Day by Day?

Communicating Severe Weather Hazard with Multi-day Outlooks in NZ

MARY ANNE T. CLIVE ✉, EMMA E. H. DOYLE, SALLY H. POTTER, CHRIS NOBLE, AND DAVID M. JOHNSTON

✉ m.clive@gns.cri.nz

GNS SCIENCE TE PŪ AO · MetService TE RATONGA TIRORANGI · TE KUNENGA KI PŪREHUROA MASSEY UNIVERSITY UNIVERSITY OF NEW ZEALAND

Severe weather outlook forecasts can be hard to clearly communicate because they show multiple weather patterns across multiple days and regions with varying uncertainty. This study explored how visual elements of outlook design, such as how forecasts are shown across days, affect the way that people understand and make decisions with these complex graphics. Here, we share our findings about how visualization of the time window, forecast area, icons, and uncertainty can influence inferences and decisions about severe weather. We show how the learnings have informed a redesign of the outlook used in Aotearoa New Zealand (NZ).

Severe weather outlooks

Multiday severe weather outlooks can inform planning beyond the hour-to-day windows of warnings and watches. Although commonly used by specialist audiences, these longer-range vizualisations, such as the NOAA Storm Prediction Centre Convective Outlooks in the USA and the MetService Severe Weather Outlook in NZ, are increasingly used and shared by public audiences on social media for activities such as planning weekend activities. Previous work has shown that visualization of weather forecasts can have important influences on comprehension and behavioral intentions. We tested visual variables of the MetService Severe Weather Outlook design, which targets weather 3-6 days out.

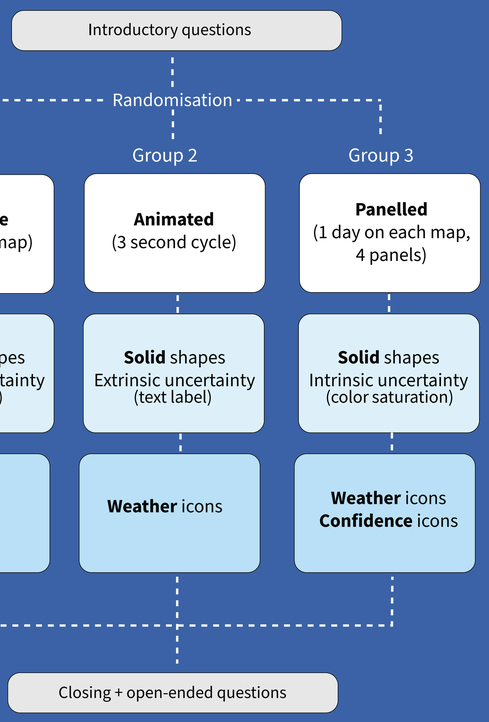
NZ Severe Weather Alerts

Warning	Next 24 hours
Watch	1 - 2 days out
Outlook	3 - 6 days out

The MetService Severe Weather Outlook targets widespread (1000 km²) wind, rain, and snow events that meet specific thresholds.

Study Design

Three separate groups responded to the same series of questions while viewing different modified versions of a hypothetical outlook and we compared their responses.



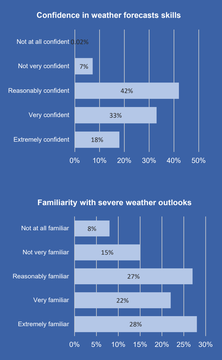
417 Participants across NZ

93% Between the **ages of 20 - 69**, most of which had been in NZ more than 10 years

51% Very or extremely **confident in their skill** to read and interpret weather forecasts

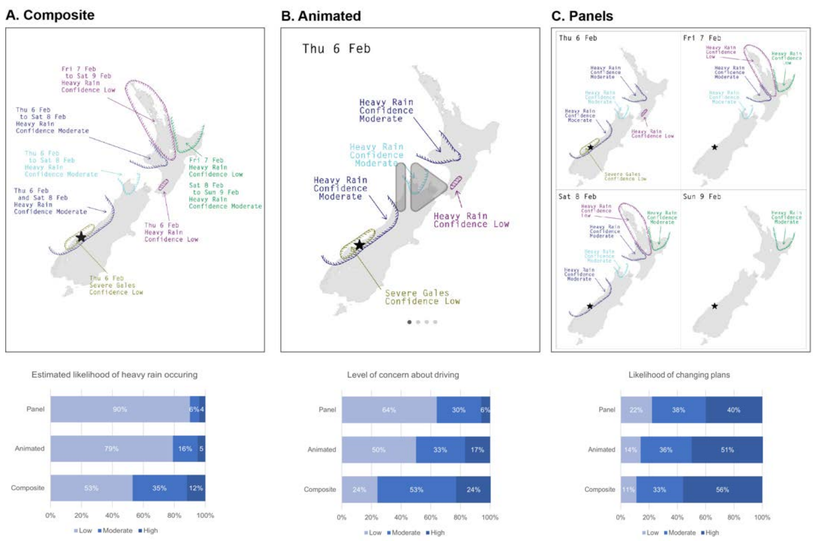
50% Very or extremely **familiar** with the MetService severe weather outlook

>0.05 No observed differences in the level of confidence or familiarity with the outlooks between groups at the p = 0.05 level



Grouping content by day can reduce potential for bias

Displaying outlook content for multiple days alongside each other in a panel graphic (e.g., Tuesday, Wednesday, Thursday), rather than collectively in a composite graphic (e.g., Tuesday–Thursday), may help support accurate inferences and reduce perceived forecasting biases.



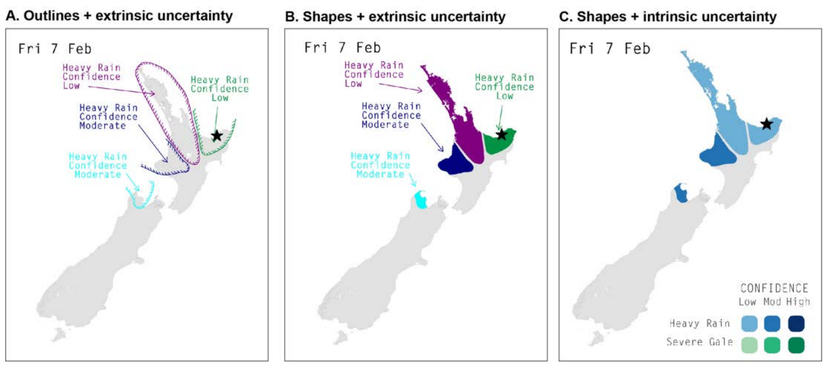
Participants in the composite outlook group (A) reported higher likelihoods of severe weather occurring on a day when there was no severe weather forecast to occur, *despite* accurately reporting that there was no severe weather forecast on that day.

They tended to extend the severe weather forecast for Thursday and Saturday into the forecast for Friday (suggesting an assumption that it was underforecast). This perceived bias was associated with higher reported levels of concern about travel on Friday and greater likelihood of changing plans for weekend travel.

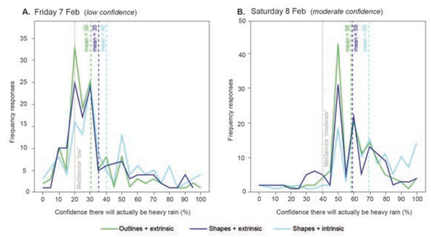
In future studies, it would be valuable to compare this with a situation in which the desired response is an increase in protective action and increased levels of concern are warranted.

Visualization of forecast area can affect perceived uncertainty

Extrinsic expressions of uncertainty, which add objects such as text to describe uncertainty, may help support more accurate interpretations about likelihood than intrinsic expressions, which manipulate visual variables of the existing graphic, such as color saturation.

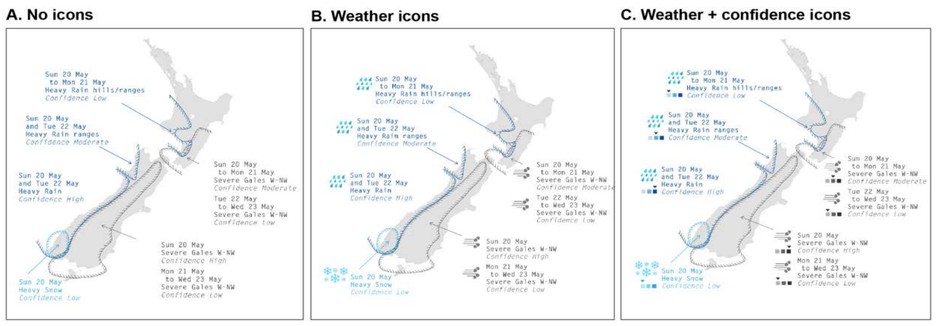


Salient (visually bold) areas were associated with higher levels of perceived forecast confidence than areas that are displayed using outlines.

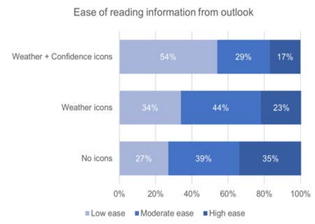


Icons can be helpful...in moderation

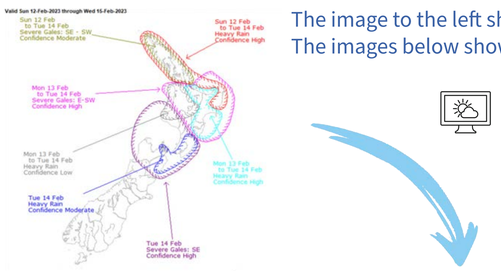
Inclusion of weather icons in outlooks can increase comprehension of overall regional weather patterns, but adding icons for uncertainty creates visual clutter and confusion. Icons should be used in moderation and should be tested with users for ease of reading.



Weather icons were associated with improved ability to correctly identify how many weather phenomena were forecast to occur, but did not increase reported ease of reading.



Applying findings in practice



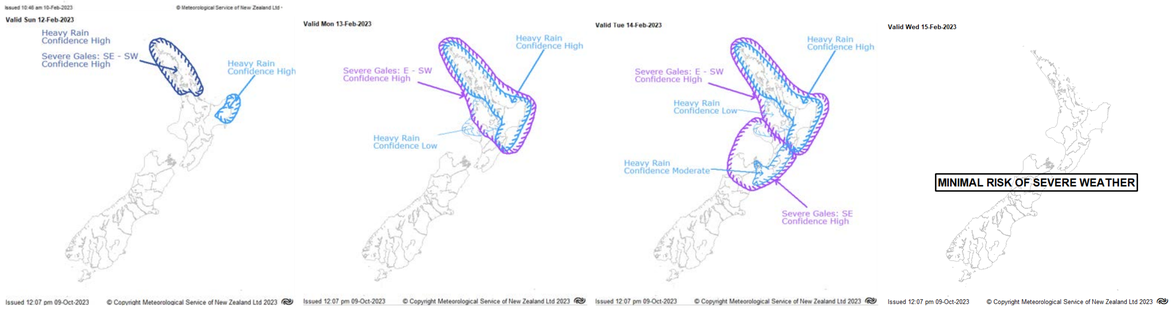
The image to the left shows a large event in the **previous** outlook style.
The images below show the same event in the **revised** outlook style.

NZ Outlook Updates

- Forecast grouped by day
- Phenomena grouped by color
- Higher visual salience for higher confidence

The revisions were worked in during a technical back-end update, building on lessons from this work. A more comprehensive update is planned for the future.

learn more!
Link to paper in *Weather, Climate, and Society*



Severe Weather Outlooks are always provided with comprehensive text descriptions