in November 2009. This paper presents a summary of the key findings from the survey.

2.0 METHOD

Data were gathered using the short interview structured questionnaire surveying method. Questions were developed to take respondents through a logical progression of thinking about their daily weather information sources, about severe weather events that could and had impacted them significantly, and whether they recognised and understood the specific terms used specifically by MetService for severe weather advice. Survey questions were

developed in conjunction with MetService staff, in order to ensure correct terminology was used and that the right types of question were being asked. The result of this process was a short questionnaire (Appendix 1), designed to take about five to ten minutes to complete, and to be conducted by a researcher with reasonably simple level of training required.

Each question was numerically coded to allow for quantitative analysis of the results. Some qualitative analysis was required of free response questions. Free response questions were prompted 'to exhaustion', where the interviewer asked 'and what else' until they were specifically told 'nothing else'. For the pilot study MetService offered a draw prize of a digital home weather station as an incentive for people to agree to be questioned. Contact details were collected from those who wished to be entered in the draw, but not saved or related to question answers in any of the analysis. Potential respondents were all verbally offered this opportunity before they decided whether to complete the survey. As with all GNS social science team surveys, an ethics approval process was followed using the Massey University protocols, as GNS Science is a partner in the Joint Centre for Disaster Research with the Massey University School of Psychology. Those approached and asked to participate in the survey were always provided with the option not to participate.

Christchurch City was chosen as the pilot location for the survey for several reasons:

- The Canterbury Agricultural and Pastoral Show was scheduled for three days in November;
- The show provided a large, cross-sectional pool of potential respondents;
- Public attending the show would be in leisure mode, and potentially be more approachable in terms of agreeing to share 10 minutes of their time with researchers;
- MetService had a trade stall booked at the show which allowed researchers to gain free entry to the show for all three days and provide a base to store materials and liaise throughout the day.

Two researchers (one GNS social scientist and one research assistant from the University of Canterbury) attended the show and completed 160 surveys throughout the event. Potentially more surveys could have been collected but a severe gale, with hail and rain swept through the show on the third day and drove people away from the show or into covered shelter. One of the conditions show organisers had set for surveyors was that show attendees could only be approached in outside spaces, not inside the covered pavilions. Data collected were loaded into spreadsheets in Microsoft Excel and SPSS software for analysis.

The margin of error for the survey of sample size $n=160$, out of a 2006 census population $P=521,832$, is 7.7%. A difference between two responses in a survey isn't simply 'significant' vs. 'not' if it is inside or outside of the margin of error. The greater the gap between the two responses of interest (recalculated together to be out of 100%, i.e. excluding any other possible responses to that question), the more likely it is to be real in the population. A gap half the margin of error is about 69% likely to be real, a gap exactly the margin of error about 84% likely to be real, and a gap twice the margin of error is about 97.5% likely to be real (these are called 'probabilities of leading').

$$\text{Margin of error} = 1.96 \sqrt{\frac{.25^2}{n} \times \frac{P-n}{P-1}}$$

Where P = population and n = sample.

3.0 RESULTS

3.1 Daily Weather Information

Respondents were asked what their main sources of daily weather information were (Table 1). All results are given in rounded whole numbers (percentages) due to the relatively small sample size combined with the margin of error. Options were unprompted and participants could name more than one source. Nearly three quarters (74%) of respondents got their daily weather information from the television and around one third reported receiving or seeking information from websites and the radio. A quarter or less reported receiving information from the newspaper (25%) and natural signs (14%). No participants reported receiving information from SMS Text, email, fax or other sources.

Table 1 Main sources of daily weather information

| Valid responses n=160 | % |
|------------------------------|----------|
| Television | 74 |
| Websites | 37 |
| Radio | 35 |
| Newspaper | 25 |
| Natural signs | 14 |
| SMS Text | 0 |
| Email | 0 |
| Fax | 0 |
| Other | 0 |

Few respondents said that they subscribe to weather services (only 12.6%), with only 3% saying that they subscribe to the MetService directly, and the remainder from other subscriptions (e.g. Sky TV).

The MetService was reported by 44% as the primary organisation producing weather information they received. Nineteen percent did not know where their weather information came from, whereas 43% stated a range of other organisations including television, radio, Blue Skies and NIWA.

3.2 Severe weather impacts

People were asked what type of severe weather events could affect them in the future or have significantly disrupted their lives in the past 5 years. Table 2 shows the responses to these questions. Respondents could name more than one type of severe weather event they believed likely to impact them.

Table 2 Severe weather events and significant impacts

| Valid responses n=160 | Could possibly affect you (% of n) | Have affected you in the last 5 years (% of n) |
|-----------------------|------------------------------------|--|
| Very strong wind | 53 | 24 |
| Major thunderstorm | 18 | 0 |
| Heavy rainfall | 36 | 23 |
| Heavy hail | 18 | 0 |
| Heavy snow | 37 | 30 |
| River flood | 19 | 12 |
| Storm surge | 0 | 0 |
| Others | 24 | 9 |

3.2.1 Severe weather events believed likely to impact them

Approximately half of respondents considered very strong wind (52%) to be the most likely severe weather event to impact them in future. Over a third of people felt that they could possibly be affected by heavy rainfall (36%) or snow (37%). Less than a third of people mentioned thunderstorm (18%), hail (18%) and flood (19%). The 'other' responses (23%) were a combination of meteorological and non-meteorological events (drought, tsunami, earthquake, extreme cold) with drought being the most frequently mentioned "other" event (8%). Twelve percent of all respondents said no weather events would be likely to significantly disrupt their daily lives.

3.2.2 Severe weather events that had impacted people in the last five years

In the last five years a minority of people report being significantly affected by severe weather related events, with snow (30%) and wind (24%) being the events that most often affected people, followed by heavy rainfall (23%) and river flooding (12%). Hail had impacted nearly 7% of people and thunderstorms 3%. Eight percent of people had been impacted by other types of events, including extreme heat, frost and tornadoes. One person had been impacted by a storm surge event.

3.3 MetService Severe Weather Advice

Respondents were asked if they had heard of specific terms for severe weather advice given by MetService. The terms used are 'severe weather outlook', 'severe weather watch' and 'severe weather warning' (Table 3).

Table 3 Respondents' recognition of terms for severe weather advice

| Valid responses n=160 | Yes (%) | No (%) | Unsure (%) |
|-----------------------|---------|--------|------------|
| Outlook | 75 | 21 | 4 |
| Watch | 55 | 39 | 6 |
| Warning | 96 | 3 | 1 |

3.3.1 Understanding of the term severe weather outlook

When asked what the terms 'severe weather outlook', 'severe weather watch' and 'severe weather warning' meant, respondents were free to answer with their own terms and

explanations. Some people provided answers that fit more than one theme of the answer analysis; e.g. they linked terms to probabilities and event types, or to how a message was delivered and whether the public should take action. Because of the possibility for respondents to provide answers that fit more than one theme (probability, time scale, event types etc) the results of the questions on understanding sum to greater than 100%.

When asked what they thought the term severe weather outlook meant there was a wide range of responses including interpretation of the context of the term. For example, 8% considered that the term outlook related to a timeframe for something occurring, although what this time frame was differed between respondents; answers included two days (or couple of days), three to five days, a few days, short-term, long-term, in the future and seven to ten days. Other interpretations were related to the likelihood of something occurring without specifying what the event occurring might be. Eight percent of people thought that outlook meant “something coming up”, 6% thought it meant something is “predicted” and 6% thought it meant something was “possible”.

Around 39% stated that a severe weather outlook meant weather that was abnormally bad, severe, or horrible was on the way. Eleven percent of respondents named specific types of events, most of which were weather related with one person naming tsunami as related to the term severe weather outlook. Of those that named a type of event 4% of people named storms, 3% named wind and the remainder mentioned heavy rain, floods, drought, southerlies and/or snow.

Other interpretations of the term severe weather event included 4% of people identifying this type of advice as “a warning”, 3% of people saying it was an indicator that “you should take action” and 3% of people responding that it was an indicator that people should “pay attention”.

Finally 2% of people said they didn’t know what the term meant and 25% made no response to this question.

3.3.2 Understanding of the term severe weather watch

There was a slightly lower response rate to this question; 56% of people specified what they thought the term severe weather watch meant, and 3% of people indicated they “did not know” what the term meant.

Again the context varied for different respondents with some people linking the term to a timeframe, a small number to specific locations or weather types, some indicating that the term indicated a likelihood of something happening and others linking the term to actions. The most frequent answer (21% of respondents) from those who specified what the term severe weather watch meant thought that it meant that forecasters (some mentioned MetService specifically) were “keeping an eye on things” or “monitoring”. Conversely, other people (11%) thought it meant that that they should keep an eye on the weather themselves. Thirteen % linked the term severe weather watch to a probability of something possibly occurring, while 2.5% of people thought it meant something would definitely happen. While 1.3% of respondents stated that severe weather watch was not as bad as a warning, a few people 2% considered that a severe weather watch indicated some kind of action should be taken by the public.

In terms of timeframes for severe weather watches, few people linked this type of information to a specific timeframe. Two people (1%) stated it applied to events happening within 48 hours, and 2% of people linked severe weather watches to immediate events. A small number of people (3%) mentioned specific types of hazards (including river rise, mountain forecast, storms or tsunami events) while 12% mentioned severe, bad or worse than normal weather in general as being indicated by the term severe weather watch.

3.3.3 Understanding of the term severe weather warning

More respondents chose to answer the question regarding the meaning of the term severe weather warning (92%) than for the explanations of severe weather outlook (75%) and watches (56%). This implies the term was more familiar to respondents. However, there was still considerable diversity in what people thought a severe weather warning meant. Again some people related it to different time frames, but many more differentiated by the degree of certainty inherent in a warning message. Again, some people identified particular types of weather events, and some included hazard events not covered by MetService severe weather warnings.

The time scales mentioned by respondents included 8% of people stating warnings were applied to events that were imminent or less than 24 hours away, and one person (<1%) said warnings applied to events up to 48 hours away.

With regards to associating a severe weather warning with a probability, 19.5% of people stated that a warning meant something was certain or highly likely, and 5% identified that a warning meant something may occur or might be going to happen. Three percent indicated that warnings meant an event had already arrived. Other respondents phrased probability in a slightly different manner with 19% stating that severe weather warnings were a forewarning of severe weather events that had not yet arrived and 11% said the term severe weather warning meant “something is coming”.

There was recognition among 28% of respondents that severe weather warnings were associated with events that were worse than normal, bad, “yuk” or extreme. More people identified specific event types in this question than for outlooks and watches including snow, wind, rain, or tsunami (all 3%), flood or storms (1%), and hail (1%). Two people (1%) identified the event warned for as being “impending doom”.

In terms of actions and response 12% said that severe weather warnings meant the public should take action, 8% said the public should watch out or keep an eye on things, and 1% said that the messages were for farmers to take action. Three percent of people commented that severe weather warnings came from particular sources: 1% said from MetService, 1% from television messages and 1% said warnings were from the radio.

3.3.4 Metservice provision of severe weather advice

Participants were asked to indicate for which type of severe weather event MetService could provide forecasts. Respondents could choose yes, no or unsure for a range of severe weather types and one hazard event type (flooding). These were all prompted and self-completed. Flooding was included because it was mentioned by some of the GNS Science staff test participants who trialled the survey before it was used with the public.

Table 4 Types of severe weather forecasts respondents believed MetService could provide

| Valid responses n=160 | Yes (%) | No (%) | Unsure (%) |
|------------------------------|----------------|---------------|-------------------|
| Very strong wind | 98 | 1 | 1 |
| Major thunderstorm | 67 | 21 | 12 |
| Heavy rainfall | 98 | 1 | 1 |
| Heavy hail | 67 | 18 | 15 |
| Heavy snow | 97 | 2 | 1 |
| River flood | 57 | 27 | 16 |
| Storm surge | 53 | 27 | 20 |

There was very high awareness of MetService providing forecasts for severe wind (98%), rain (98%) and snow events (97%), and good awareness of MetService providing thunderstorm (67%) and storm surge warnings (53%). Just over half (57%) incorrectly attributed the issuing of flood warnings to the MetService

4.0 SUMMARY

In November 2009 a public survey was conducted to gauge awareness and understanding of severe weather that could affect or had affected them significantly and also their awareness and understanding of MetService severe weather outlooks, watches, and warnings. The survey had a sample size of 160 people and had a margin of error of 7.7%.

In general there was recognition of the potential impact that could arise from a wide range of severe weather types. People were less confident in their answers when discussing awareness and understanding of the MetService terms severe weather outlook, severe weather watch and severe weather warning.

5.0 ACKNOWLEDGEMENTS

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APPENDIX 1 SURVEY QUESTIONS

Severe Weather Advice Survey

(Q1-Q4 Do NOT prompt any responses – record only those reported from memory)

- Q1** What are your main source(s) of daily weather information? (tick all that apply)
- ₁ Television ₂ Radio ₃ Newspaper
- ₄ Web sites ₅ SMS/Text Updates ₆ Fax
- ₇ Email ₈ Natural Signs ₉ Other (please describe)
- Q2** Do you subscribe to any weather information services? (tick one)
- ₁ Yes (**Please describe where from, and what type below**) ₂ No
- _____
- Q3** Which is the primary organisation producing the weather information you receive/access? (tick one)
- ₁ MetService ₂ Don't know
- ₃ Other source (**please provide details**) _____
- Q4** What kinds of severe weather events do you think **can possibly** affect you? (tick all that apply)
- ₁ Very strong wind ₂ Major thunderstorm ₃ Heavy rainfall
- ₄ Heavy hail ₅ Heavy snow ₅ River flood
- ₆ Storm surge (coastal sea flooding) ₈ Are there any others? (please describe)
- Q5** Which of the following severe weather events in the last 5 years have significantly disrupted your daily life? (tick all that apply - READ OUT the listed options)
- ₁ Very strong wind ₂ Major thunderstorm ₃ Heavy rainfall
- ₄ Heavy hail ₅ Heavy snow ₆ River flood
- ₇ Storm surge (coastal sea flooding) ₈ Are there any others? (please describe)
- _____
- _____
- Q6** For each severe weather event in the last 5 years which significantly disrupted your daily life, please briefly describe how your daily life was affected. (EVENT/AFFECT):
- _____
- _____

Q7 Name any of the types of messages MetService produces to advise of likely severe weather:

Q8 Have you heard of the term *severe weather outlook*? (tick one)

₁ Yes ₂ No ₃ Unsure

Please describe what you think it means _____

Q9 Have you heard of the term *severe weather watch*? (tick one)

₁ Yes ₂ No ₃ Unsure

Please describe what you think it means _____

Q10 Have you heard of the term *severe weather warning*? (tick one)

₁ Yes ₂ No ₃ Unsure

Please describe what you think it means _____

Q11 Please indicate which types of severe weather event MetService provides forecasts of:
(respondent self-complete, tick all that are appropriate)

| | | | |
|------------------------------------|---|--|--|
| Very strong wind | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |
| Major thunderstorm | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |
| Heavy rainfall | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |
| Heavy hail | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |
| Heavy snow | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |
| River flood | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |
| Storm surge (coastal sea flooding) | <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₃ Unsure |

Q12 Are you: ₁ Male or ₂ Female

In what year were you born?: _____

Where do you live? (town/city, or country if not NZ) _____

What is your occupation?: _____

If you would like to go in the draw for a mini weather station please supply a contact phone number: _____

(personal telephone information is confidential and will not be used for any other purpose than the prize draw).



www.gns.cri.nz

Principal Location

1 Fairway Drive
Avalon
PO Box 30368
Lower Hutt
New Zealand
T +64-4-570 1444
F +64-4-570 4600

Other Locations

Dunedin Research Centre
764 Cumberland Street
Private Bag 1930
Dunedin
New Zealand
T +64-3-477 4050
F +64-3-477 5232

Wairakei Research Centre
114 Karetoto Road
Wairakei
Private Bag 2000, Taupo
New Zealand
T +64-7-374 8211
F +64-7-374 8199

National Isotope Centre
30 Gracefield Road
PO Box 31312
Lower Hutt
New Zealand
T +64-4-570 1444
F +64-4-570 4657