Natural Hazards Research Australia

Flash Flooding case studies to improve predictions and the communication of uncertainty

T4-A2

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Background

- Three distinct but related Bureau / NHRA projects considering heavy rainfall and its impacts.
- Work to improve **predictions**, **lead time** and the **communication** of risk.
- Project 1 forms the basis for the work planned in Projects 2 and 3.

THIS PROJECT

Project 1 – Flash flooding case studies to improve predictions and the communication of uncertainty

Underway

- What works well in the current service? What doesn't?
- What are the user needs for a future service?

Project 2 – Developing an integrated predictive capability for extreme rainfall and inundation

Started

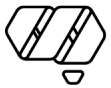
- How can we better use existing forecast information (e.g. ensembles) to improve predictions?

Project 3 – Long Range Flood Outlook for Strategic Preparedness

Approved

- How can we improve lead time?

Proposal previously endorsed by AFAC FSWISTG



What is flash flooding?

*"Flooding of **short duration** with a relatively **high peak discharge** in which the time interval between the observable causative event and the Flood is **less than six hours**."*

Generally due to Heavy Rain and difficult to predict.

... and how is it warned for?

- The prime responsibility for flash flood warnings lies with States and Territories through local councils.

- The Bureau provides forecasts and warnings for severe weather conditions and potential heavy rainfall *conducive* to Flash Flooding.

  Intergovernmental Agreement On The Provision Of Bureau Of Meteorology Hazard Services To The States And Territories

The Project

Our goal is to identify service gaps and potential strategies to **improve communication of flash flood risk**, both to the public and Emergency Management.

Two key components:

1. A short public survey on flash flooding.
2. Case study analysis, including workshops.

Key outputs:

1. Report on project findings and survey
2. Individual case study reports
3. Preliminary guidance on the communication of flash flood risk.

Project ends 30 September 2024

Flash flooding wreaks havoc in Melbourne suburb of Lilydale (Herald Sun)

An NHRA workshop on flash flood in 2022 found communicating uncertainty in forecasts to be a key priority.

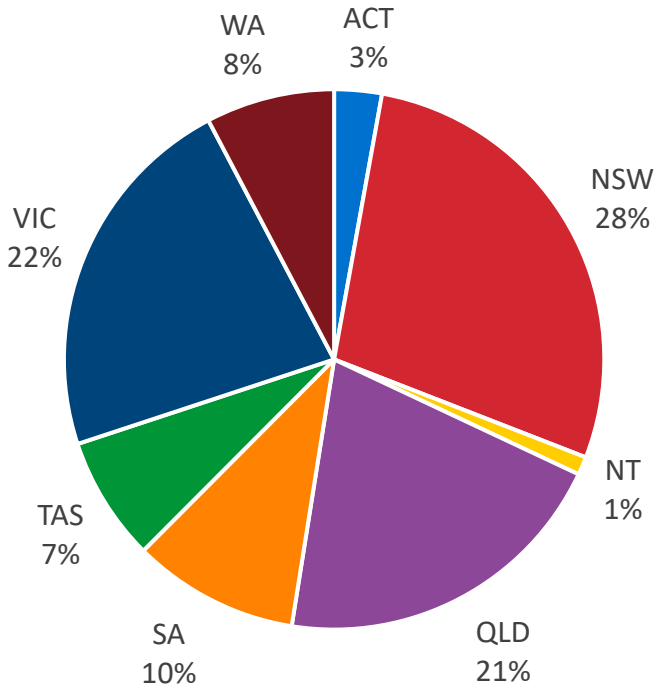
Research Questions

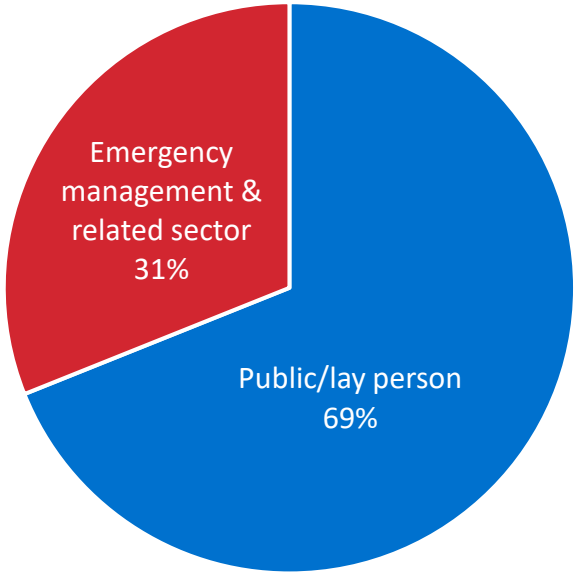
- Is ‘flash flooding’ well understood by the community and emergency services?
- Is uncertainty terminology well communicated?
- Is the fidelity of information changed as it passes along the information value chain?
- Is the uncertainty around the forecast communicated effectively?
- Is the balance between lead time and uncertainty right?

Flash flooding wreaks havoc in Melbourne suburb of Lilydale (Herald Sun)

... how do the above affect community response?

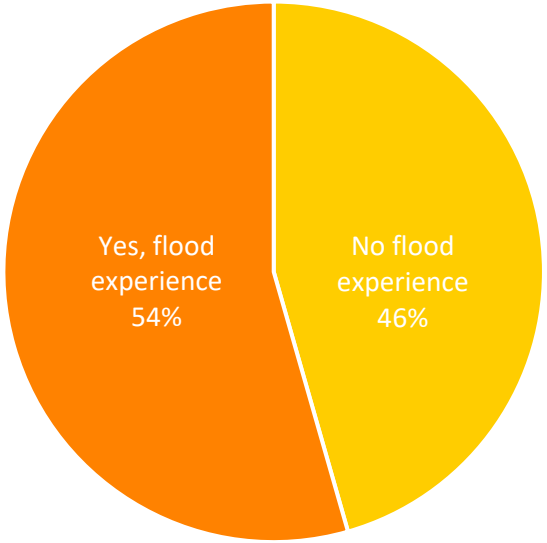
The Severe Weather and Heavy Rain Survey 2024 *Preliminary results*





Survey questions on:

- perceptions and knowledge of flash flood
- protective actions
- experience
- comprehension of warning messages
- information preferences.



Riverine and flash flood experience

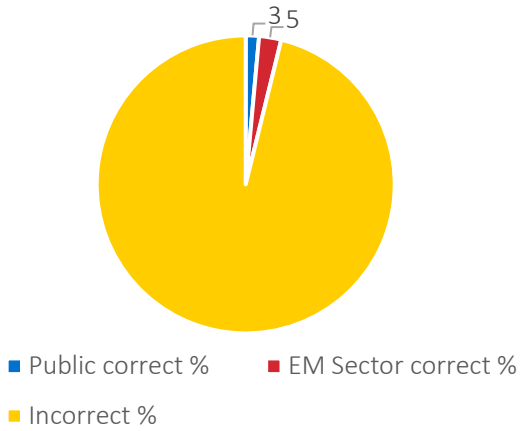
The Severe Weather and Heavy Rain Survey 2024

Preliminary results

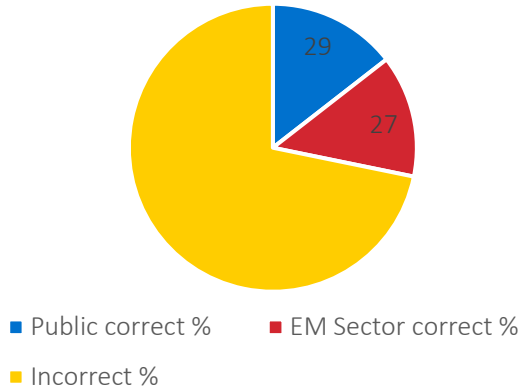
Is ‘flash flooding’ well understood by the community and emergency services?

- → There is not much difference in knowledge of flash flooding between EM agencies and the public
- → Generally, the level of knowledge is low across the board
- → However, knowledge of appropriate response actions and behaviours during a flash flood event is higher
- → People think they know more about flash flooding than they actually do

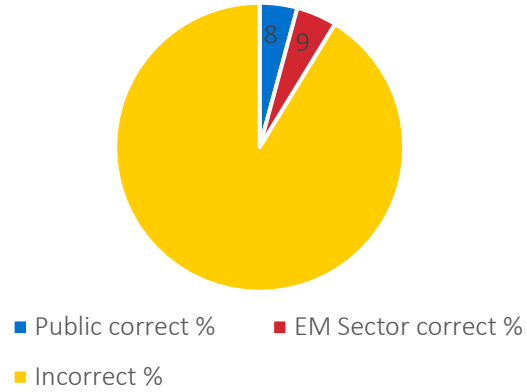
Q1 Flash flooding is:



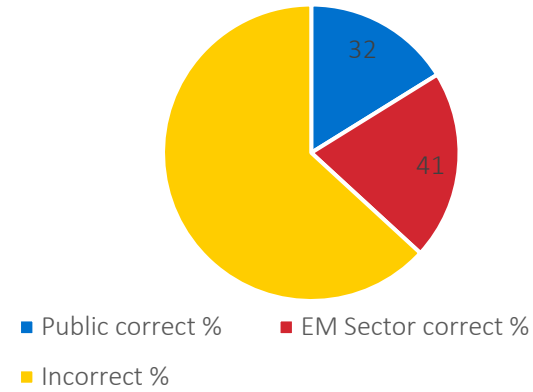
Q2 … what do you think the difference between 'Heavy' and 'Intense' rainfall is?



Q3 Which of the following can lead to flash flooding?



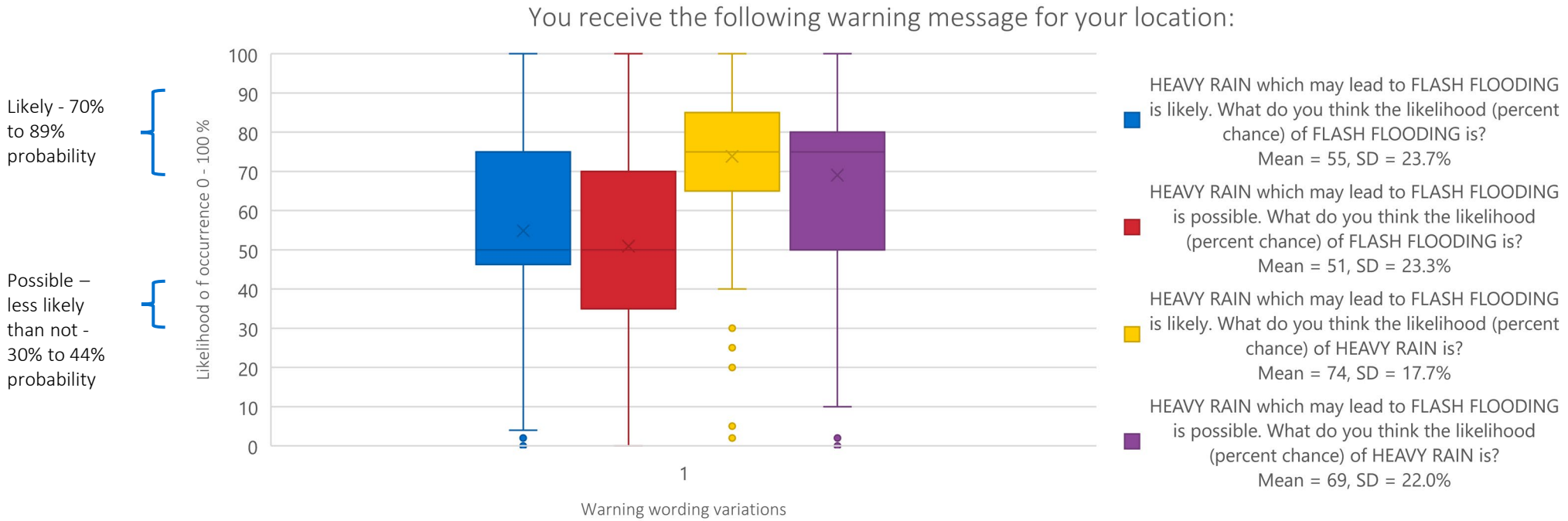
Q4 If you receive a severe weather warning for heavy rainfall which may lead to flash flooding, and you are outdoors walking, biking, recreating, or working, you should:



The Severe Weather and Heavy Rain Survey 2024 *Preliminary results*

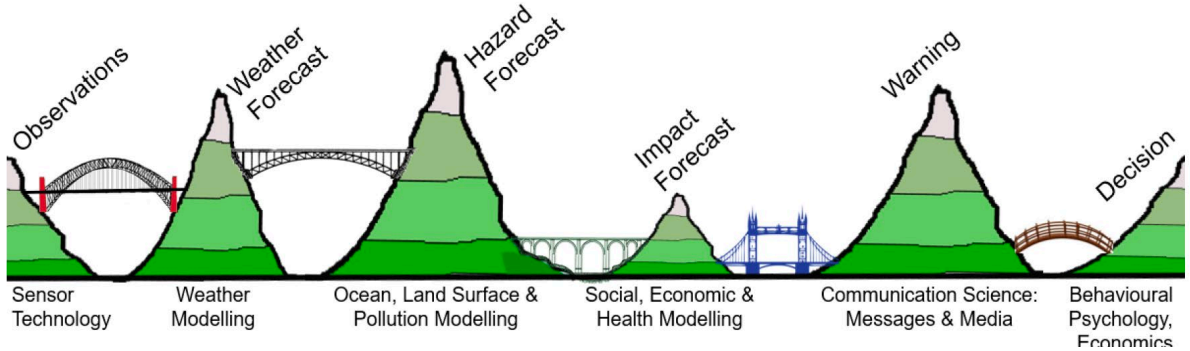
Is uncertainty terminology well communicated?

- → Uncertainty terminology is not well communicated
- → The use of terms such as 'likely' or 'possible' is understood differently by different people
- → Responses for likelihood of occurrence are context dependent and related to the wording in the warning and event type
- → Our respondents indicated 'likely' and 'possible' as meaning anywhere between a range of 0-100%



Case studies

- → Use the value chain case study template developed by the Hi-Weather Value Chain Project.
- → Analyse 3 case studies of the end-to-end warning chain for flash flood, via workshops with practitioners
- → Contribute 3 completed case studies to the international value chain database.



The Value Chain Project
by HIWeather and SERA WG

WORLD METEOROLOGICAL ORGANIZATION

WWRP WORLD WEATHER RESEARCH PROGRAMME

The actors: roles and responsibilities

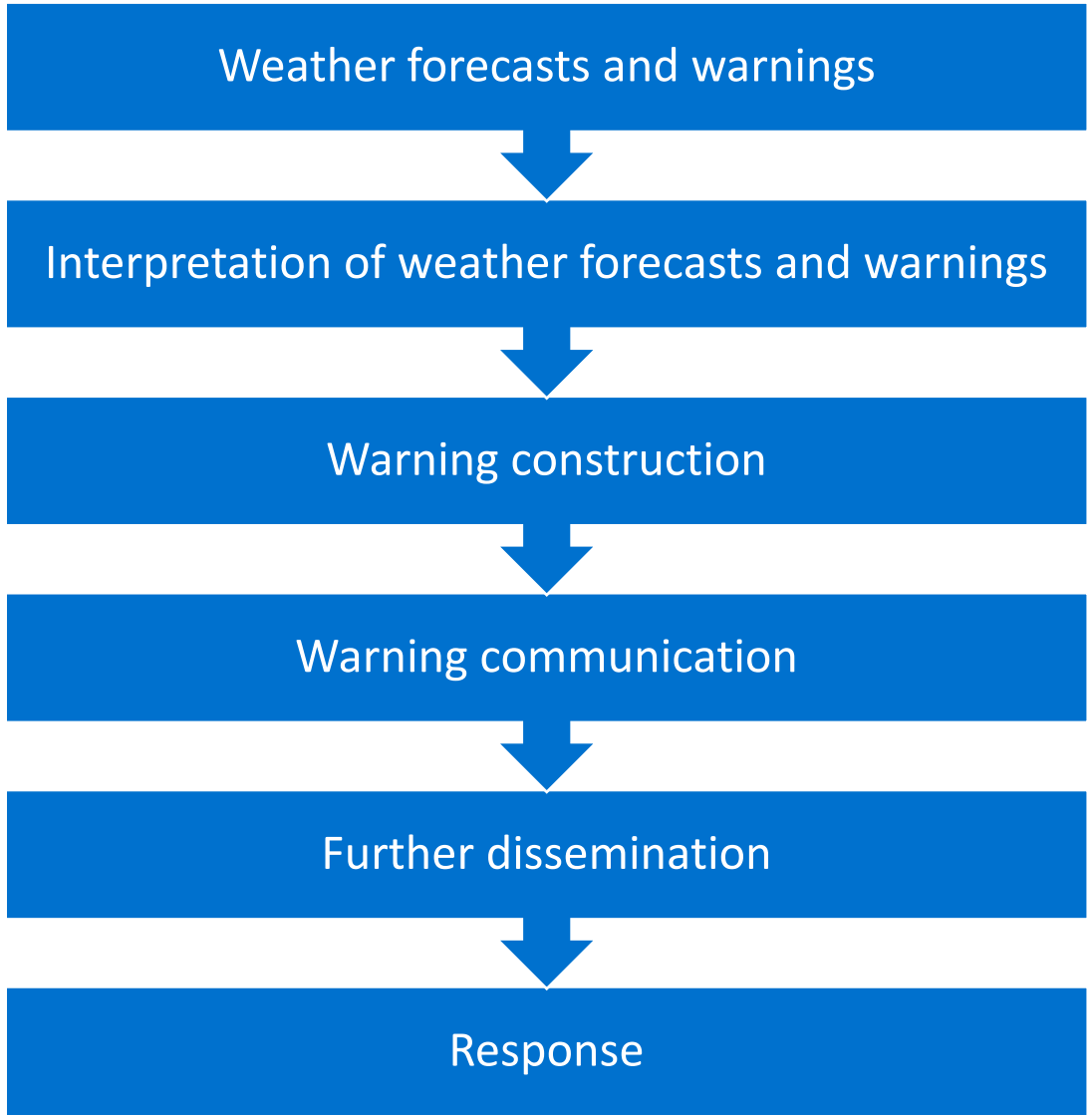
Bureau of Meteorology

Local Government
State Government; State emergency services; Police
Infrastructure owners/operators

Via radio, websites, press conferences, television, text and phone messages, emails, social media, sirens/alarms

Unofficial or personal forms of communication – word of mouth, social media

Households and individuals, businesses, local and state governments, State Emergency Services, Police



Wallis Creek, NSW, July 2022

East Coast Low

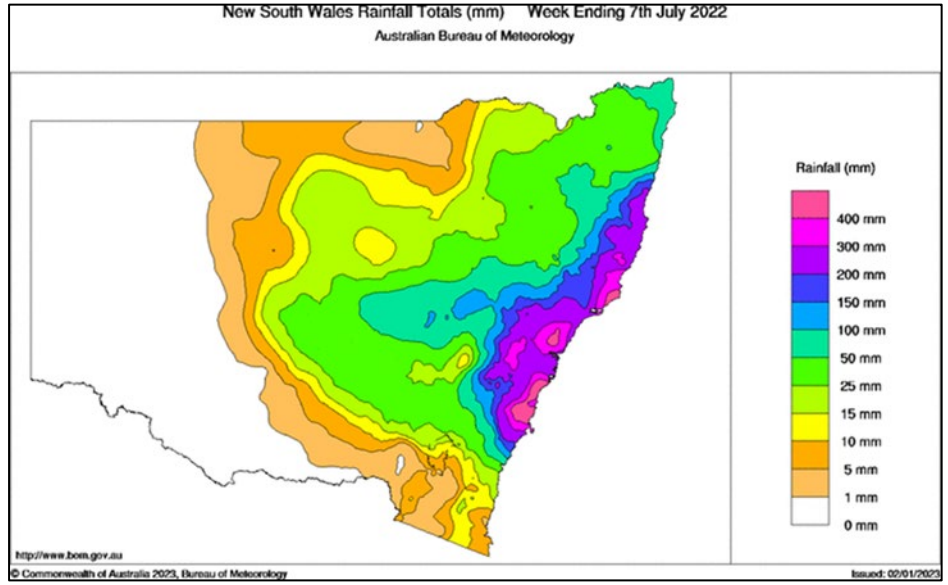
- Widespread heavy rain over central parts of the NSW coast.
- Flash flooding near Maitland, with record major riverine flooding in other areas.

Challenges

- East Coast Lows notoriously hard to forecast.
- Recent history of significant and (in some areas) unprecedented riverine flooding.
- Emergency services active across multiple areas and for a prolonged period.

Impacts

- Around 3000 people evacuated in Maitland.
- Town of Gillieston Heights isolated for over a week.
- Essential services disruption - electricity, phones, internet, water, sewerage.



An aerial photo shows the extent of floodwaters in the Maitland region. (Courtesy ABC, Eugene Koen)

Adelaide, SA, November 2023

Severe thunderstorms

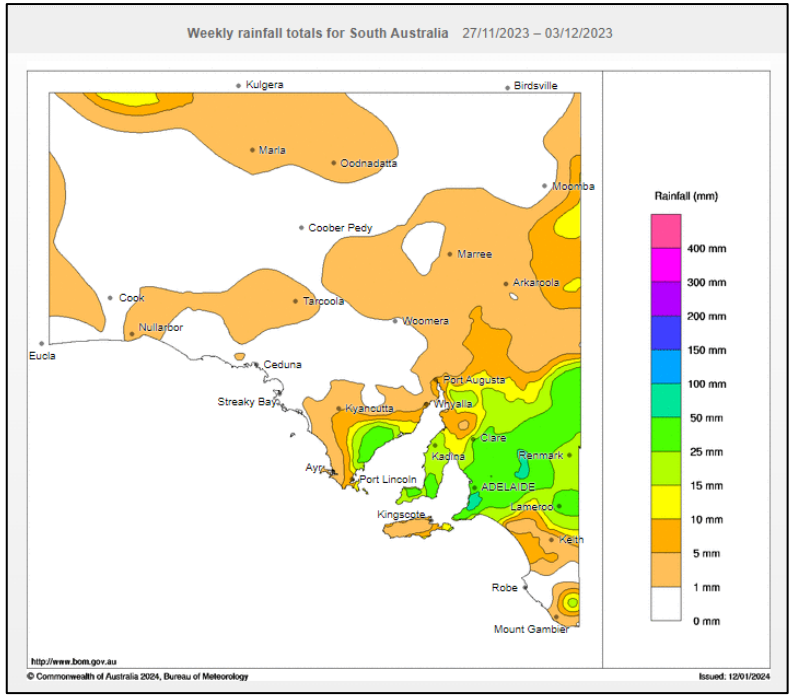
- very heavy rainfall across the Adelaide area
- widespread flash flooding and storm damage

Challenges

- rapid development of storms
- succession of severe thunderstorm warnings issued
- urban flash flooding and populated area; morning rush-hour

Impacts

- State Emergency Service received 335 requests for assistance
- most active period for RFAs 06:00 to 12:00 on 28th November
- more than 14,000 customers lost power
- houses inundated by water coming across roads and through roofs
- Riverbank Christmas display damaged



Scotch College recorded 59.8 mm in 2 hours (and 19.2 mm in 15 minutes)

Hobart, TAS, May 2018

Severe thunderstorms

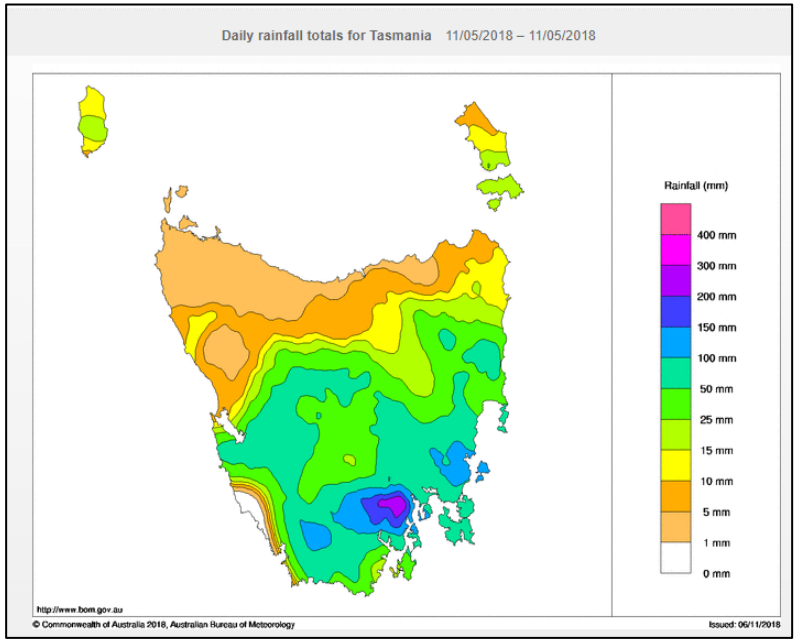
- intense rainfall across Hobart area (100-230 mm in 6-12 hours)
- widespread flash flooding and destruction

Challenges

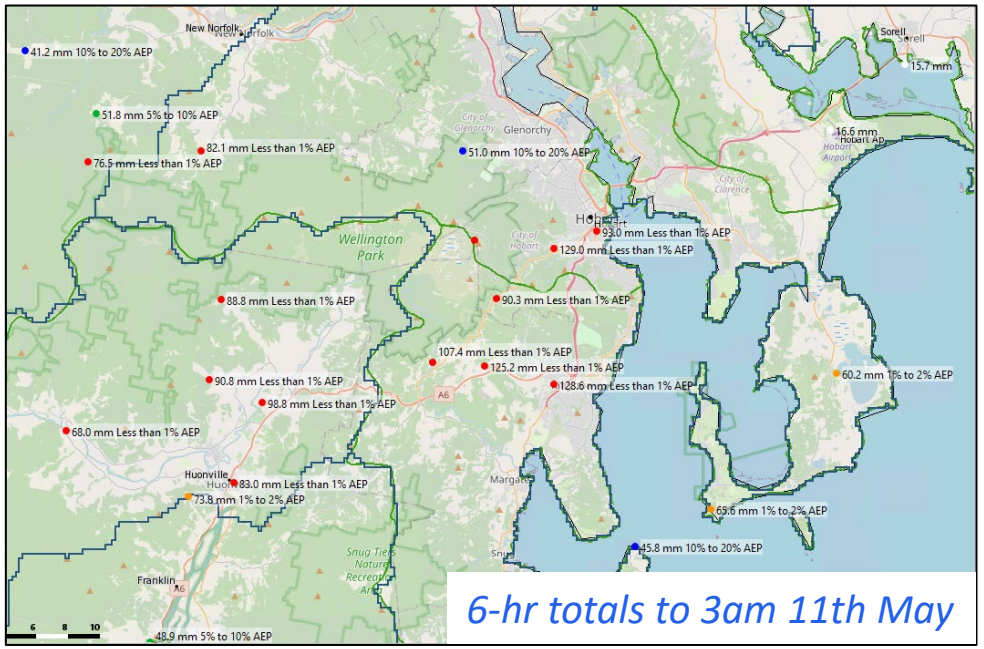
- location and intensity of heaviest rain not well-modelled
- 'training' of an active line of storms across the same area
- no significant rain since the preceding summer
- event occurred during the evening and into the night

Impacts

- Hobart Rivulet burst its banks and several cars were swept away
- extensive damage to bridges, roads, buildings and other infrastructure
- significant agricultural impacts including stock and crop losses
- total estimated losses greater than $135 million
- more than 13,000 homes lost electricity; more than 30 schools closed
- evacuation centres established



Hobart recorded 44.4 mm in one hour (previous record 28.9mm)

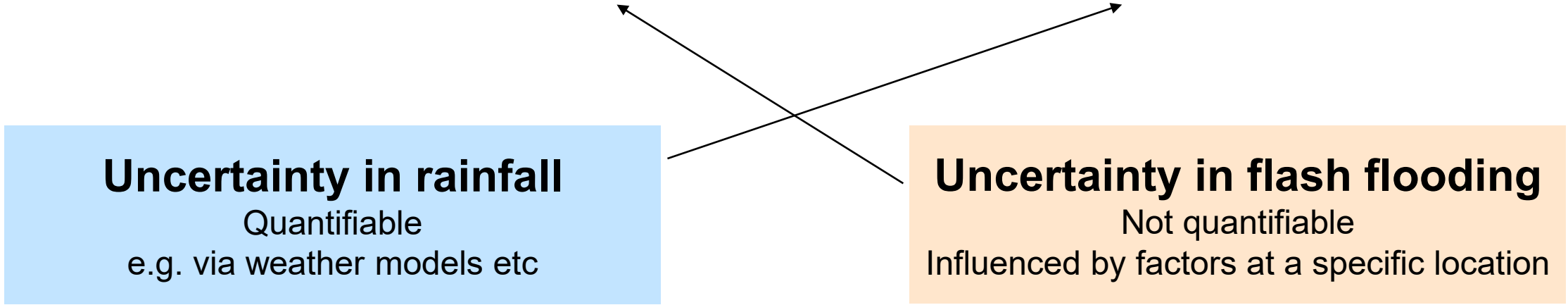


6-hr totals to 3am 11th May

The communication challenge

Warning Message:

"Heavy rainfall which MAY lead to flash flooding is POSSIBLE."



- Evidence the public do not have a strong understanding of flash flood and contributing factors.
- Research has shown words like **possible**, **probable** and **chance** have different meanings to the public, meteorologists and emergency managers.

What next?

→ Survey analysis

→ Workshops June and July

→ Case study compilation and reporting

→ Development of preliminary guidance on communication of uncertainty

Thankyou

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