An Analysis of Building Losses and Human Fatalities from Natural Disasters

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An Australian Government Initiative

OBJECTIVES:

- To analyse the social and environmental circumstances surrounding deaths from natural hazards
- To analyse building losses from natural hazards

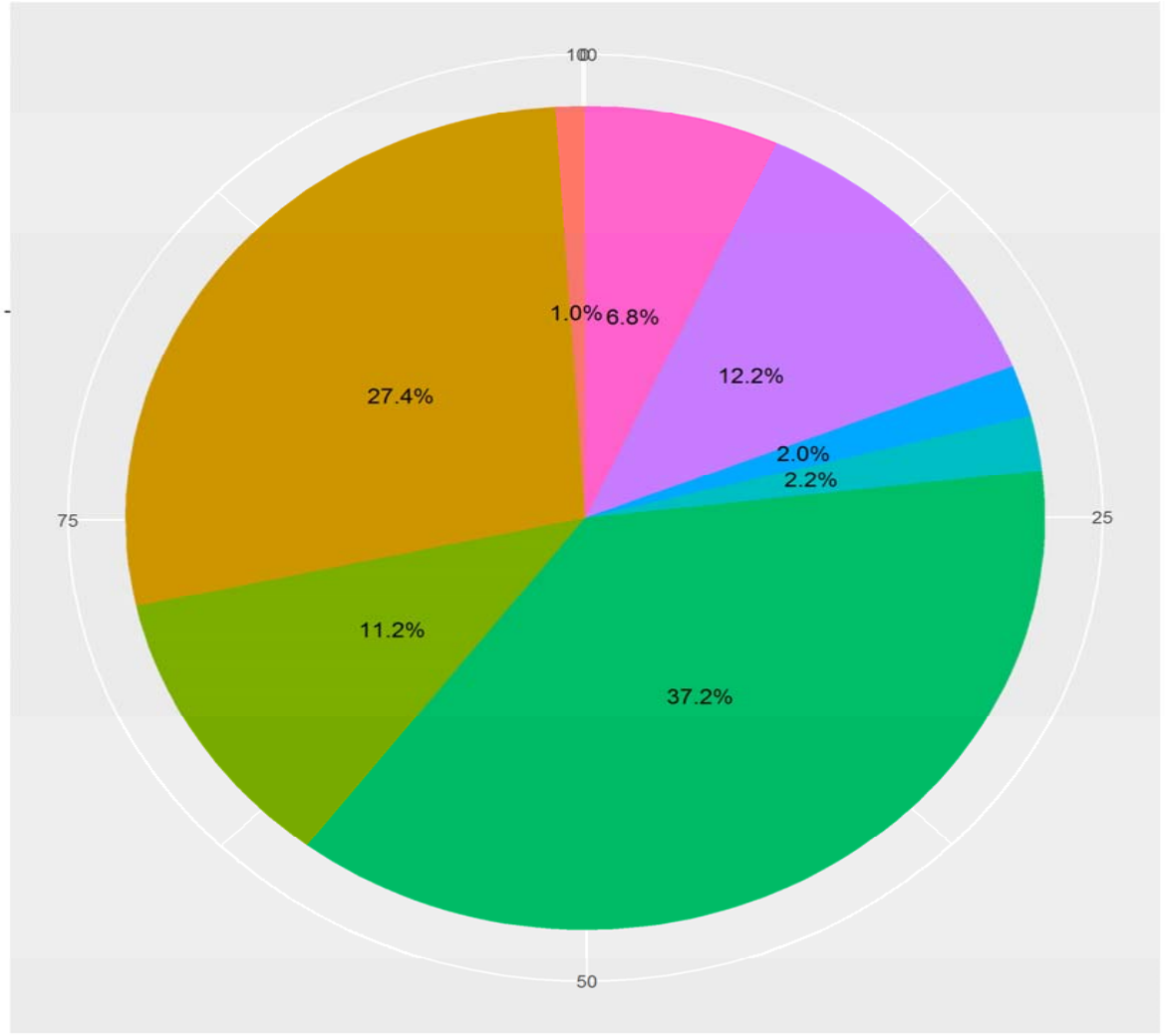
OUTCOMES:

- A longitudinal and geographical examination of trends in the exposure and vulnerability of people
- Evidence-based data to assist with appropriate emergency management and government decision making

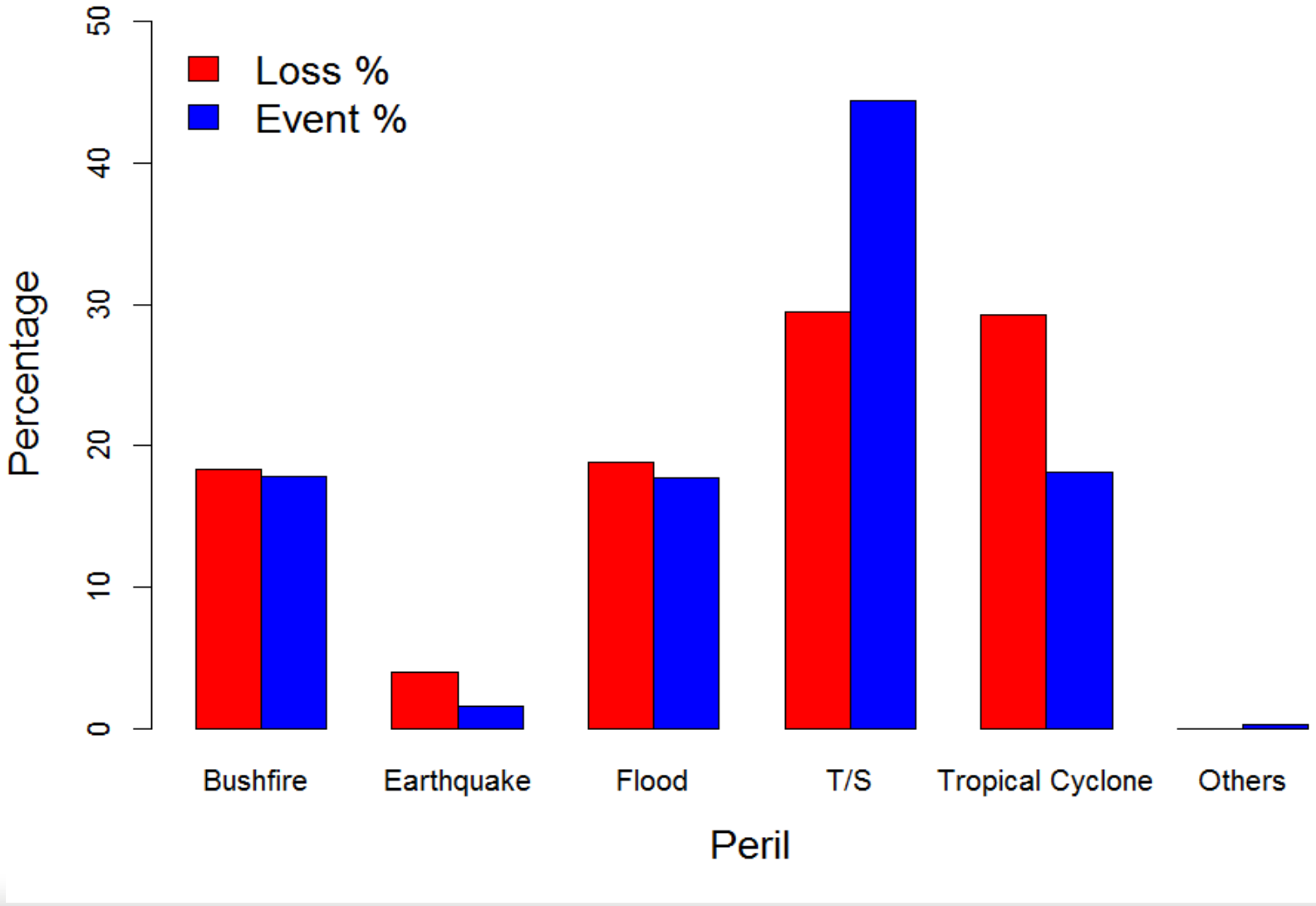
BUILDING IMPACTS METHODS

- Utilises PerilAus database – 15299 records
- Building impacts based upon Housing Equivalent analysis (Blong, 2005)
- $HE_i = RR_i \times CDV_i$
- Examples:
  - Residential buildings e.g. 4 x building with 25% damage = 1 Housing Equivalent
  - Others based upon comparison of floor area e.g. 100$ damage to a hospital = 410 buildings.
- Only building damage e.g. not cars

PROPORTION OF BUILIDNG LOSSES BY STATE

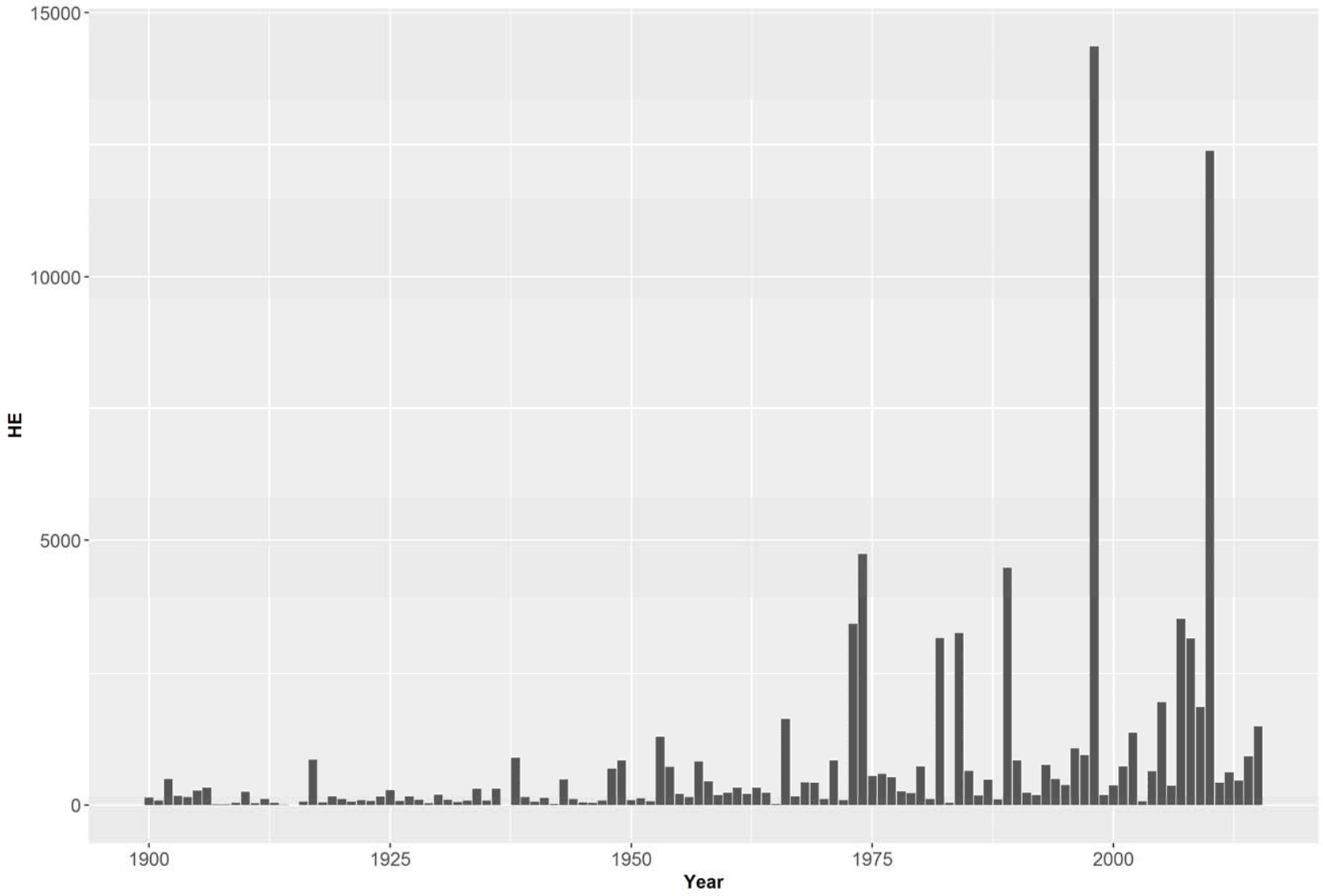


BUILDING LOSSES PER HAZARD

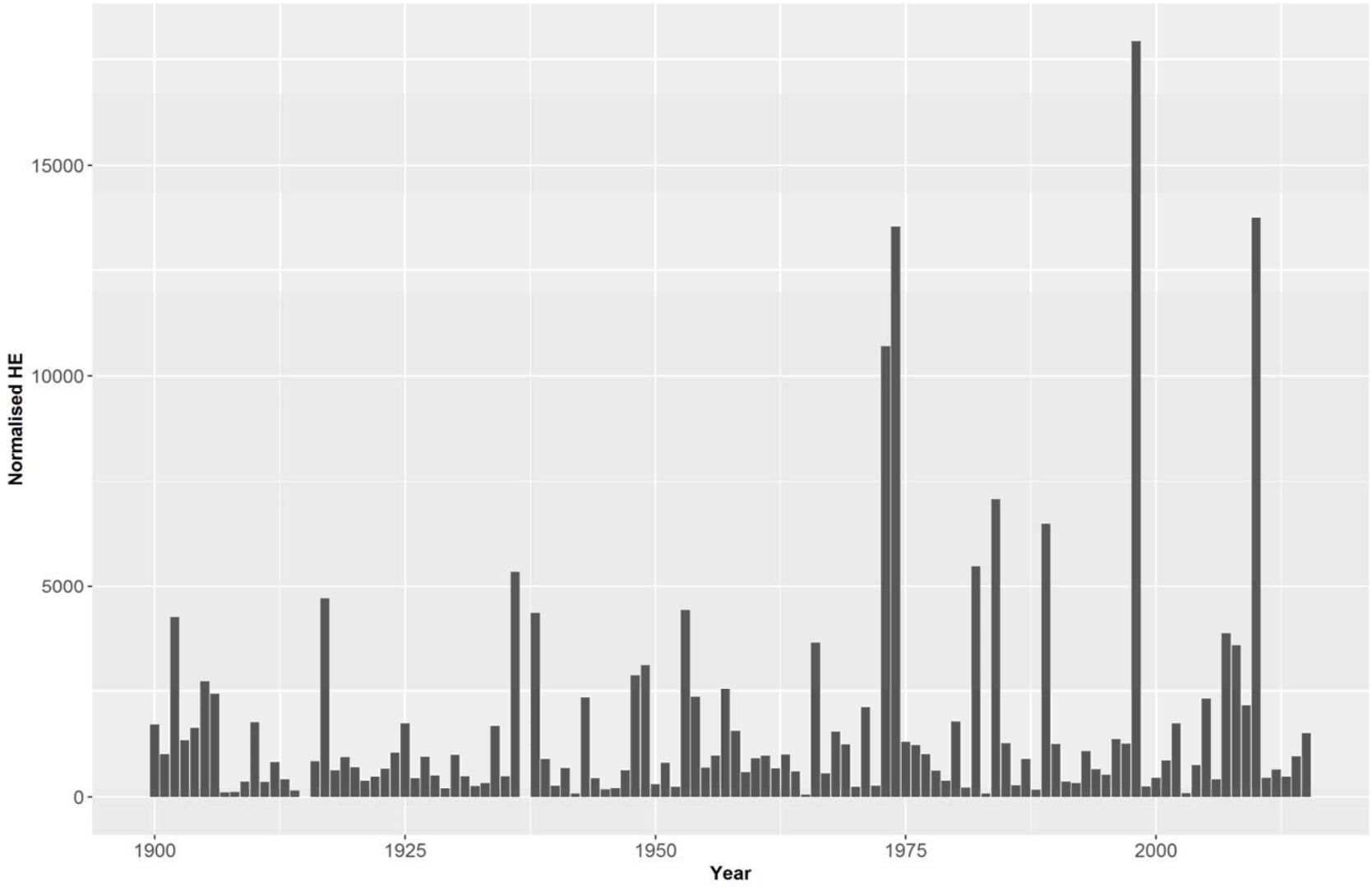


Rank	Year	Event	Estimated Loss ($millions)	ARI (years)
1	1999	Sydney hailstorm	5754	116
2	1974	TC Tracy	5334	58
3	2011	Brisbane floods	4763	39
4	1974	TC Wanda floods	3654	29
5	1985	Brisbane hailstorm	2323	23
6	1983	Ash Wednesday fires	1991	19
7	1937	Unnamed TC	1990	17
8	1989	Newcastle earthquake	1952	15
9	1939	Black Saturday bushfires	1673	13
10	1903	TC Leonta	1556	12
11	1967	Hobart bushfires	1394	11
12	2007	Western Sydney hailstorm	1219	10
13	1954	Unnamed TC	1108	9
14	1918	Unnamed TC	1017	8
15	2009	Black Saturday bushfires	995	8
16	1907	Unnamed TC	874	7
17	1998	Brisbane and region hailstorm	778	7
18	2010	Perth hailstorm	742	6
19	1918	Unnamed TC	604	6
20	2003	Canberra bushfires	603	6

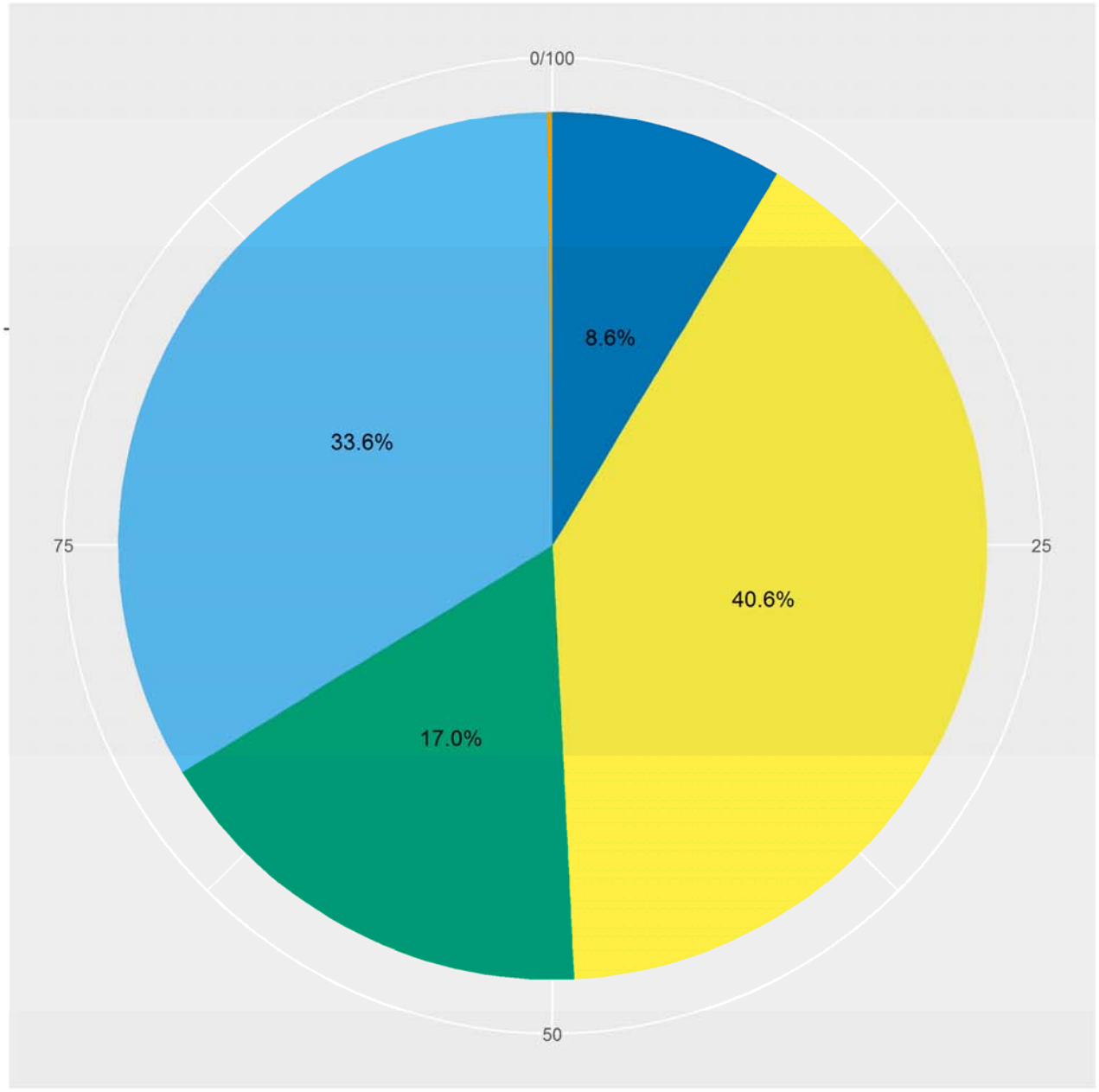
*Losses have been estimated assuming the value of a median-sized building in 2016 is $400k.



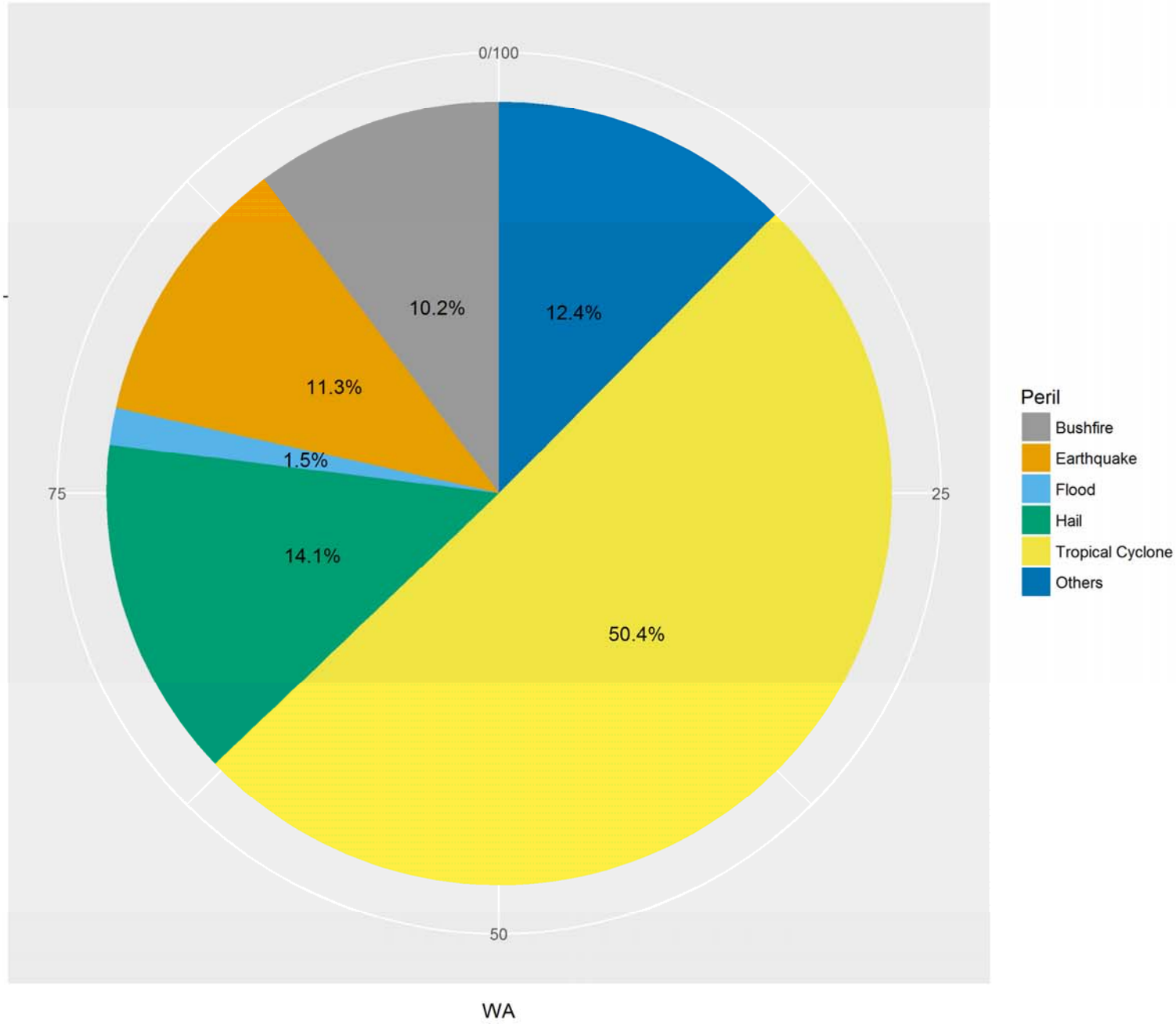
Non – normalised HE aggregated losses



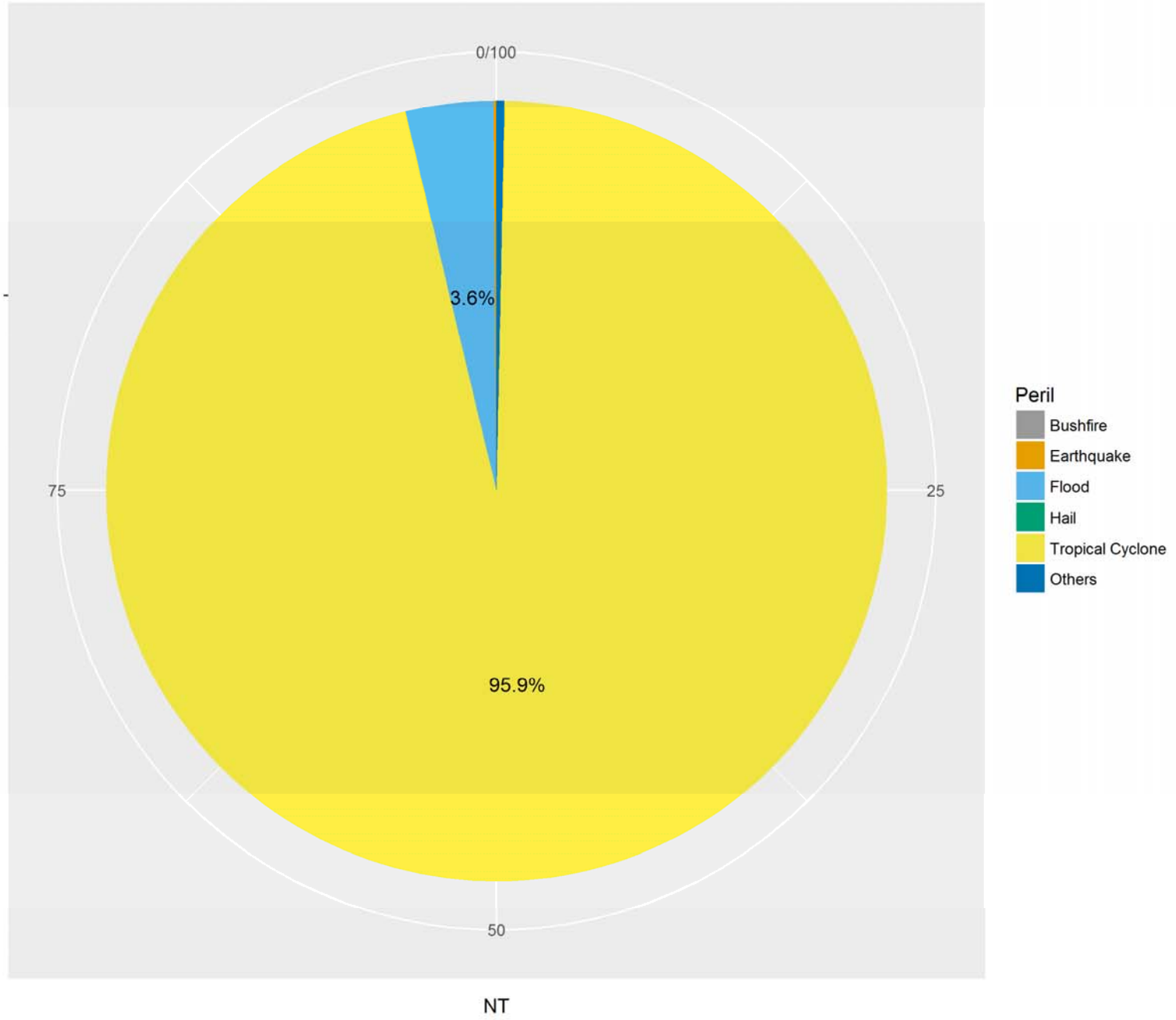
Normalised aggregated losses

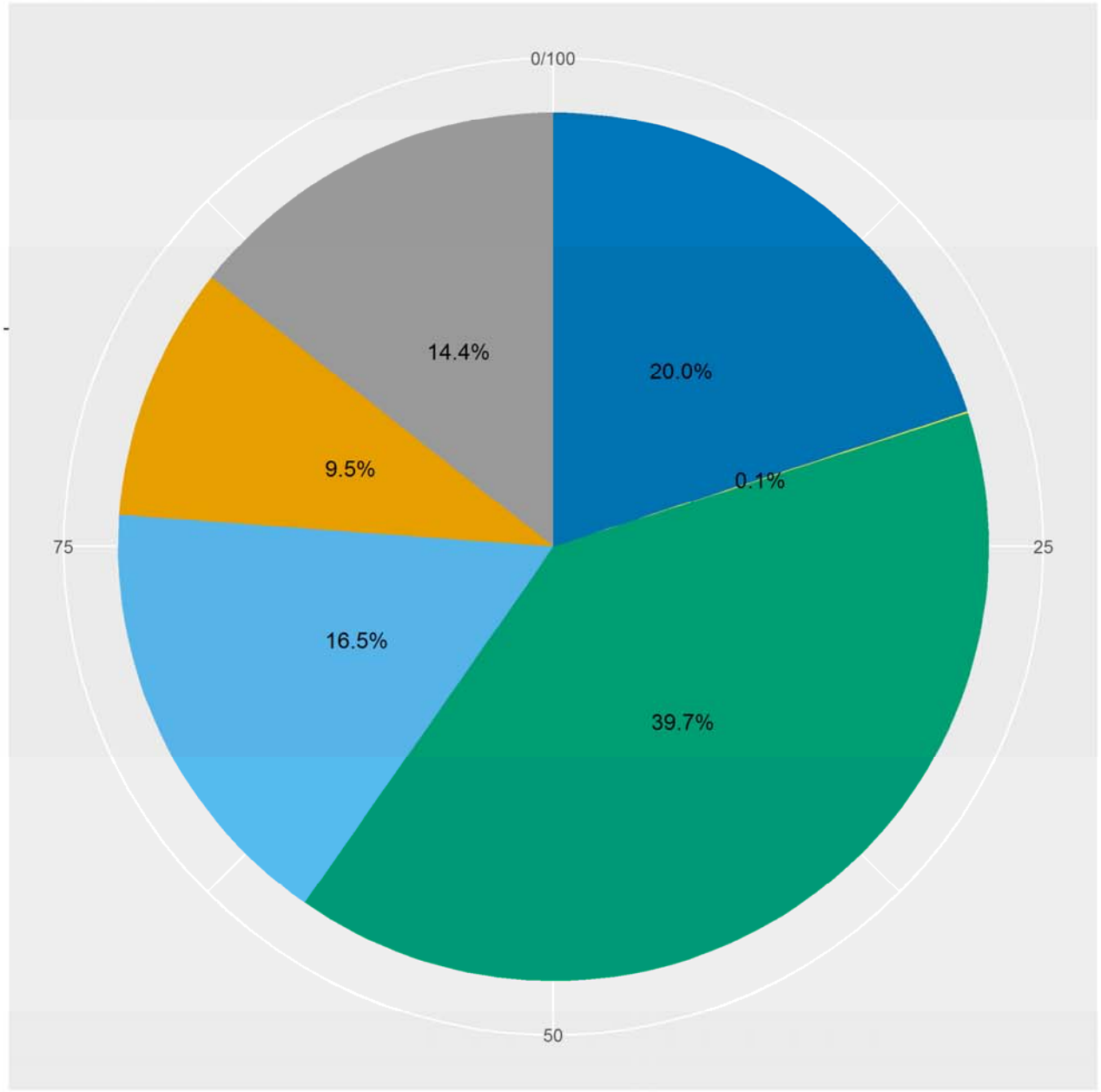

0/100
25
50
75
8.6%
40.6%
17.0%
33.6%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others

QLD

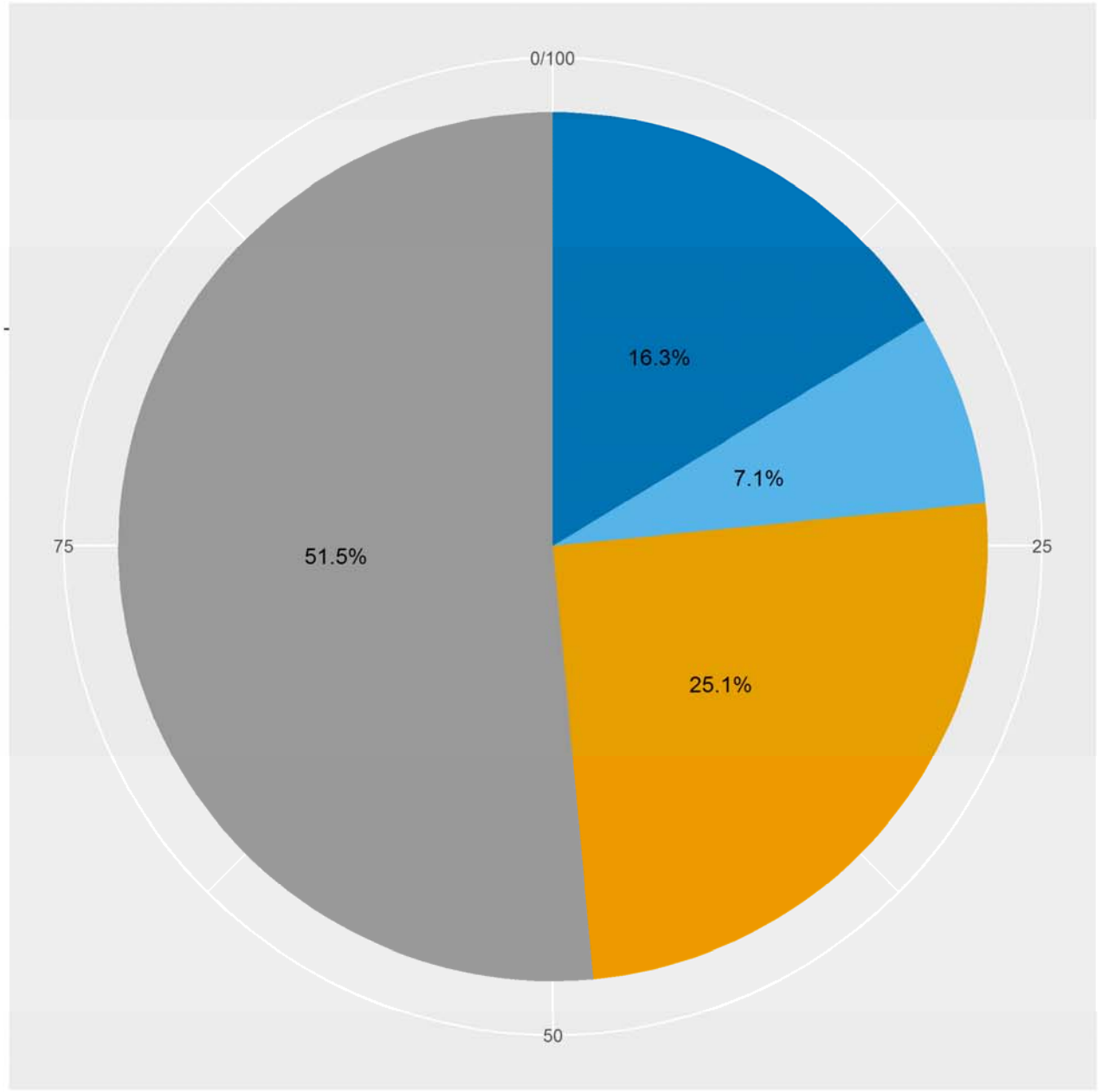

0/100
25
50
75
10.2%
12.4%
11.3%
1.5%
14.1%
50.4%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others

WA

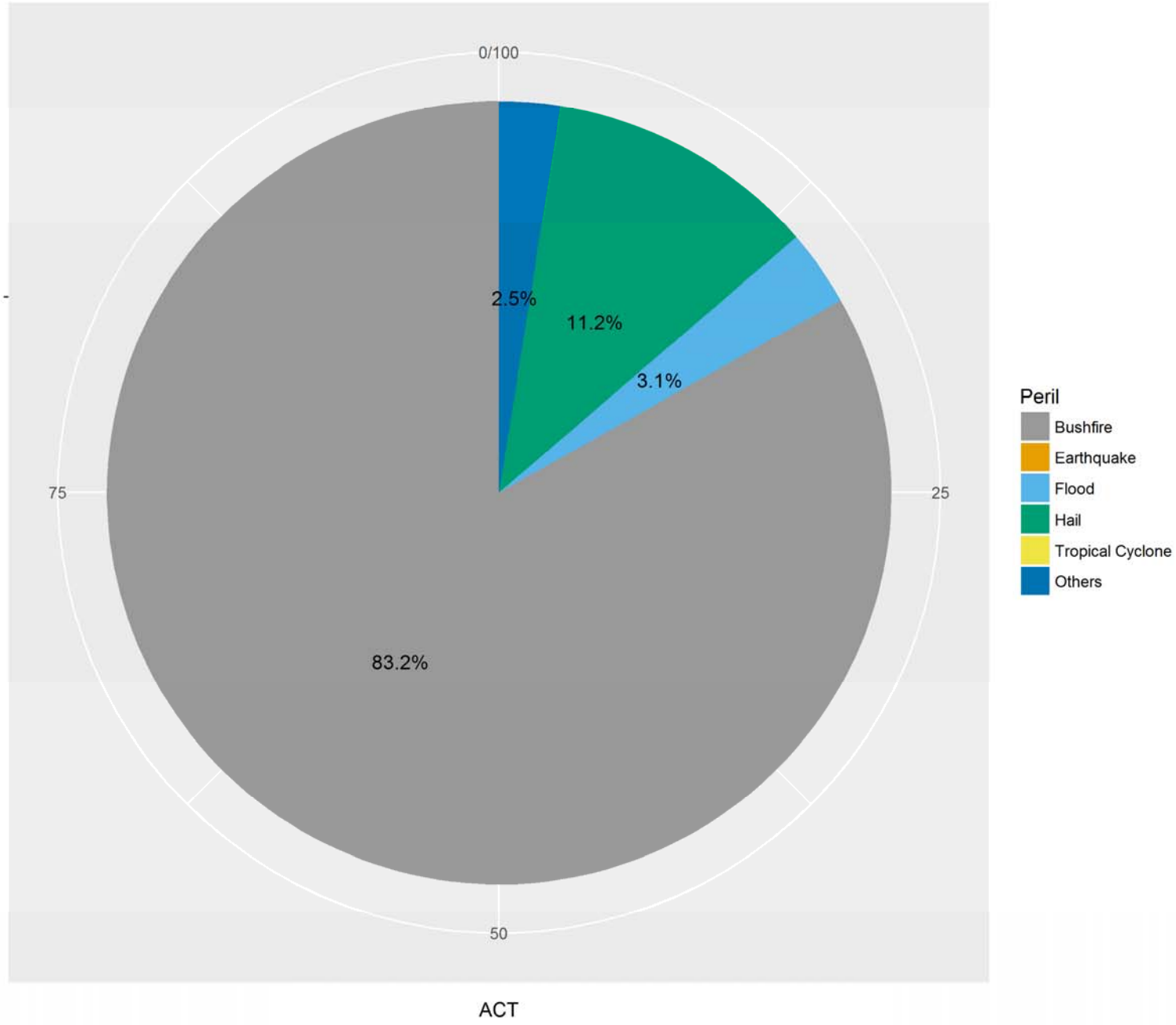

0/100
25
50
75
3.6%
95.9%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others
NT


0/100
25
50
75
14.4%
20.0%
9.5%
0.1%
16.5%
39.7%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others

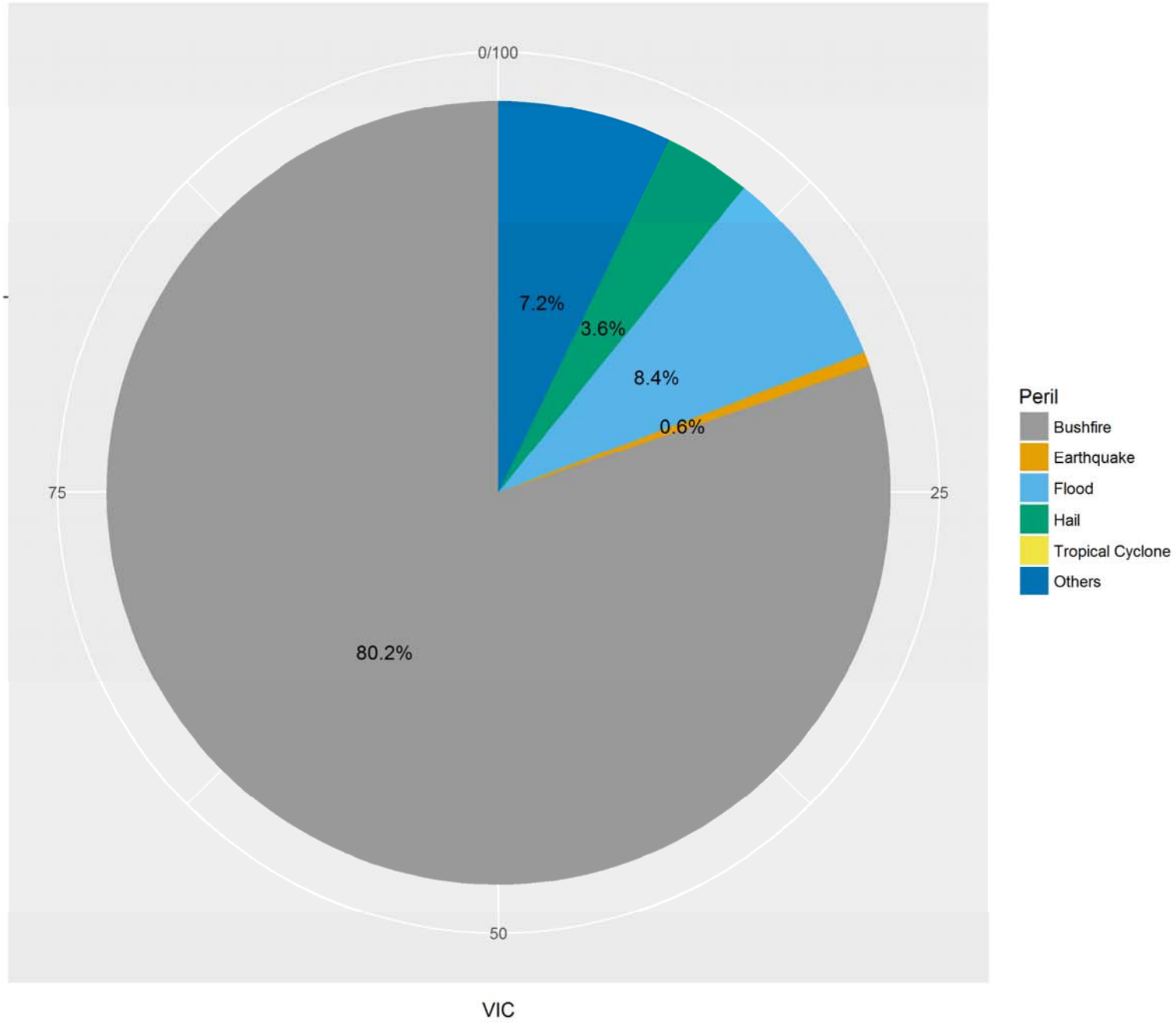
NSW

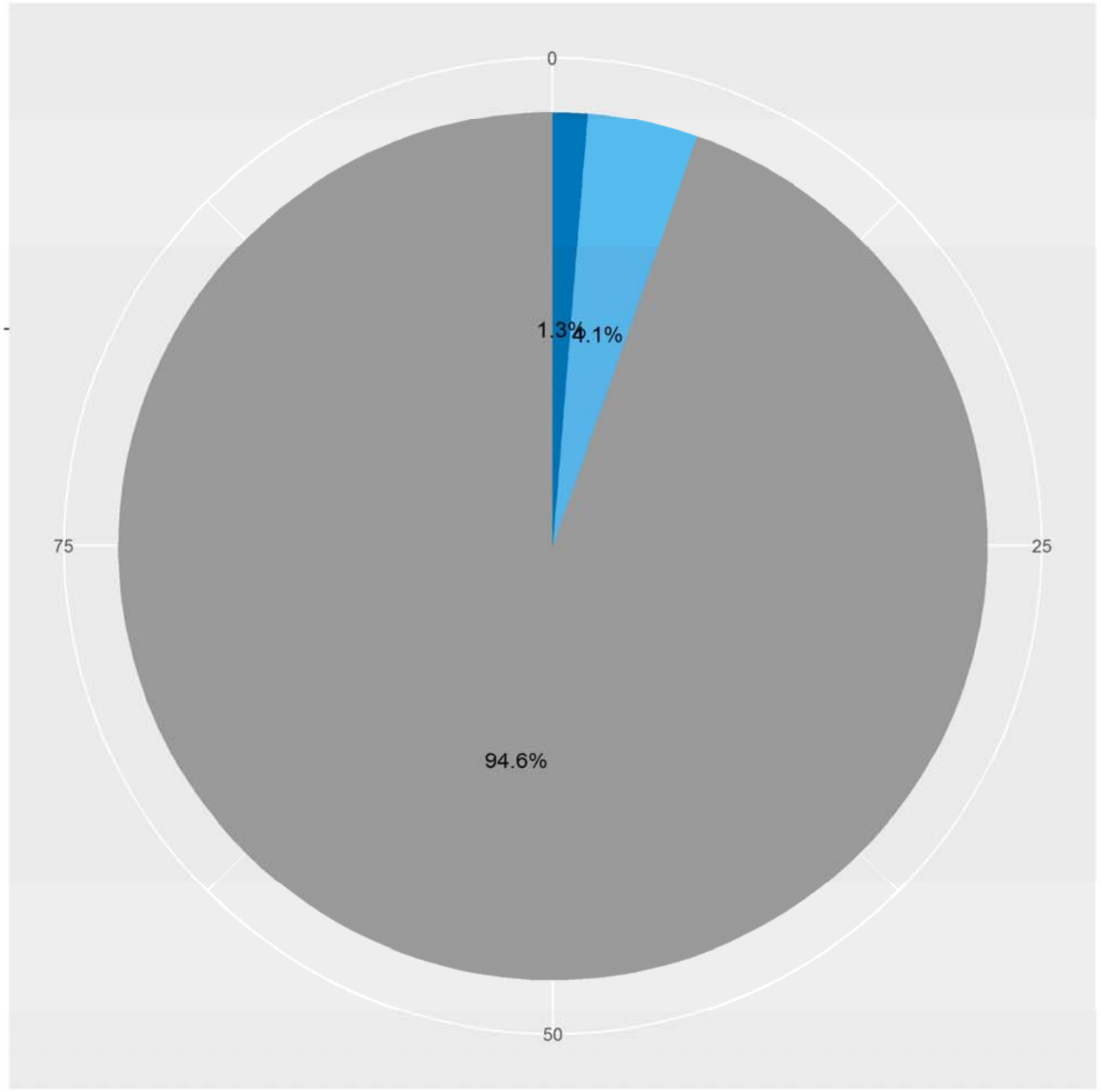

0/100
25
50
75
16.3%
7.1%
25.1%
51.5%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others

SA


0/100
25
50
75
2.5%
11.2%
3.1%
83.2%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others

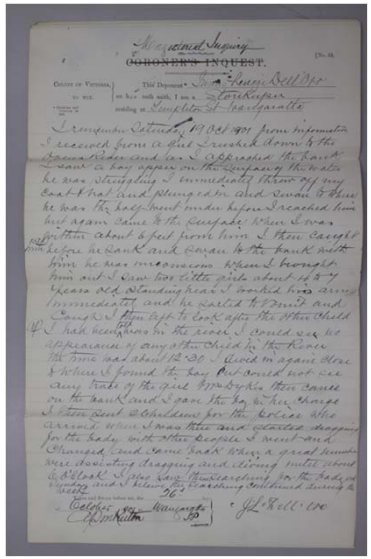
ACT


0/100
25
50
75
7.2%
3.6%
8.4%
0.6%
80.2%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others
VIC


0
25
50
75
1.3%
4.1%
94.6%
Peril
Bushfire
Earthquake
Flood
Hail
Tropical Cyclone
Others

TAS

METHODS



- Update the number of named flood fatalities within PerilAUS – via Factiva and Trove
    - Number of flood deaths 1207 → 1859

- Retrieve coronial inquests, crucial to augmenting the detail surrounding fatalities.
    - name, age, occupation, where found, date of death
    - actions of deceased; reasoning behind decisions
    - knowledge/ forewarning of flood dangers; preparedness; ability to swim; blood alcohol level
    - details of weather; state of river; type of flood.

AUSTRALIA'S TOP FIVE NATURAL HAZARD KILLERS

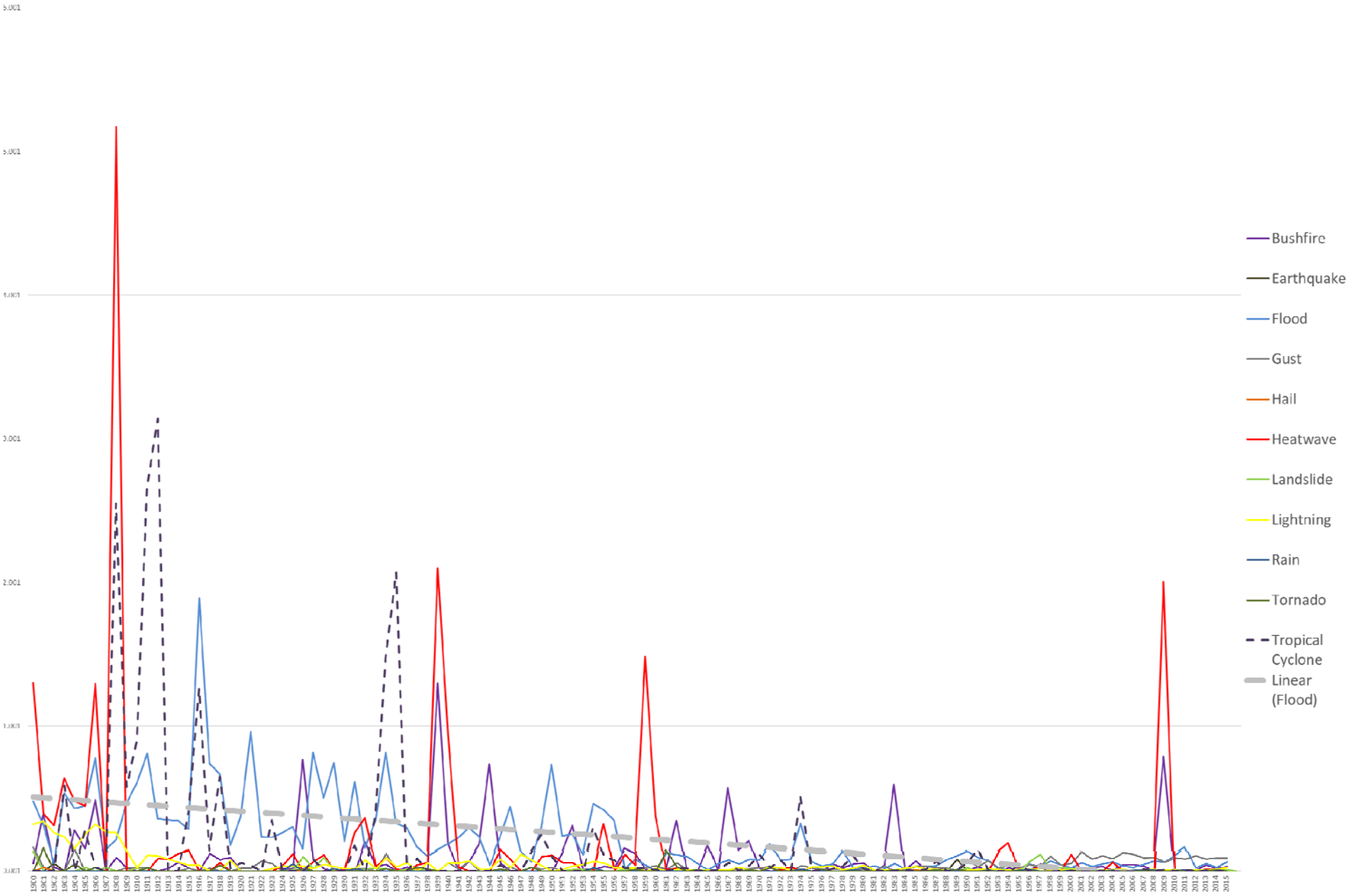
Hazard	Period of coverage	Fatalities
Extreme heat[1]	1900-2011	4,555
Flood[2]	1900-2015	1,859
Tropical cyclone[4]	1900-2015	1,208
Bushfire[3]	1900-2011	825
Wind storm[4]	1900-2015	495

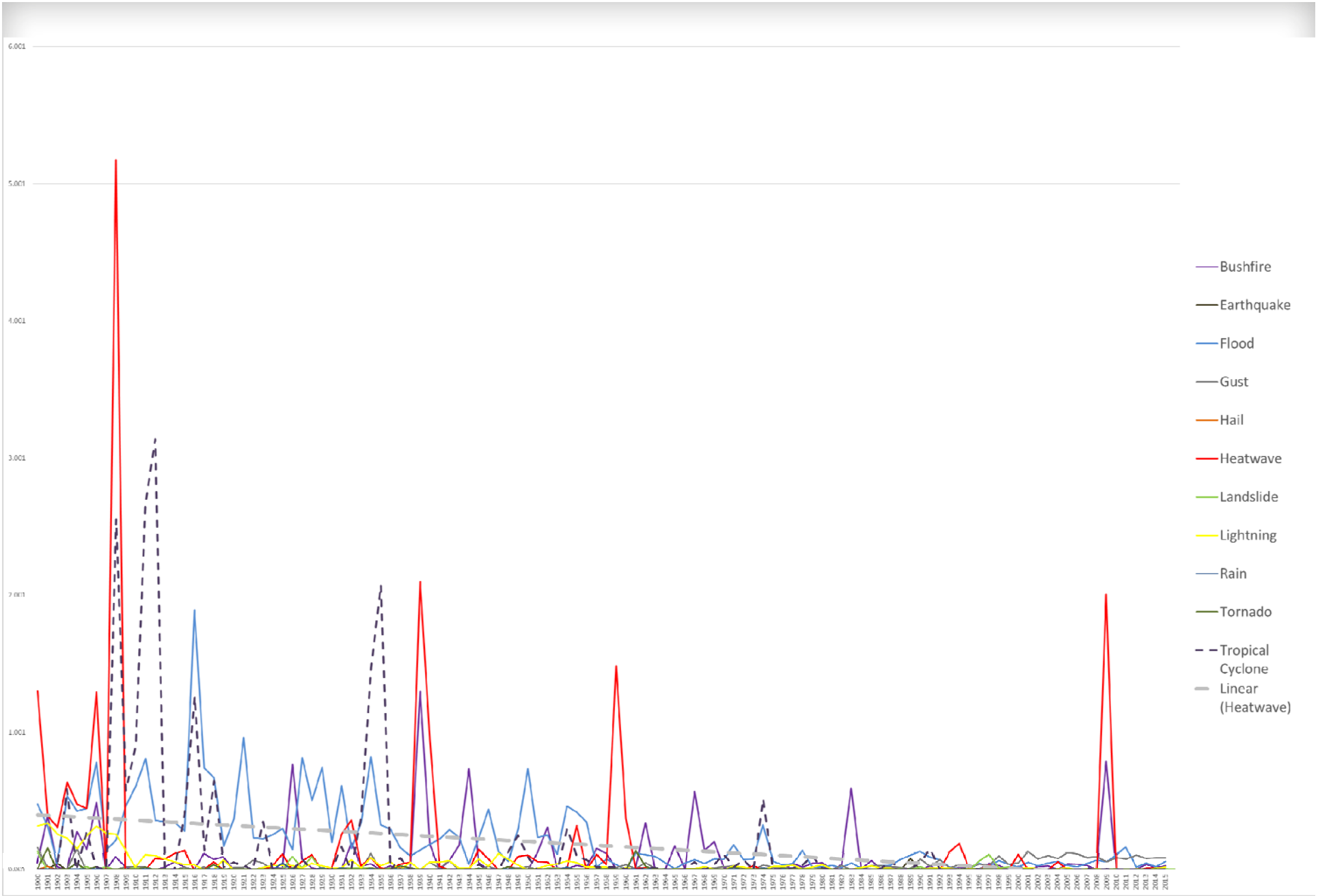
[1] Coates et al., 2014
[2] Haynes et al., 2016
[3] Blanchi et al., 2014
[4] Recent updates to PerilAUS

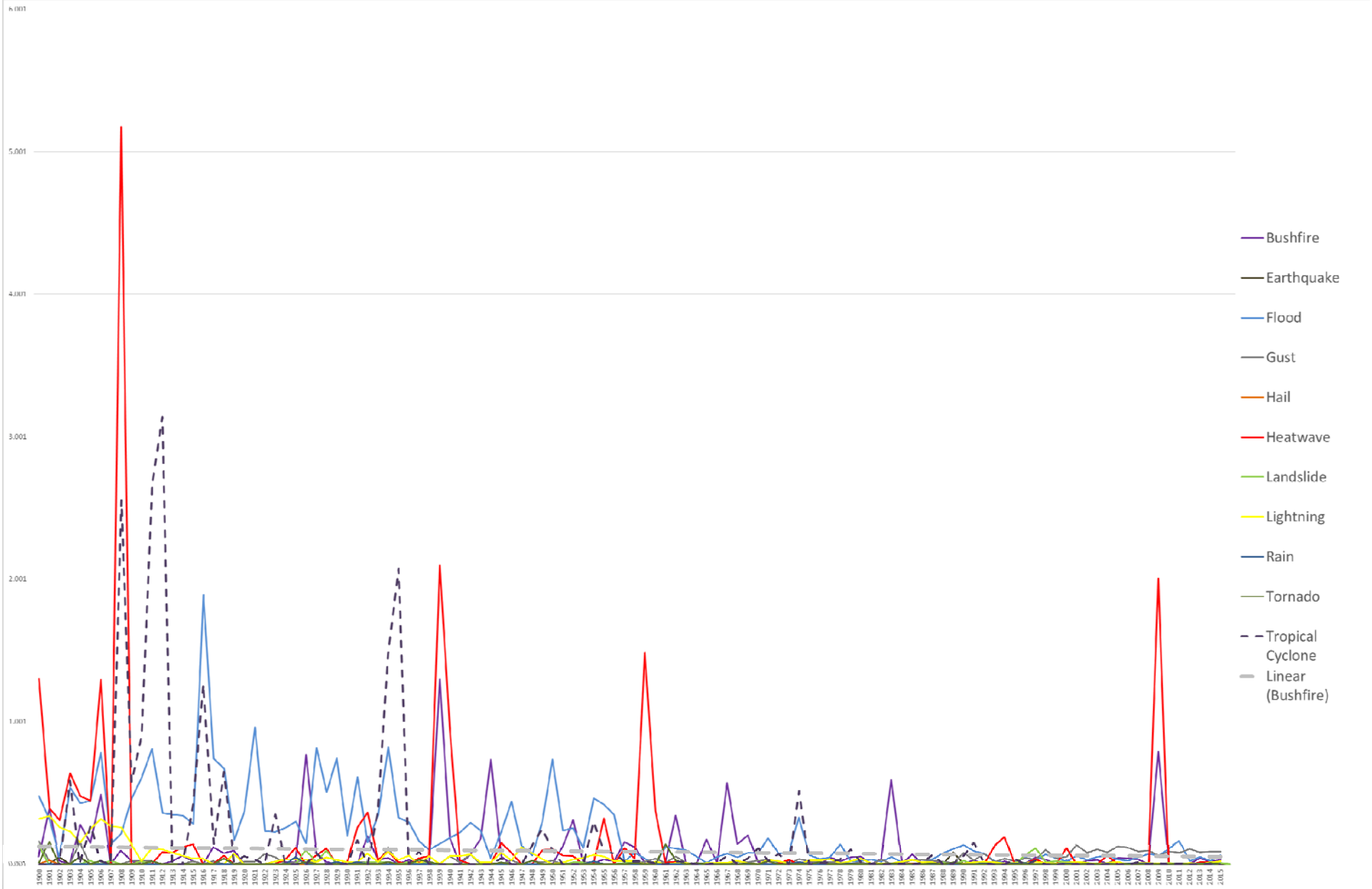
FATALITIES 1970-2015

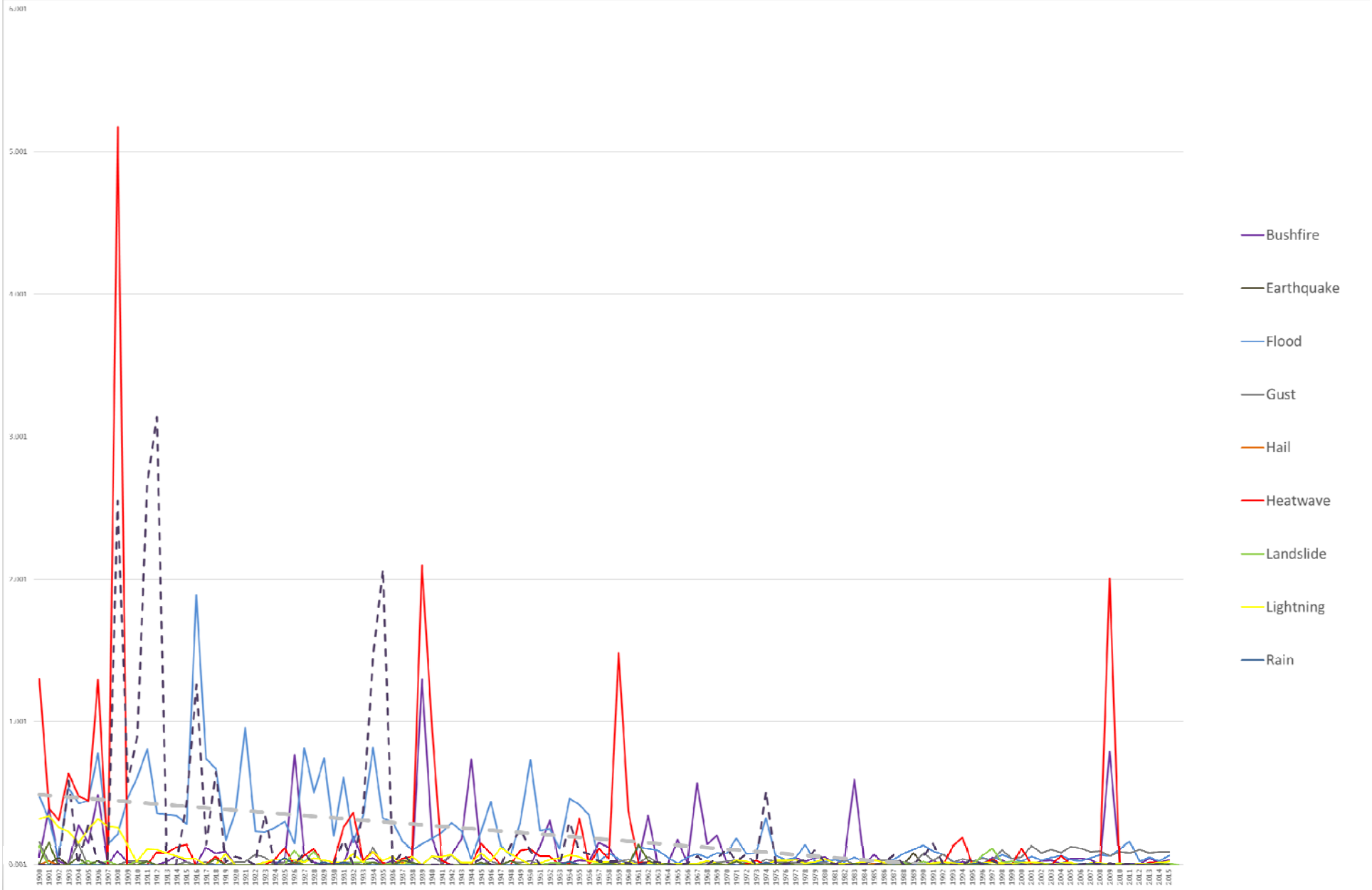
	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Total
Bushfire	4	59	1	6	48	5	269	19	407
Earthquake		14							14
Flood	11	165	37	203	8	17	39	18	487
Gust	2	240	2	43	19	21	68	57	450
Hail							1		1
Landslide		36		4		3	8	14	65
Lightning		36	6	18	3		22	9	94
Rain		6		4		1	3		14
Tornado		1		6			2	3	12
Tropical Cyclone		1	72	41				80	194
Total	17	558	118	325	78	47	412	200	1738

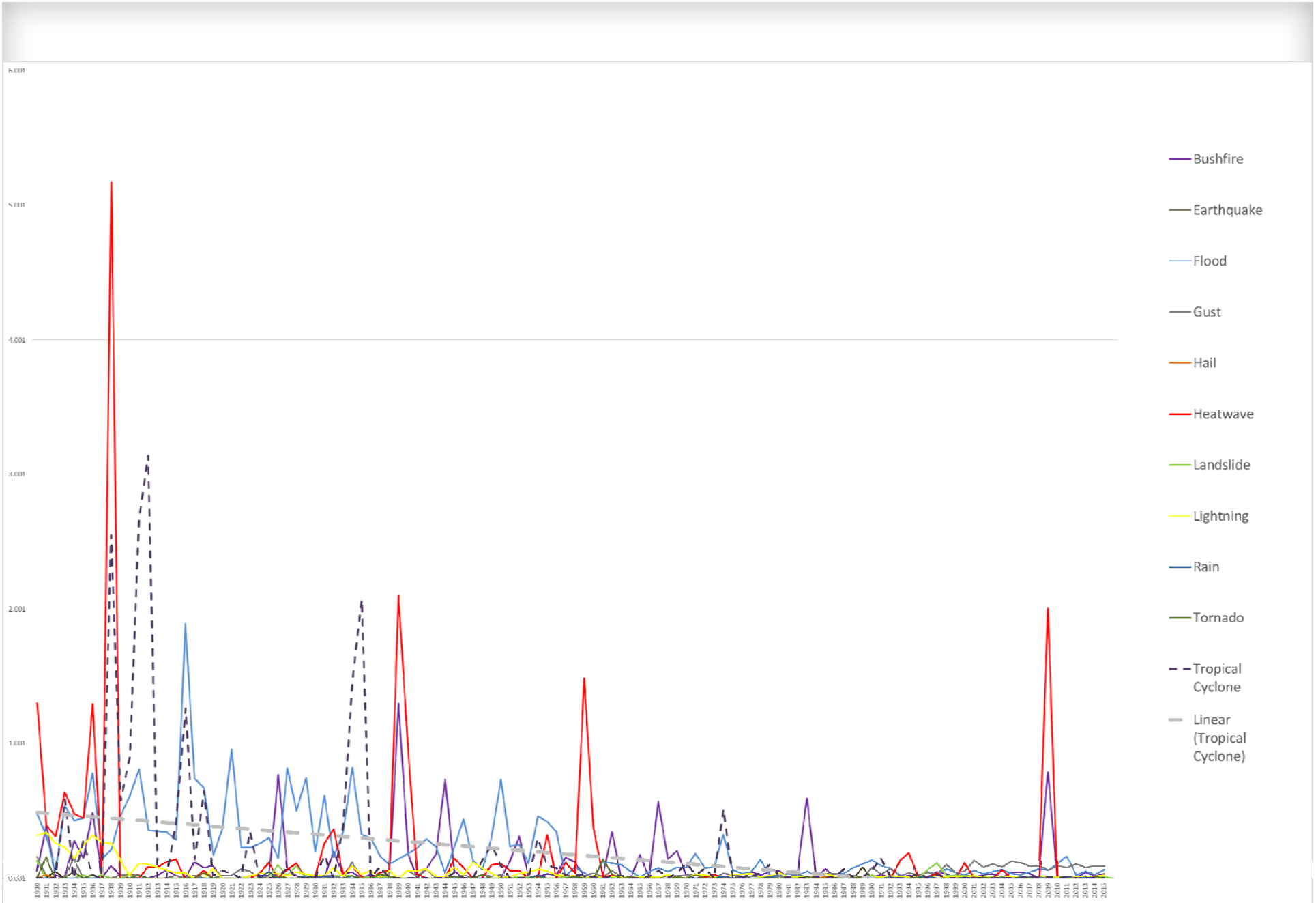
*excludes heatwaves


Bushfire
Earthquake
Flood
Gust
Hail
Heatwave
Landslide
Lightning
Rain
Tornado
Tropical Cyclone
Linear (Flood)


Bushfire
Earthquake
Flood
Gust
Hail
Heatwave
Landslide
Lightning
Rain
Tornado
Tropical Cyclone
Linear (Heatwave)


5,001
4,001
3,001
2,001
1,001
Bushfire
Earthquake
Flood
Gust
Hail
Heatwave
Landslide
Lightning
Rain
Tornado
Tropical Cyclone
Linear (Bushfire)


Bushfire
Earthquake
Flood
Gust
Hail
Heatwave
Landslide
Lightning
Rain


6,000
5,000
4,001
3,000
2,001
1,000
0.001
Bushfire
Earthquake
Flood
Gust
Hail
Heatwave
Landslide
Lightning
Rain
Tornado
Tropical Cyclone
Linear (Tropical Cyclone)

INFLUENCE OF ROAD CHARACTERISTICS ON FLOOD FATALITIES

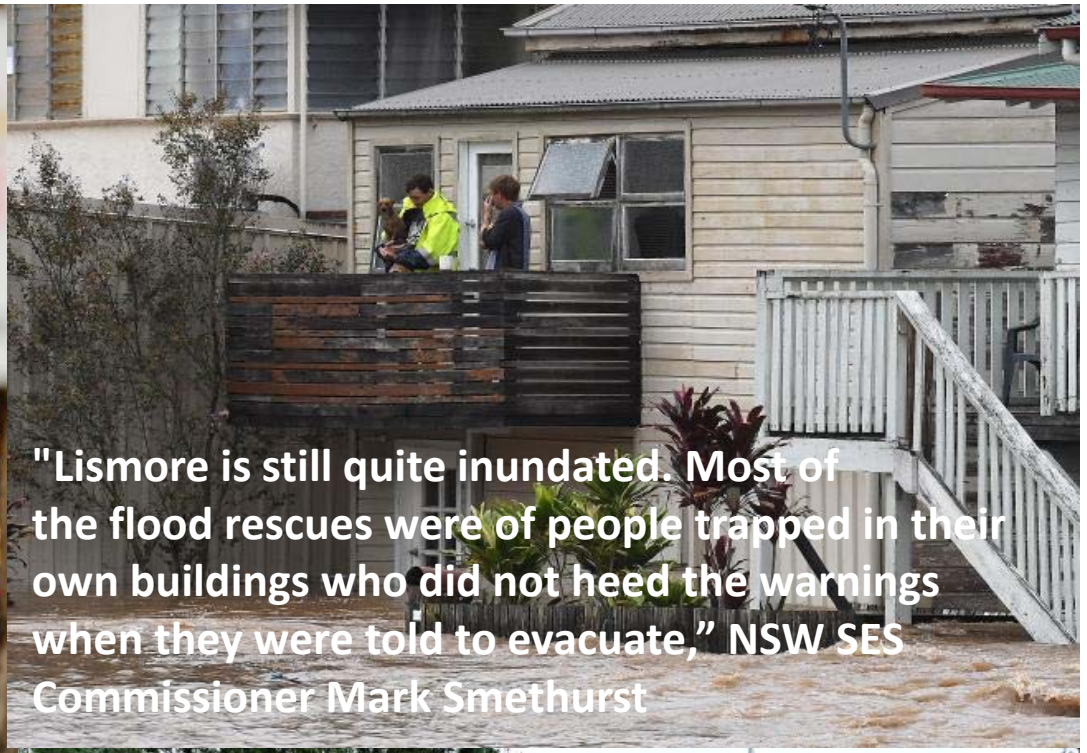
Not all roads are the same – though largely treated as such.

Road characteristics vary such as:

- Depth and velocity over road pavement
- Height of road above surroundings
- Grade of road
- Speed limit
- Lighting
- Signage
- Alignment
- Side barriers
- Curb and guttering
- Traffic flow
- Remoteness
- Downstream obstructions
- Ability for motorist to turn around


CONDITIONS
USE CAUTION
Campsie
MOTORWAY
M5
Liverpool
Canberra
MOLLI AVE


SES



"Lismore is still quite inundated. Most of the flood rescues were of people trapped in their own buildings who did not heed the warnings when they were told to evacuate," NSW SES Commissioner Mark Smethurst