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SCENARIO PROJECT:
using realistic disaster scenario analysis to understand natural hazard impacts and emergency management requirements

An Australian Government Initiative

CRC AUSTRALIA

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

RISK FRONTIERS

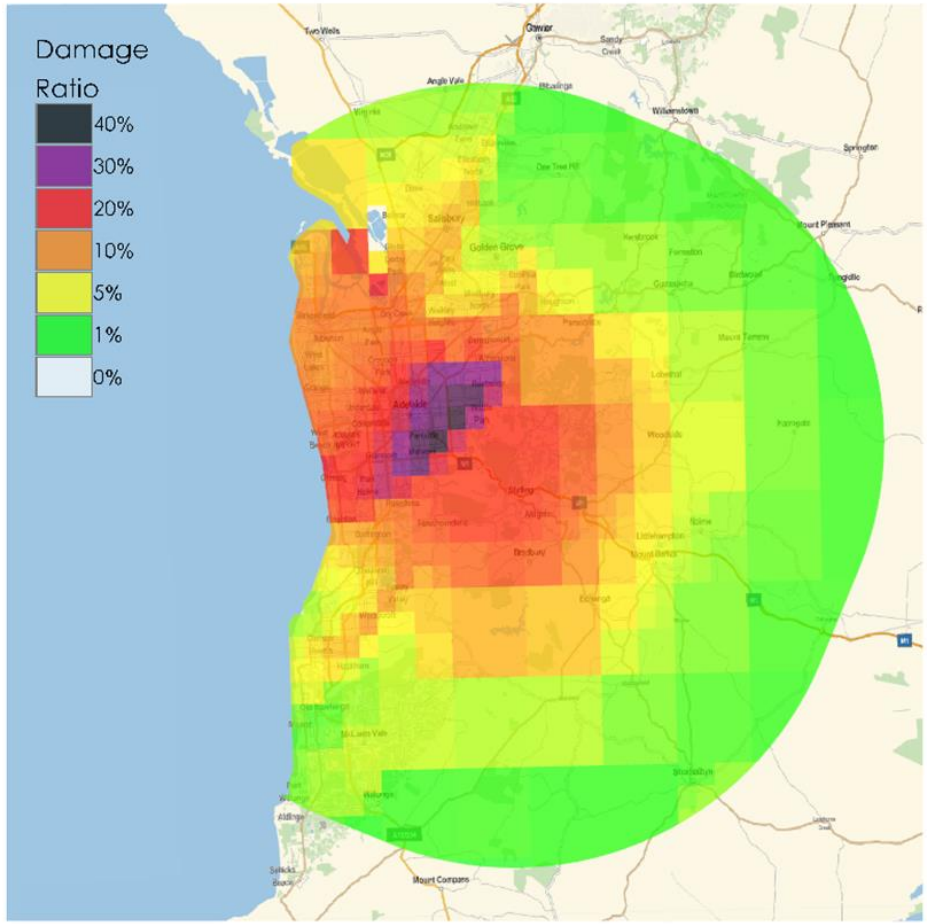
Project objectives

- Develop a set of realistic disaster scenarios:
  - Quantify hazard magnitude and risk thresholds
  - Assess vulnerability and exposure at risk

- Use this framework to:
  - help communicate about extreme disaster risk
  - assess capability from emergency management sector

Year 1: EQ scenario

- **Mw 6** earthquake on the Para fault, near **Adelaide**.
- Estimated recurrence interval: **1000 Years**.
- Modelled:
  - **hazard** (ground shaking and liquefaction)
  - damage to the **built environment**, **casualties** and disruption of **essential facilities** and **utility networks**.



Residential Damage Percentage of Replacement Value of the local Buildings' Stock.

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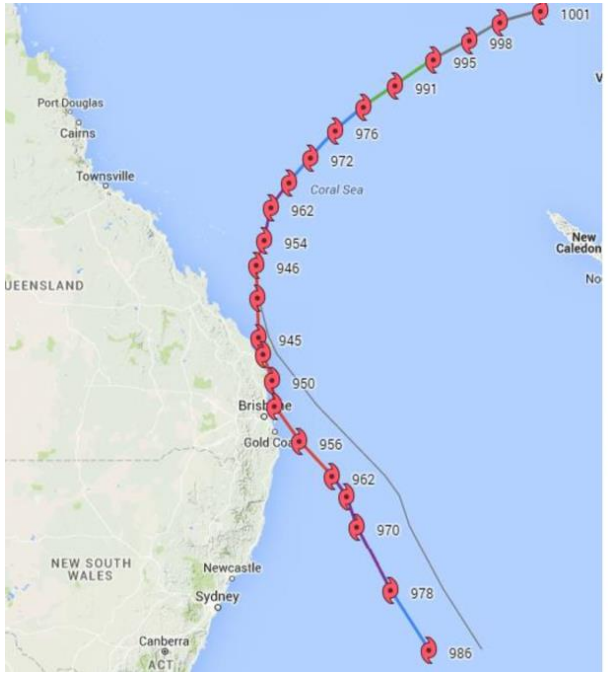
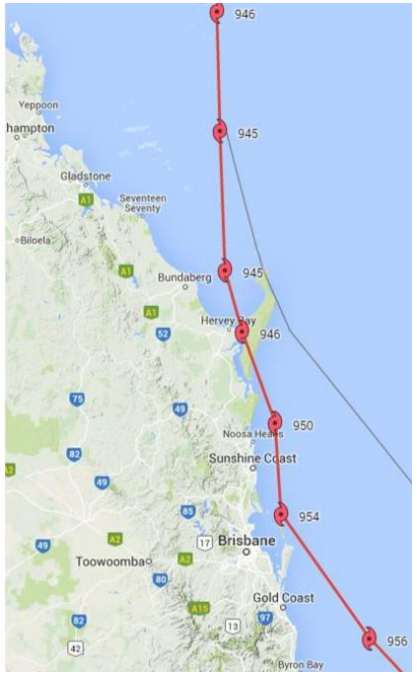
Year 1: TC scenario





- **Cat 4 storm** impacting SE Queensland
- Focus on **wind hazard/damage**
- **> 500 year design** wind speeds for the region
- Worst impacted region was Harvey bay (including Fraser Island)
- **50 000 buildings** with moderate structural damage
  - Occupants may need to seek alternate shelter
- **8 000 buildings** with major structural damage
  - many needing complete rebuild
- The expected **wind induced loss is ~ $12 Billion**

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RISK FRONTIERS

Year 2: Melbourne EQ

- Focus on delivering a set of EQ events for Melbourne
- 3 sub-scenarios
- to be delivered by the end of this Financial Year

Year 2 scenario:
Heatwave risk in VIC/SA

- HW are responsible for ***more deaths than all other natural perils in Australia put together*** (Risk Frontiers, 2014)
- There is **no clear definition** of a HW event
- There is a pressing need for a common intensity metric
- BoM developed the **Excess Heat Factor** with this goal in mind
- Risk Frontiers has developed a **HW severity categories** based on EHF

Excess Heat Factor

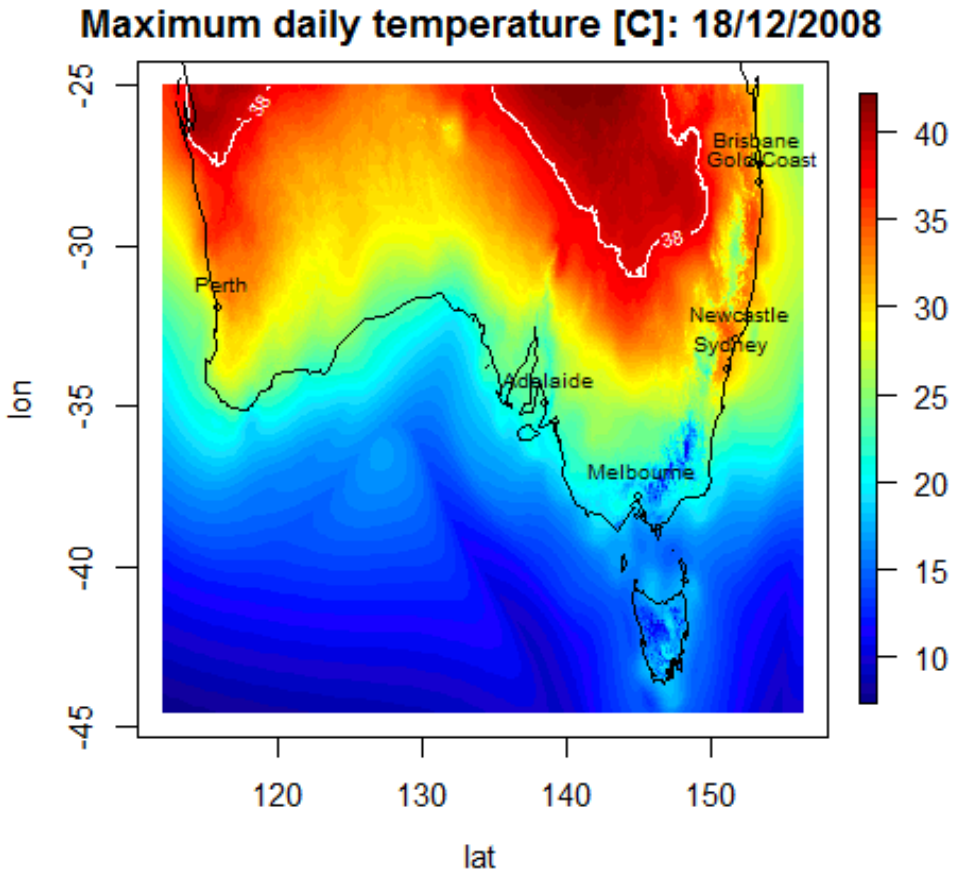
- The EHF metric takes into account:
  - the ability of the local community to adapt to its climate
  - the impact of sharp temperature spikes that do not allow such acclimatization
- A positive EHF indicates a heatwave
- The intensity of a HW event can be measured by the **peak EHF**
- By summing EHF values over the lifetime of an event we derive a measure of **Heat Load or accumulated EHF**

Objectives

- 3 heatwave events for SE Australia (SA and VIC)
- Outcomes
  - Footprint of heat risk
  - Propose fatality HW severity classification system
  - Projection of fatalities
- Inform knowledge regarding overall **heat risk** to communities to improve **planning and risk management**

Inputs

- 100 yr record of daily temperatures (max, min) (BoM)
- Peril Aus – Risk Frontiers' fatality database
- Census data (ABS)

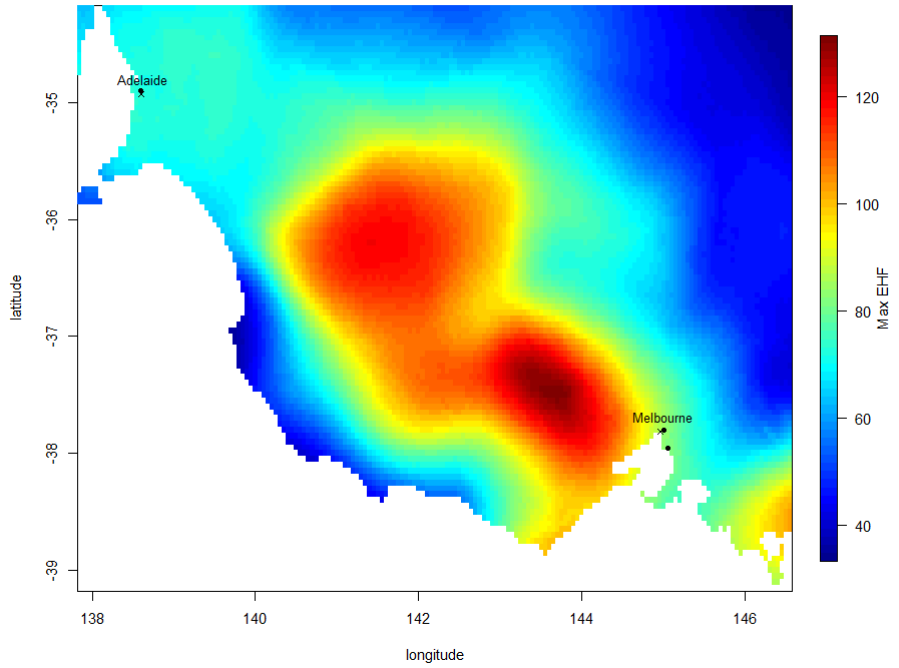


Event definition

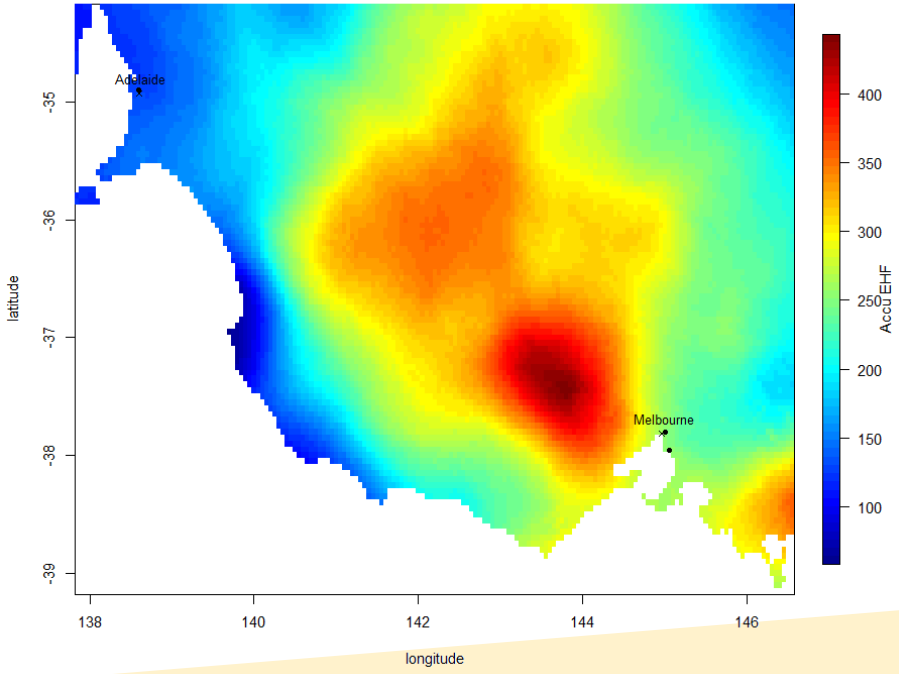
- An event starts when first grid cell in domain has **EHF > 0 for 3 consecutive days**
- Finishes when last cell turns back to EHF=0

JAN 1959

Peak EHF over the event



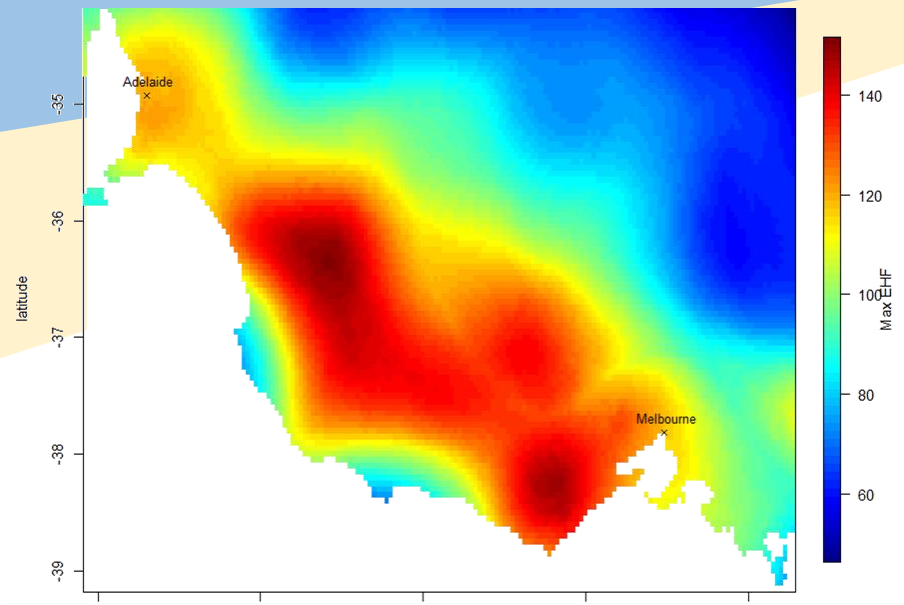
EHF accumulation over the event

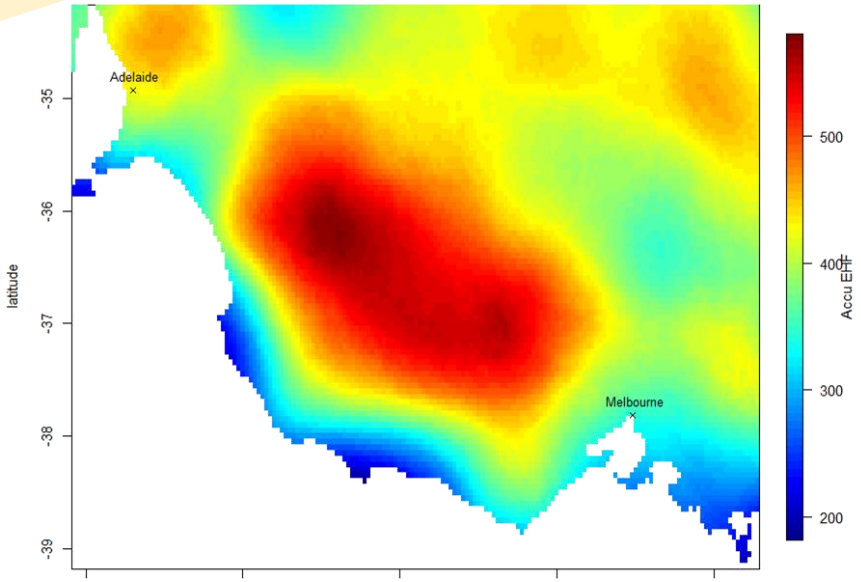


Peak EHF over the event

EHF accumulation over the event

JAN 2009

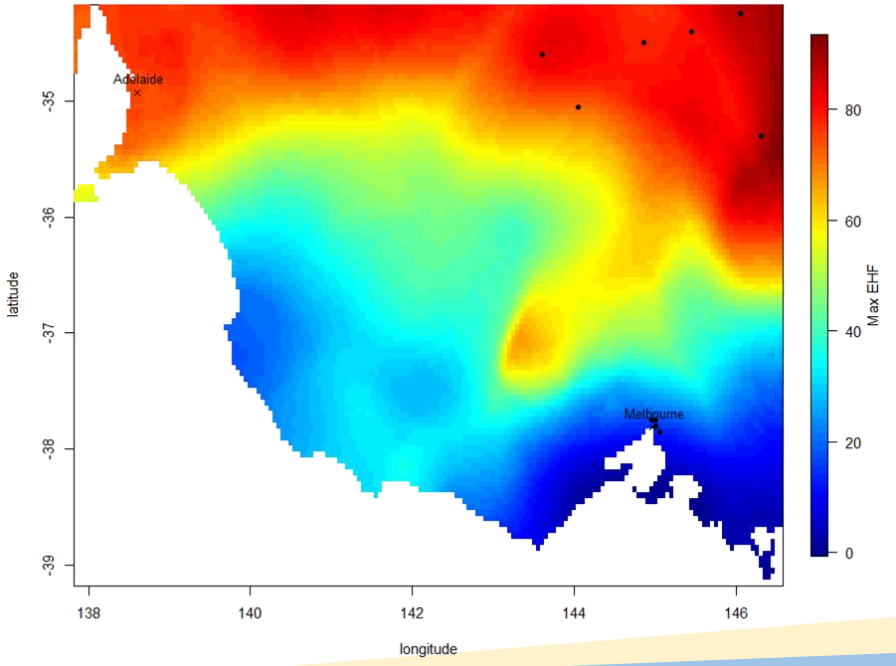


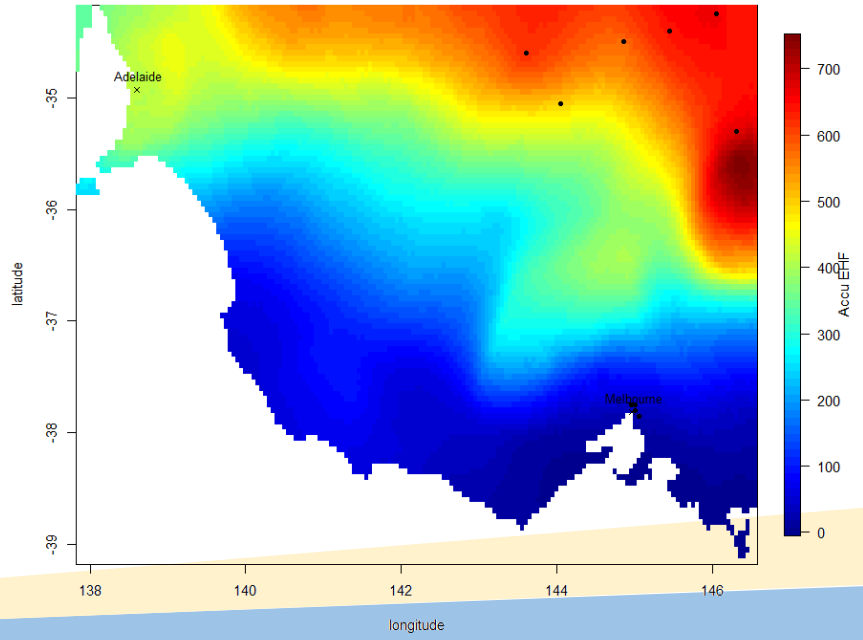


Peak EHF over the event

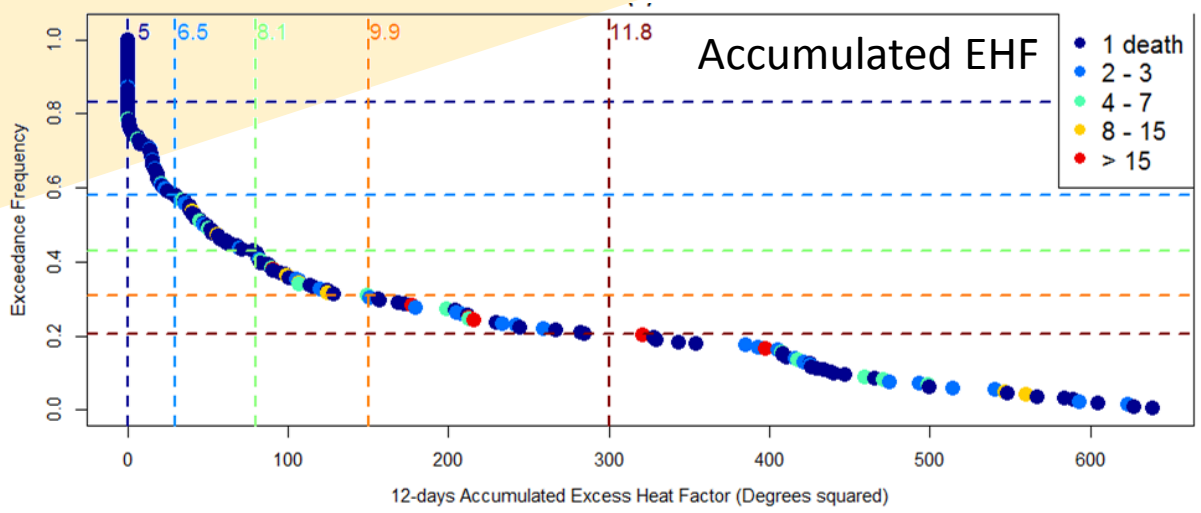
EHF accumulation over the event

JAN 1939





Heat Fatality risk categories



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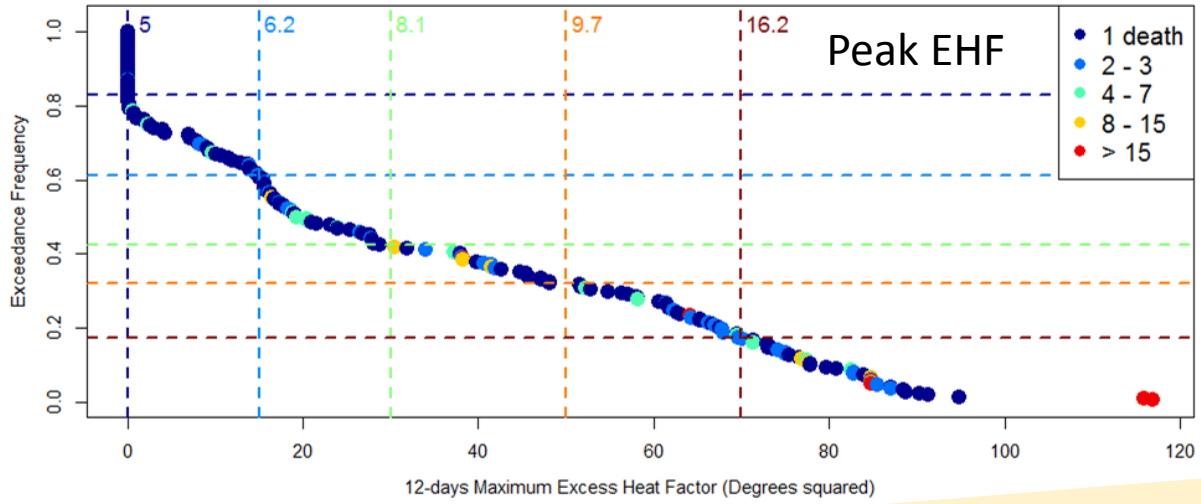

- Compute EHF for past century
- Match EHF data with fatality records from PerilAUS

Category	EHF_{sum}	EHF_{max}	Mean number of fatalities	Percentage of record covered
CAT0	> 0	> 0	5	82.6
CAT1	> 30	> 15	6.7	55.4
CAT2	> 80	> 30	8.6	38.9
CAT3	> 150	> 50	10.4	28.6
CAT4	> 300	> 70	18.5	12

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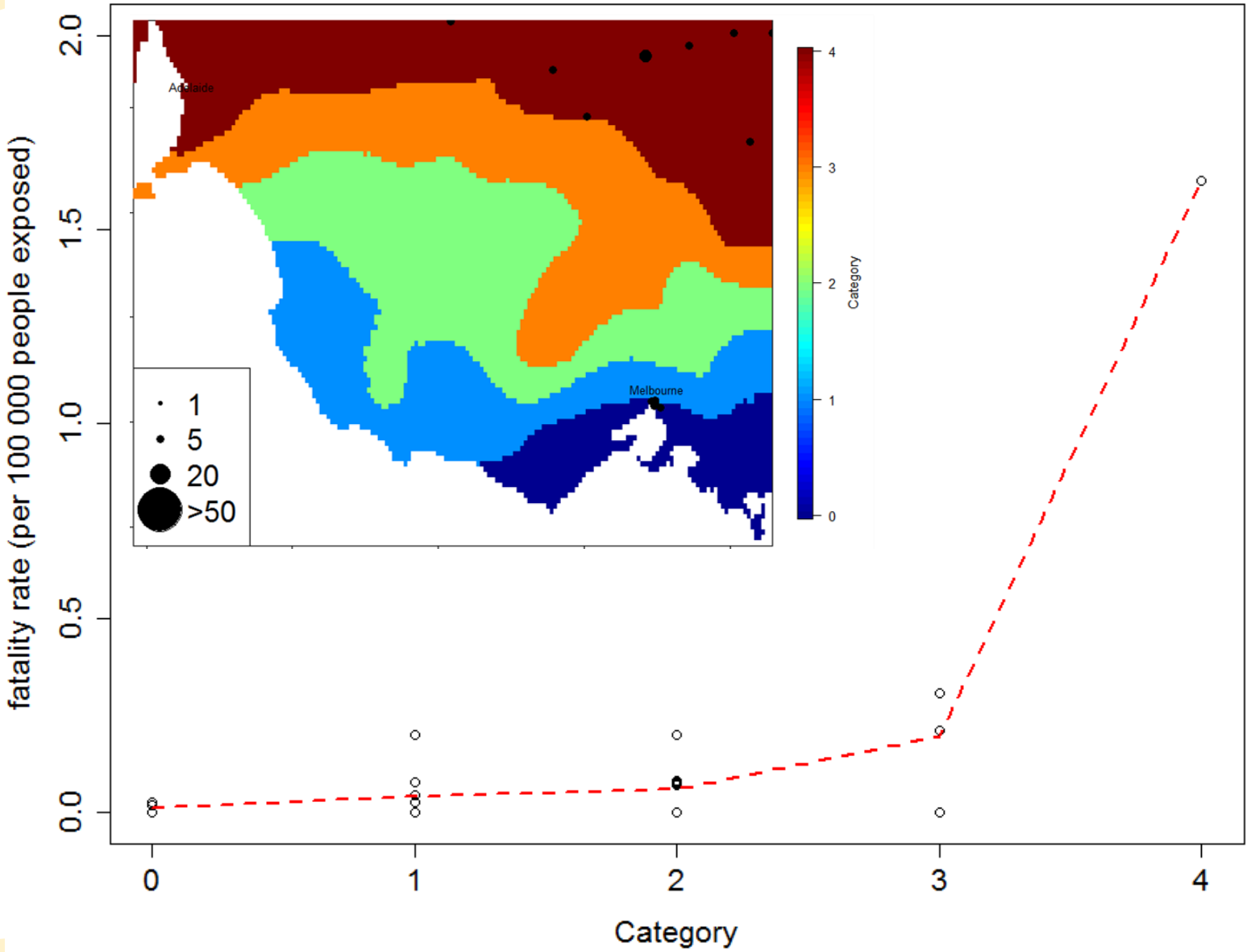
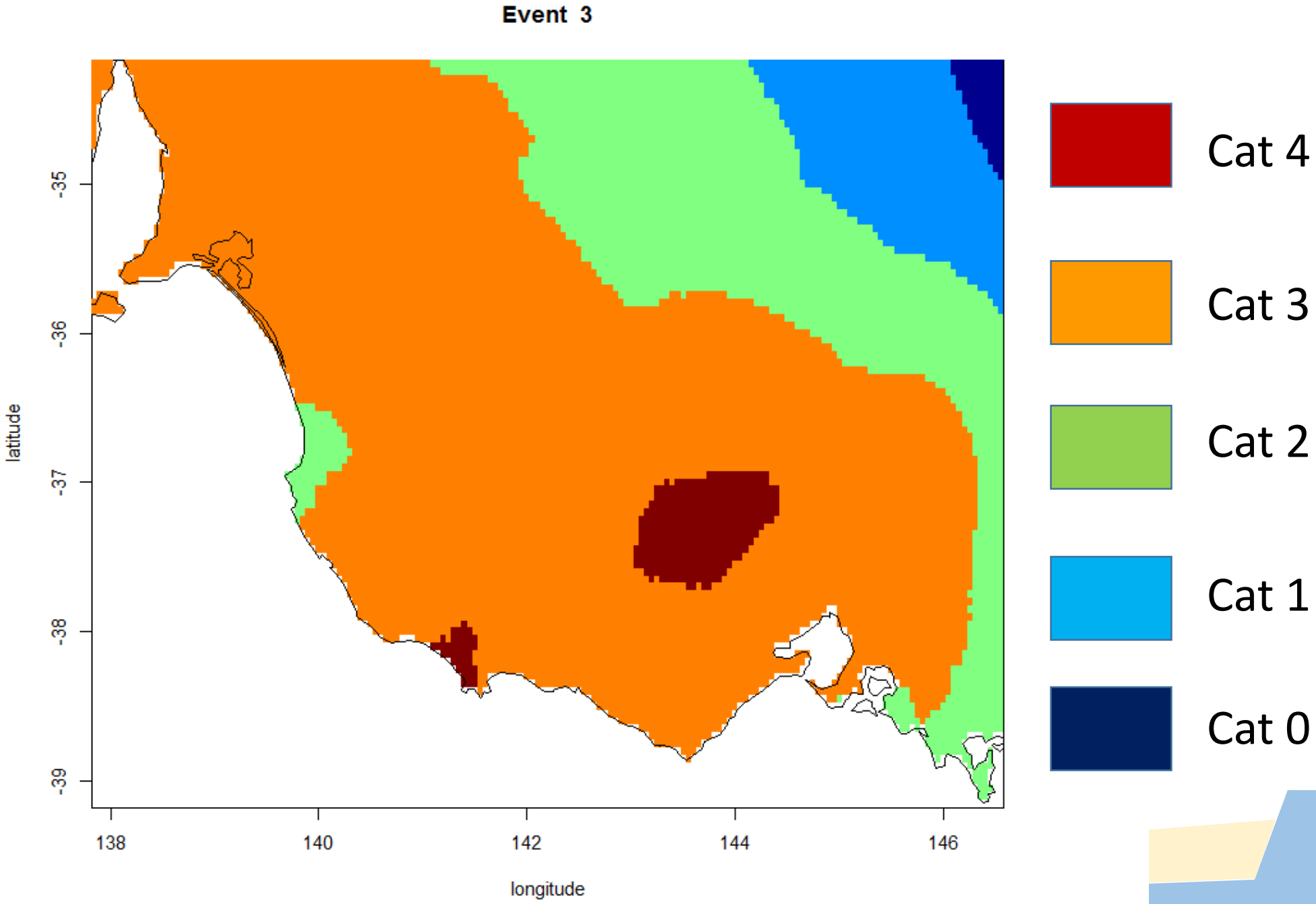
Fatality projections

Vulnerability curve to enable projection of fatalities given EHF characteristics

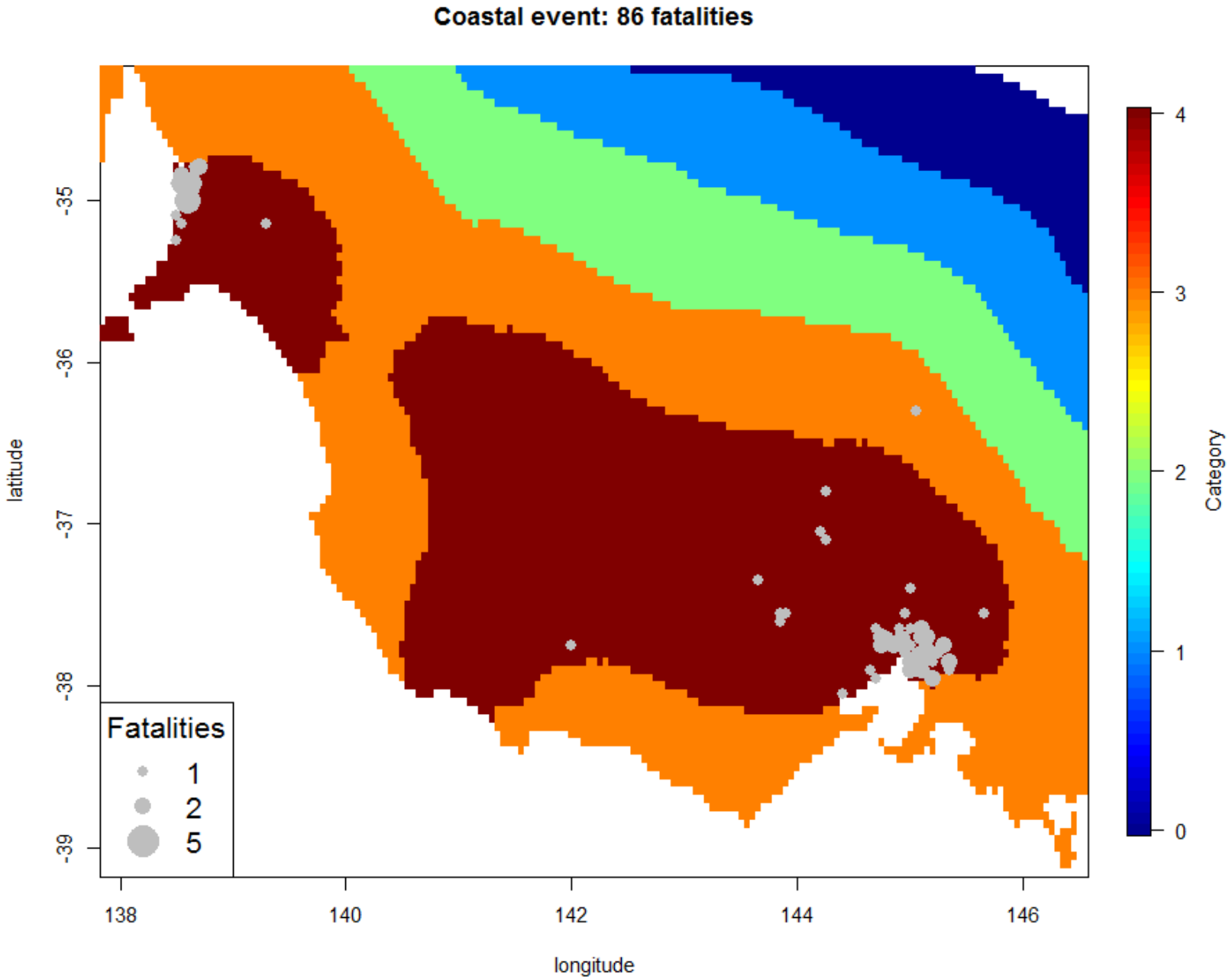
- 10 biggest events of the last decade
- Census population records trended over the period
- Normalised heat-related fatality records




Event 3
latitude
-35
-36
-37
-38
-39
138
140
142
144
146
longitude
Cat 4
Cat 3
Cat 2
Cat 1
Cat 0

Scenario 1

- Coastal event impacting both Adelaide and Melbourne with Cat 4 HW
- 86 fatalities



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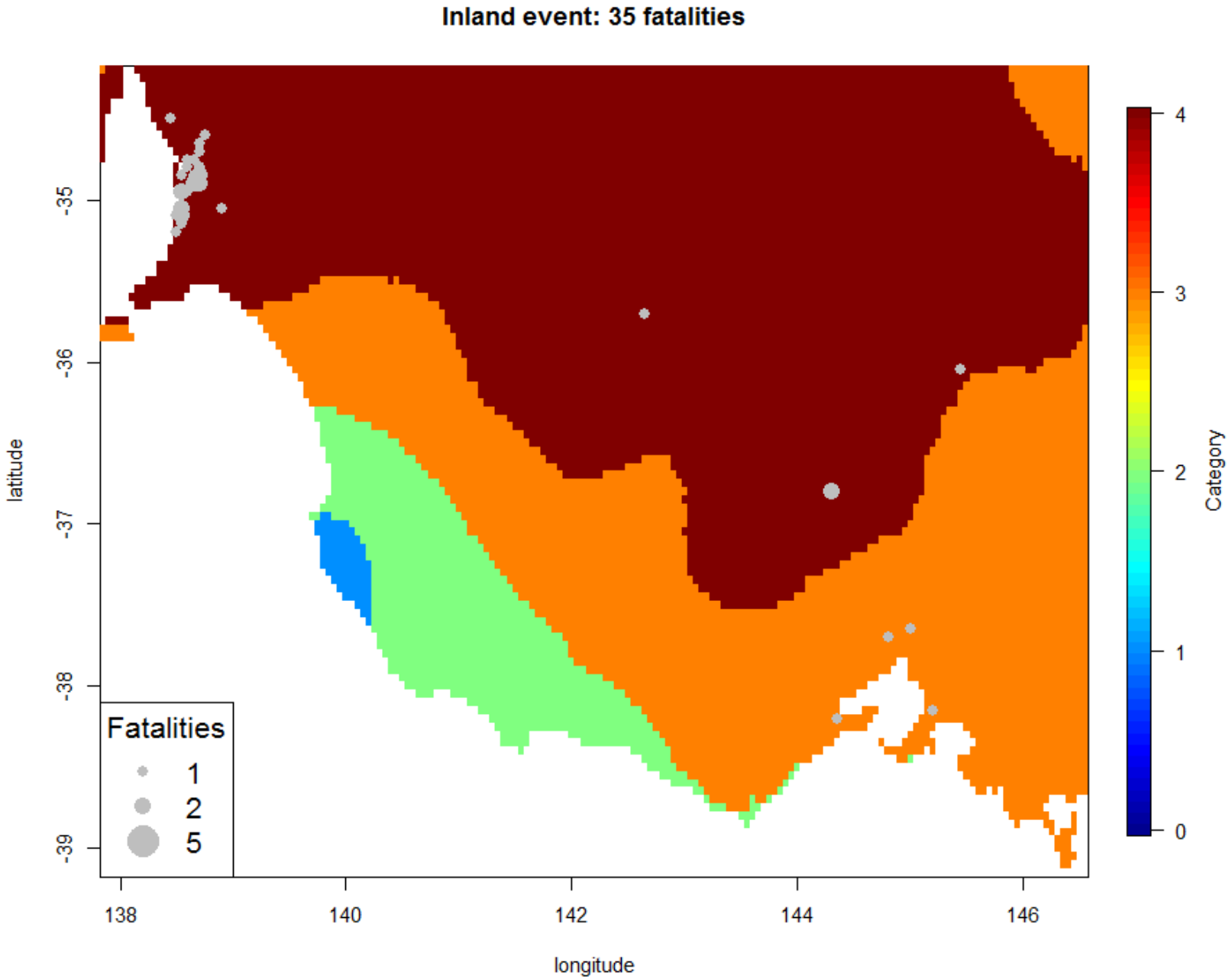
Scenario 2

- Inland event
- Higher intensity overall hazard but impacting less populated regions
- Adelaide in cat 4 and Melbourne in cat 3 risk
- 35 fatalities



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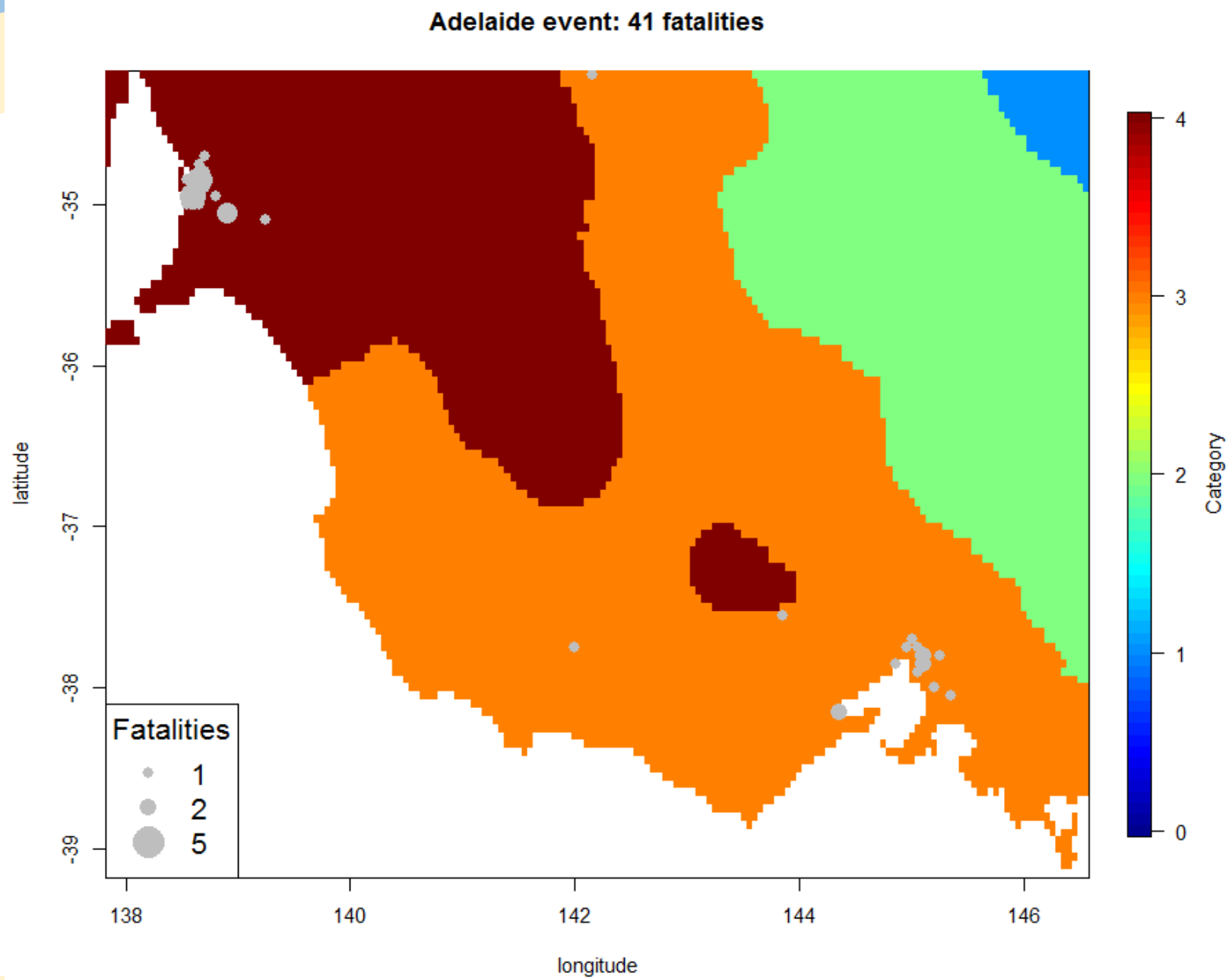
Scenario 3

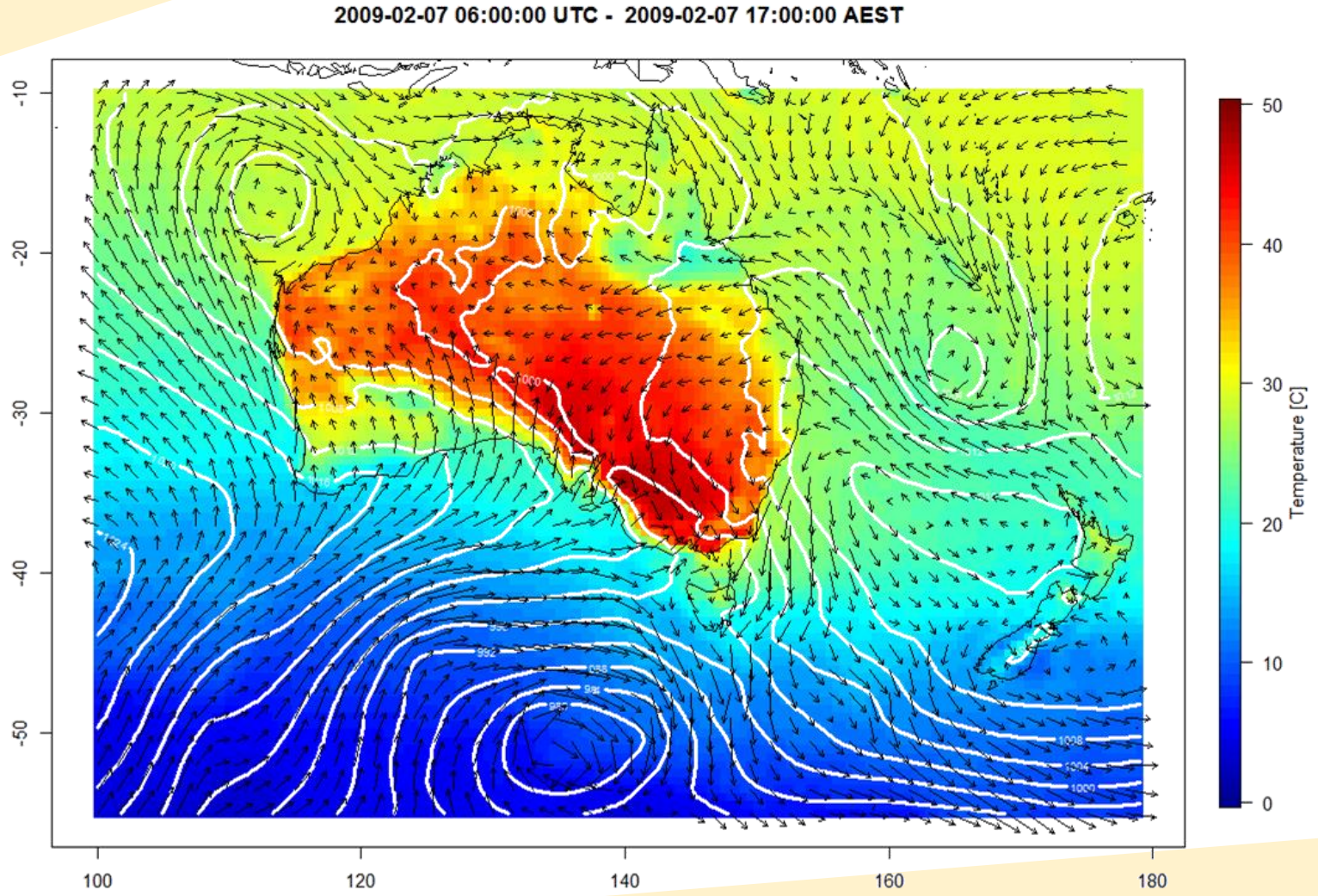
- Most severe of the 3 scenarios in terms of hazard intensity
- Peak Cat 4 risk in Adelaide
- Melbourne in Cat 3 risk
- 41 fatalities



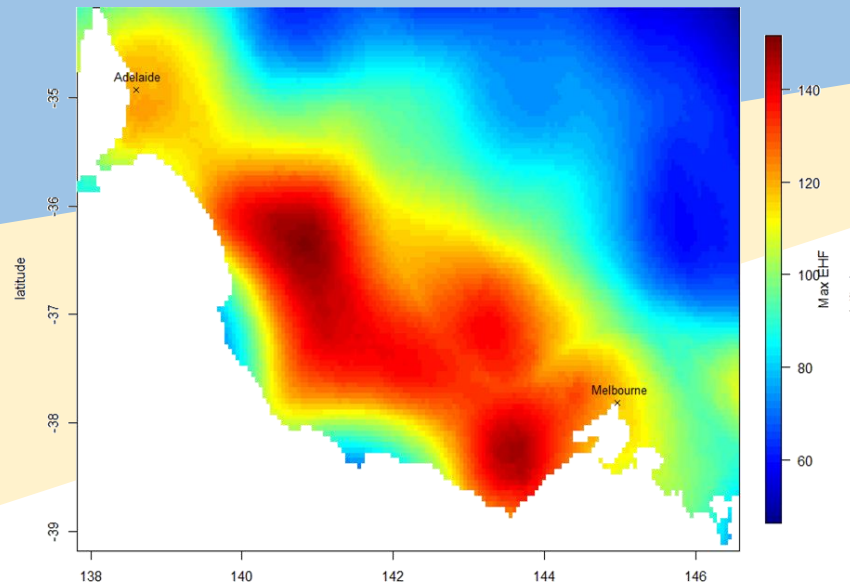
End user utilisation / feedback

- SA EQ: Utilised in cost benefit analysis for SA Government.
- QLD TC: Utilised by AFAC / AGD to exercise disaster response analysis
- VIC EQ: To be utilised as basis for Melbourne Earthquake exercise
- HW:
  - Positive feedback from EMV (Lew Short)
  - Planning workshop with VIC agencies – health, ambulance etc.
  - Positive collaboration opportunities identified with BoM Heatwave Project Director
- General feedback that agencies are wanting to use scenarios as a basis for capability planning into the future and for forecasting impacts to improve public information and warnings
- Promotion of the project through Asia Pacific Fire Magazine and Fire Australia

Synoptic setting



Peak EHF over the event (2009)



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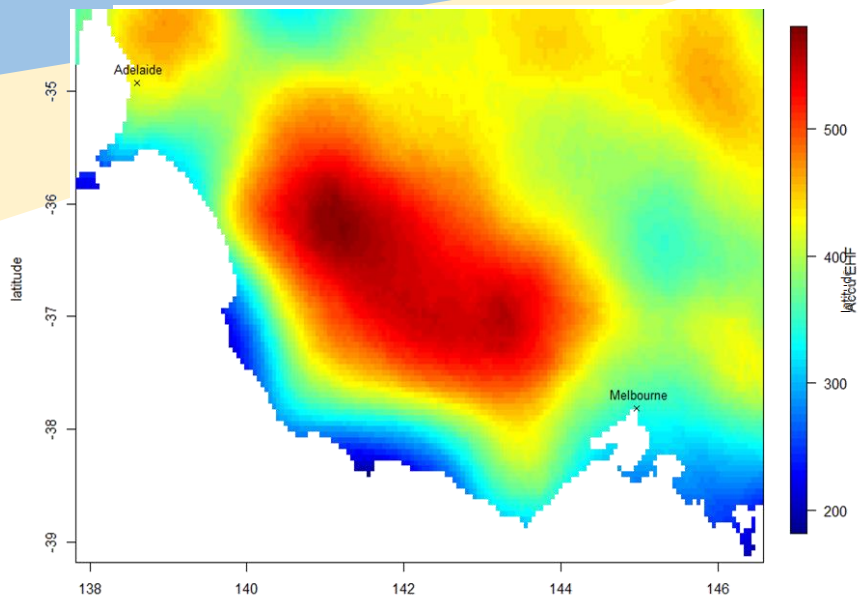
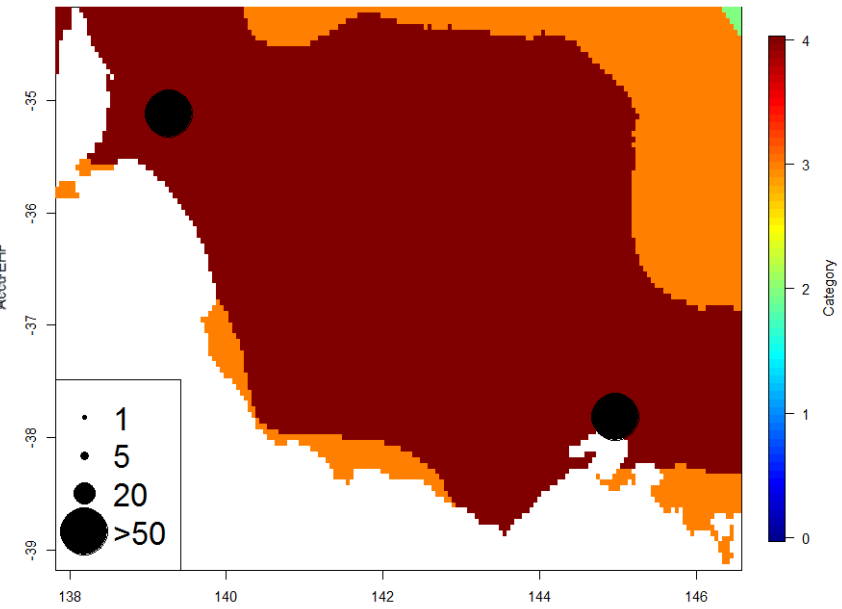
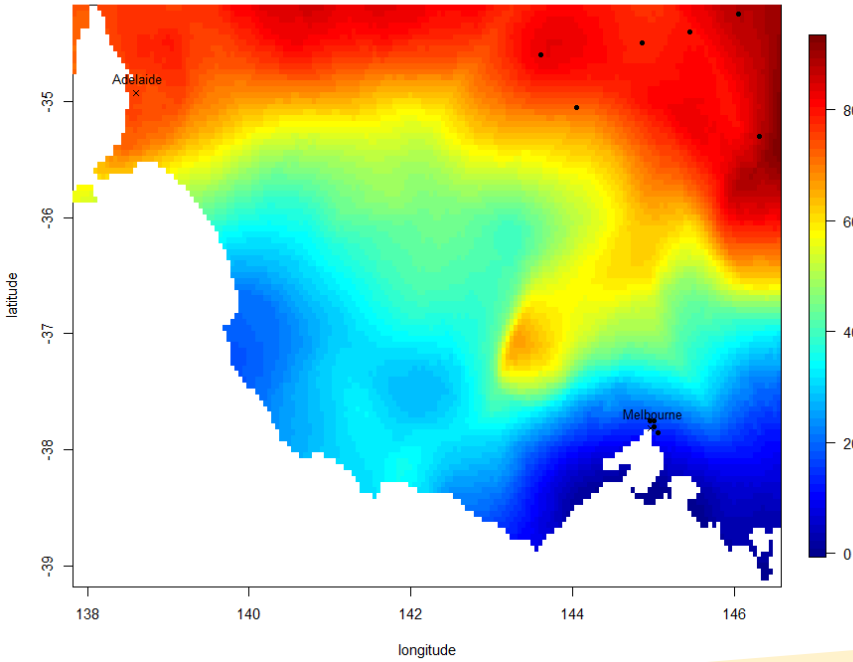


Fatality risk categories (2009)



Peak EHF over the event (1939)



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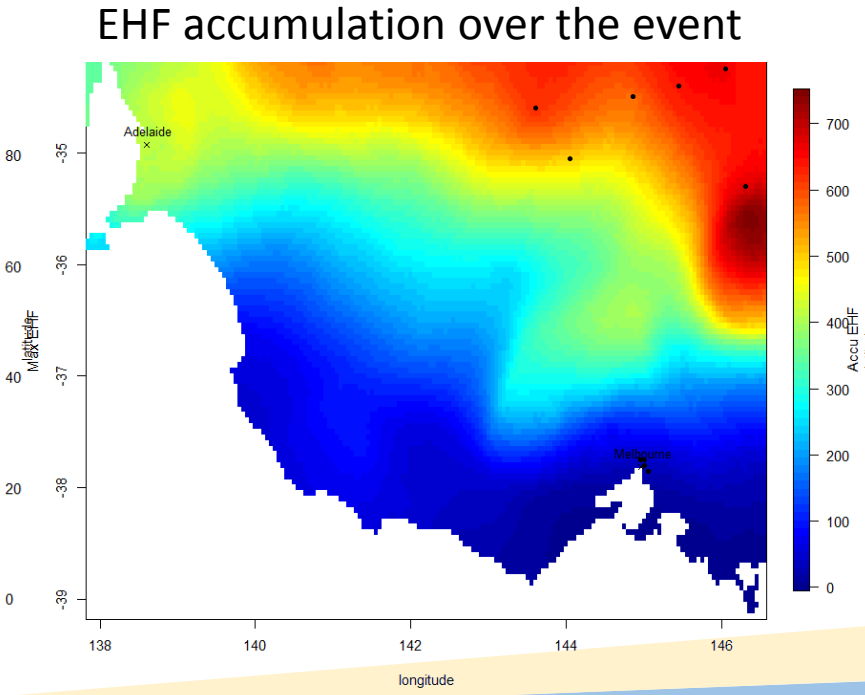
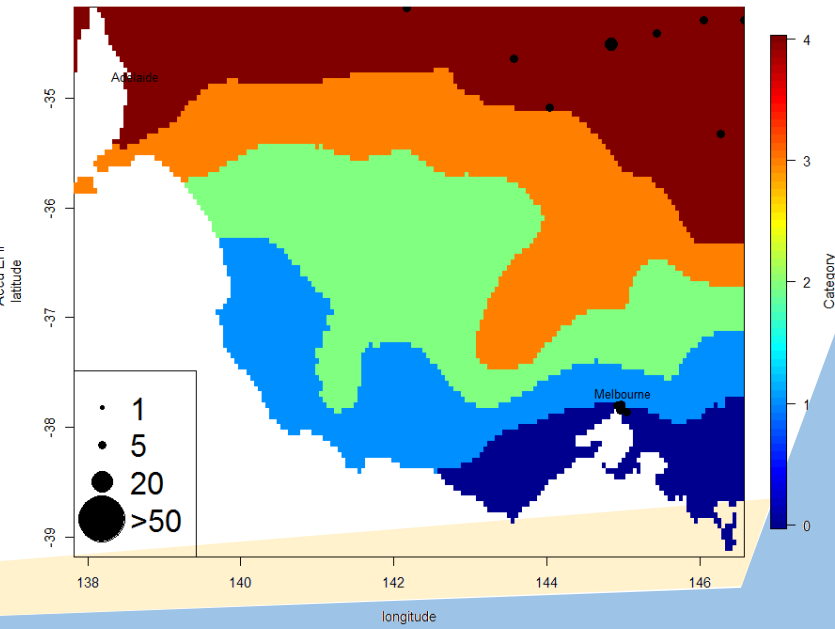
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