News Release

21 November 2019

Investor presentation – *Severe weather in a changing climate*

The attached presentation is being given today by members of IAG's Natural Perils team to investors and other market participants.

This follows the recent launch of Severe Weather in a Changing Climate, a report co-authored with the US-based National Center for Atmospheric Research (NCAR).

A full copy of the report can be found at: https://www.iag.com.au/severe-weather-changing-climate.

About IAG

IAG is the parent company of a general insurance group (the Group) with controlled operations in Australia and New Zealand. The Group's businesses underwrite over $12 billion of premium per annum, selling insurance under many leading brands, including: NRMA Insurance, CGU, SGIO, SGIC, Swann Insurance and WFI (Australia); and NZI, State, AMI and Lumley (New Zealand). IAG also has interests in general insurance joint ventures in Malaysia and India. For more information, please visit www.iag.com.au.

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Severe Weather in a Changing Climate

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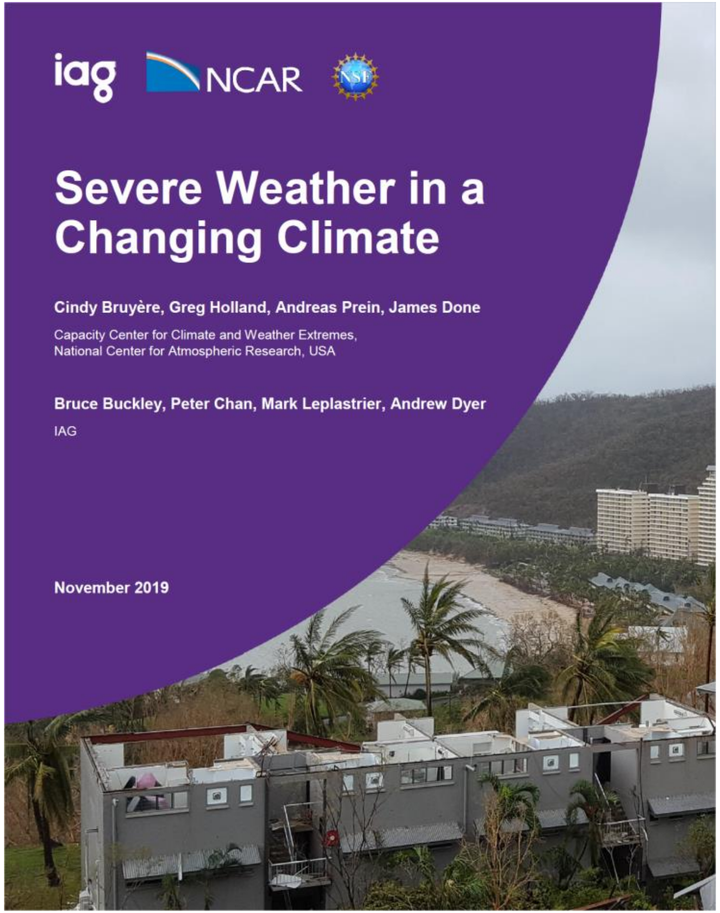
Dr Bruce Buckley, Principal Meteorologist

21 November 2019

Agenda

- **Report Context**
  - Rationale and purpose
  - Relationship with NCAR
- **Climate Change and Weather Extremes**
  - Regional interpretation, by event type
- **Implications for the Built Environment**
  - Risk reduction opportunities
- **Summary**



Report context
Developing a consistent framework

Jointly authored with NCAR

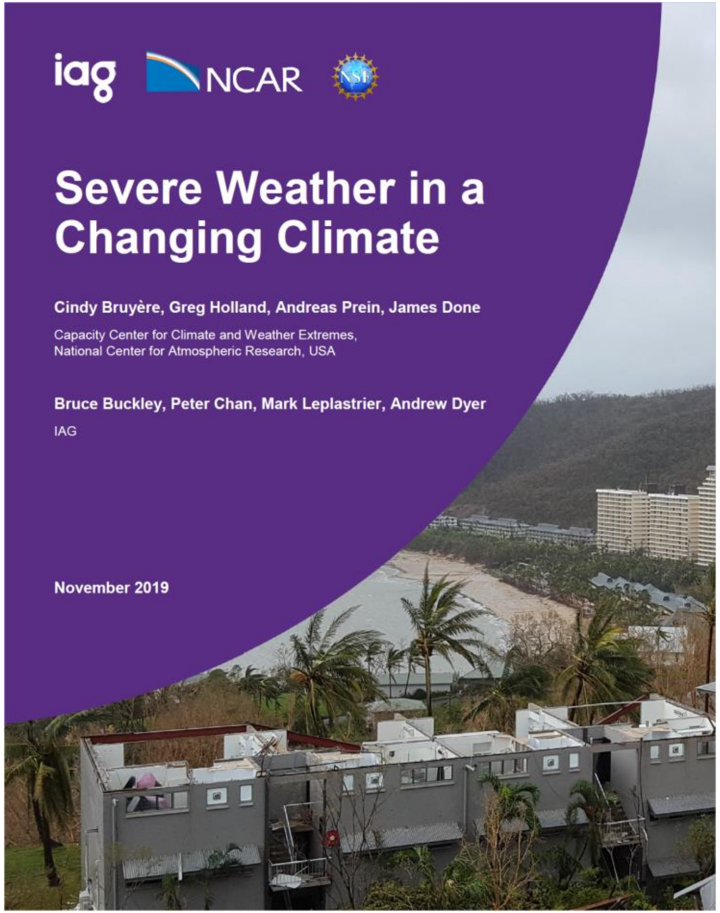
- National Center for Atmospheric Research, based in US
- Research-based relationship with IAG since 2010

Understanding climate-related risks

- Requires review and interpretation of the latest climate change science on how severe weather events may change under several future scenarios
- TCFD recommendations driving a significant increase in activity in this area
- Pressing need to develop a consistent framework for reporting, modelling and data

This report aims to:

- Help eliminate unnecessary duplication of work
- Encourage feedback to move towards establishing a central source of best scientific information



Climate Change and Weather Extremes: A Regional Interpretation

Severe Weather in a Changing Climate
21 November 2019

Major Australian weather claim events since 1980

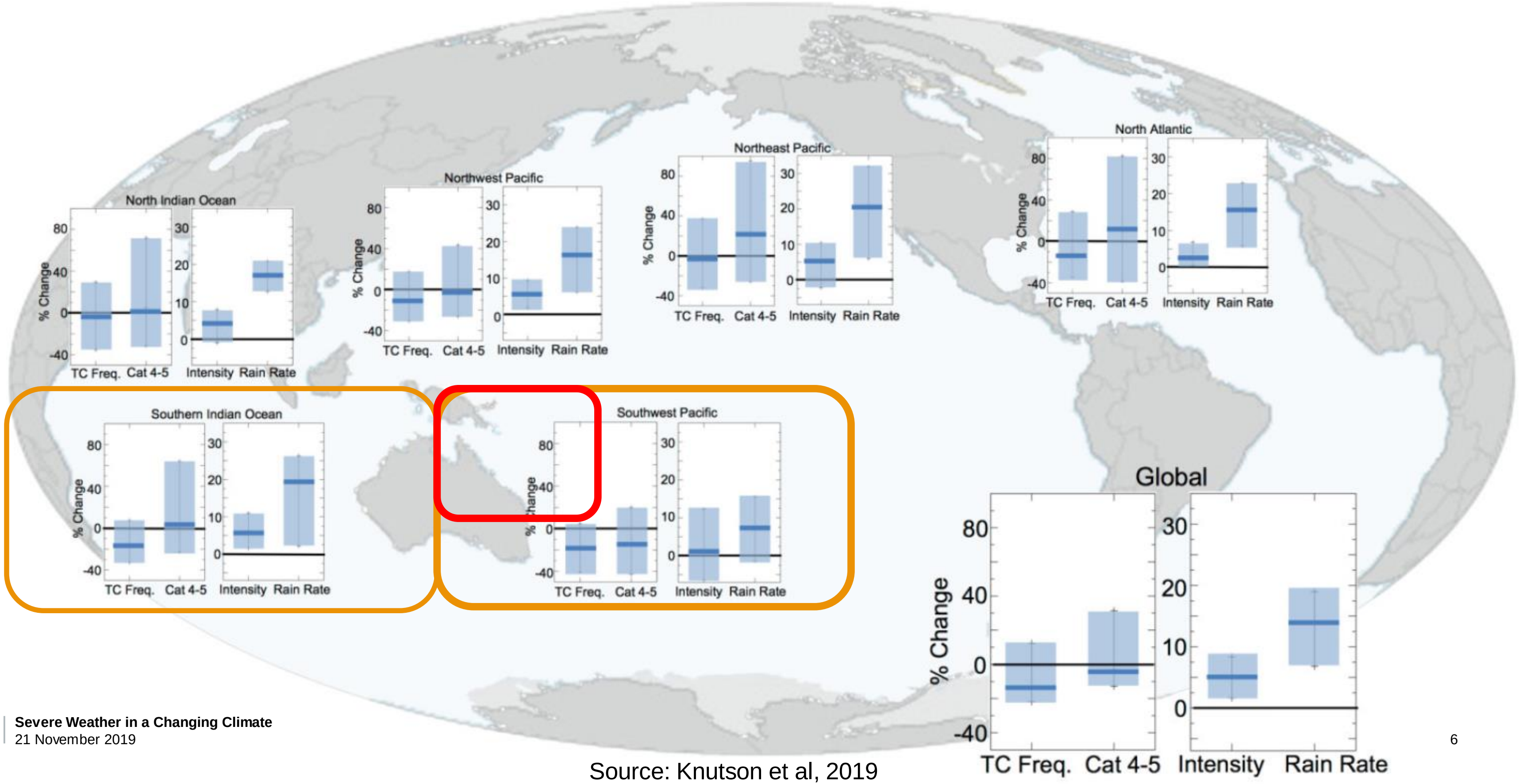
Mixture of meteorological phenomena

Date	Event	Type	Loss ($m)*	Rank
Feb-83	Ash Wednesday bushfires	Bushfire	1,762	4
Jan-85	Brisbane hail storm	Hail storm	2,274	2
Mar-90	North Sydney hail storm	Hail storm	1,681	6
Nov-91	Sydney Hills hail storm	Hail storm	1,045	17
Apr-99	Sydney hail storm	Hail storm	5,574	1
Jun-07	NSW east coast low	East coast low	2,197	3
Feb-09	Black Saturday bushfires	Bushfire	1,758	5
Mar-10	Melbourne hail storm	Hail storm	1,626	7
Mar-10	Perth hail storm	Hail storm	1,345	12
Jan-11	Lockyer, Brisbane floods	Flood	1,527	10
Feb-11	Cyclone Yasi	Tropical cyclone	1,479	11
Dec-11	Melbourne hail storm	Hail storm	988	18
Jan-13	Ex-TC Oswald flooding	Flood	1,131	15
Nov-14	Brisbane hail storm	Hail storm	1,535	9
Apr-15	NSW east coast low	East coast low	1,060	16
Apr-17	Cyclone Debbie	Tropical cyclone	1,614	8
Dec-18	Sydney hail storm	Hail storm	1,312	13
Feb-19	Townsville floods	Flood	1,248	14

*ICA DataGlobe Insurance Industry Data since 1980 – normalised to 2017 $

Phenomena	Number
Tropical cyclone	2
Hail / severe convective storm	9
East coast low	2
Flood	3
Bushfire	2

Tropical cyclone trends
A global view by key ocean basins



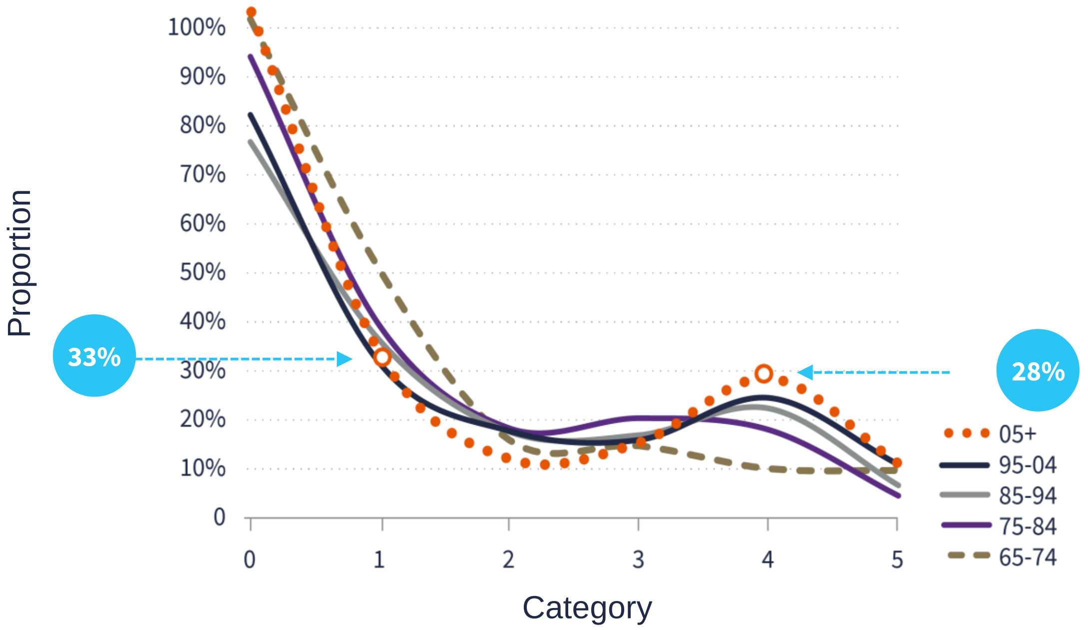
Source: Knutson et al, 2019

Observed cyclone trends

An increasing proportion of stronger cyclones

US Saffir-Simpson Hurricane Scale

All cyclone basins, all available years since 1965 (Holland / Bruyère 2013)



Cyclone category	% of risk premium	% of annual frequency
1 or less	5%	43%
2	8%	26%
3	47%	22%
4	26%	7%
5	14%	2%

87%

31%

Modelling of tropical cyclone intensity trends

IAG / NCAR research indicates 20% increase in most intense TCs

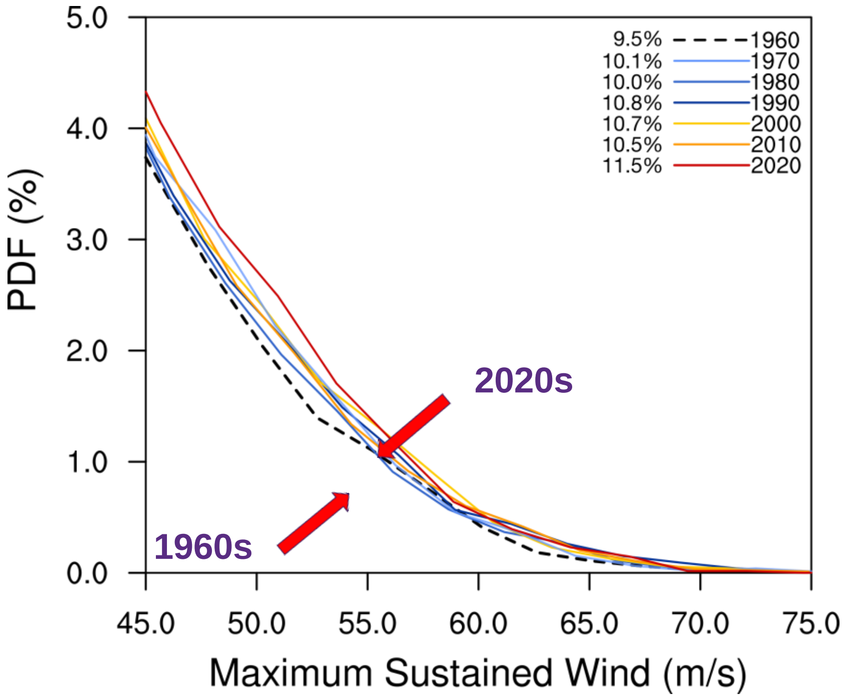
Preliminary research of most intense Coral and Tasman Sea tropical cyclones (135° to 180°E)

- Actual intensities need to be scaled upwards to allow for model resolution limitations

Identified intensity trends

- 20% increase in the number of most intense tropical cyclones, from 1960s to 2020s
- This comprises:
  - A 10% increase from 1960s to 2010s
  - A further 10% increase predicted for the 2020s

Decadal trends in most intense cyclones



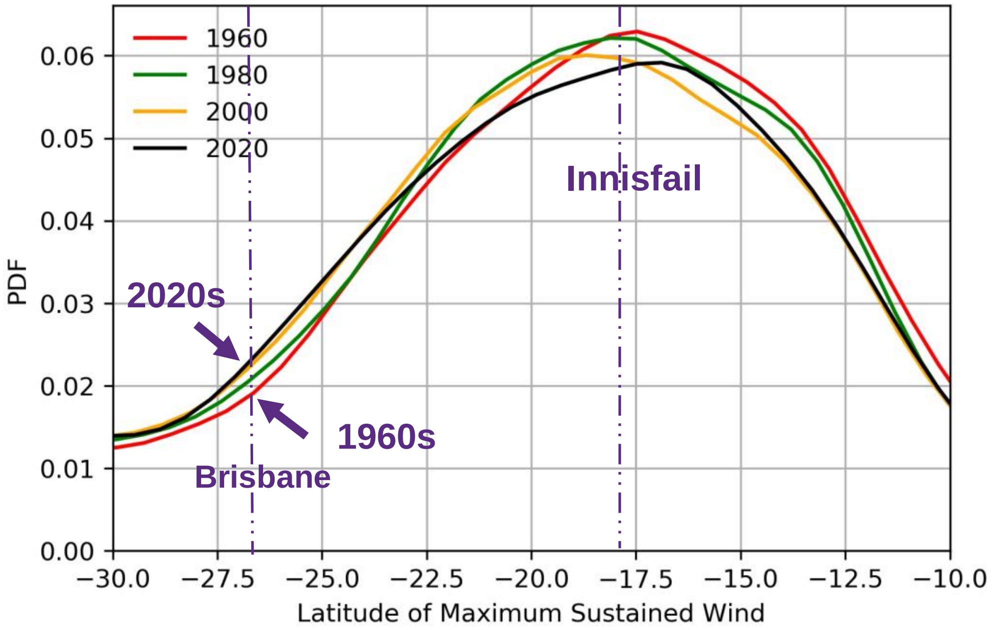
PDF = Probability Density Function

Modelling tropical cyclone trends – east coast of Australia
Southward shift evident

Coral and Tasman Sea tropical cyclones (135º to 180ºE)

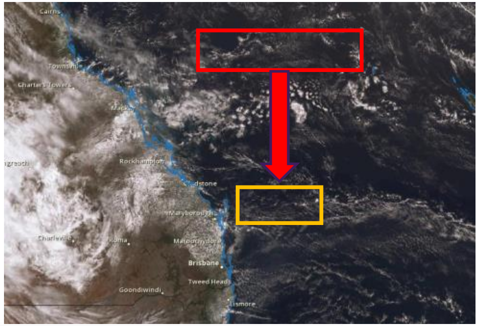
- Southward shift of lifetime maximum intensity
- Increase in tropical cyclones with maximum intensity at Brisbane's latitude, from 1960s to 2020s
- Slight decline in % of tropical cyclones having maximum intensity from Cairns to Townsville – still high risk

Decadal trends: cyclone lifetime maximum intensity

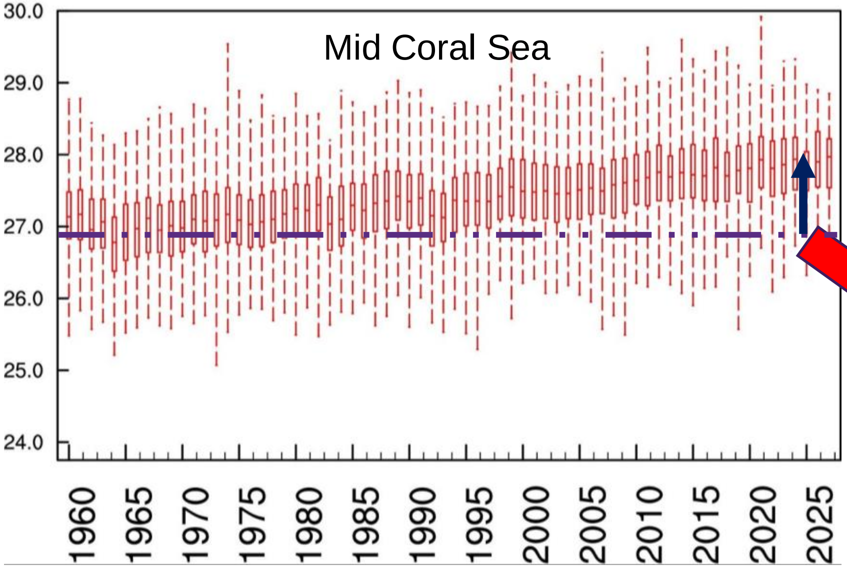


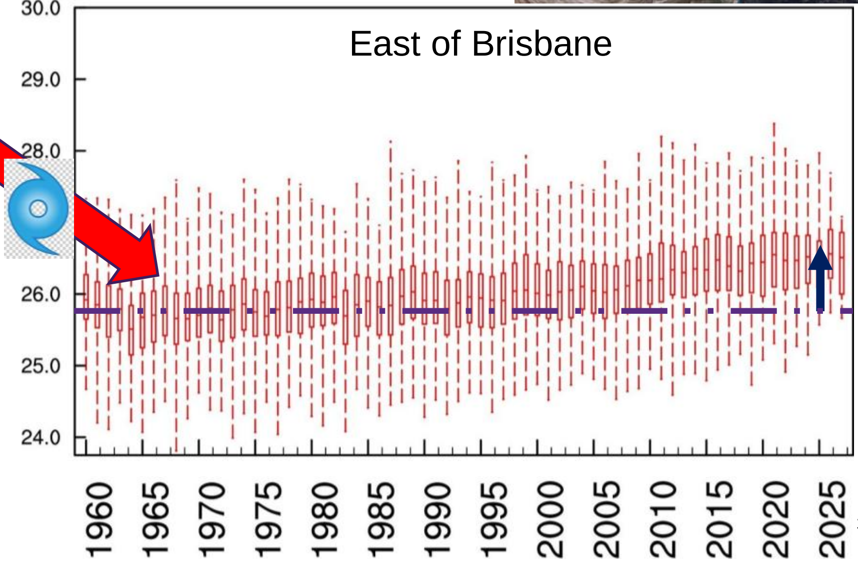
Rising sea temperatures

1ºC warming >26ºC can sustain a 1 Category intensity increase



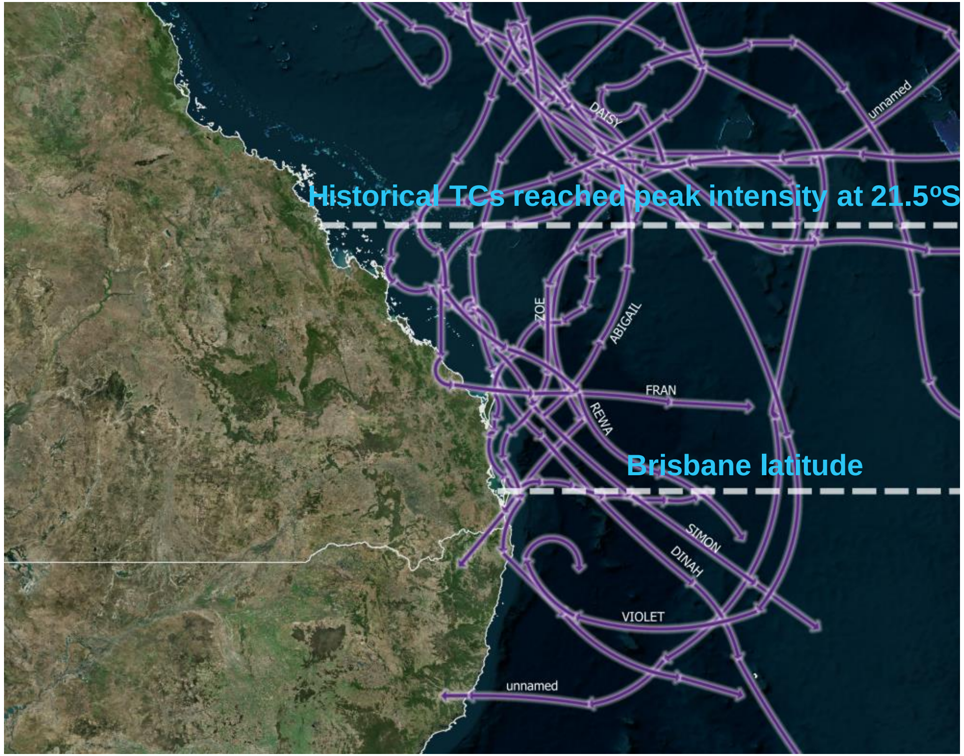
- Tropical cyclones draw their energy from the oceans
- Warming seen at both region of peak intensity (Mid Coral Sea) and off Brisbane

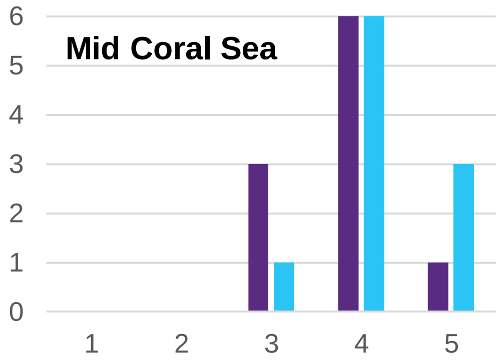


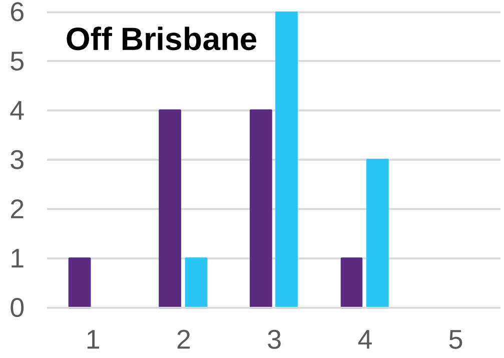


Historical cyclones at today's sea surface temperature

Observed 1°C increase implies more intense cyclones off SE Queensland





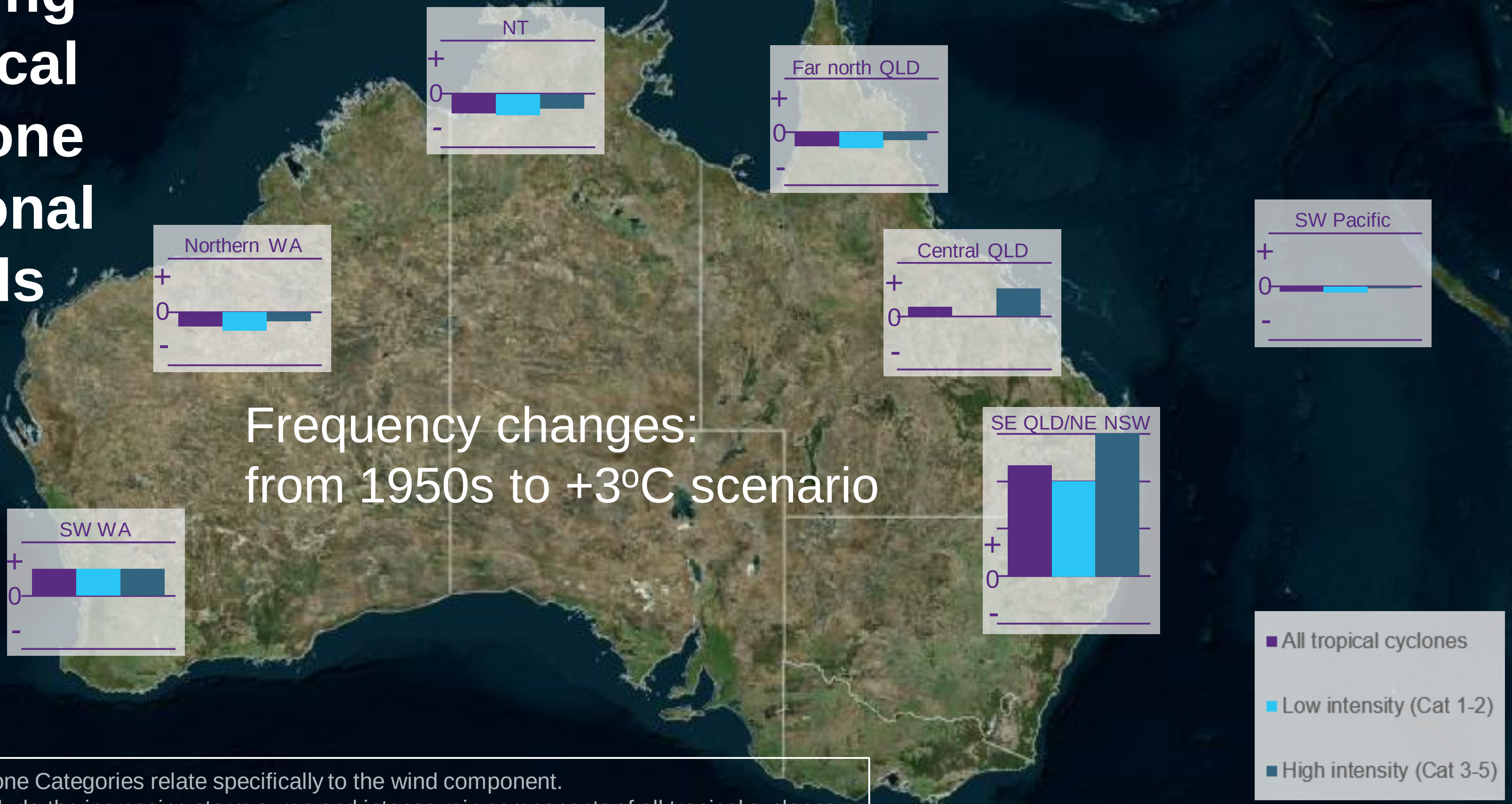


Historical intensities (purple)

Potential current intensities (blue)

Varying tropical cyclone regional trends

Frequency changes:
from 1950s to +3ºC scenario

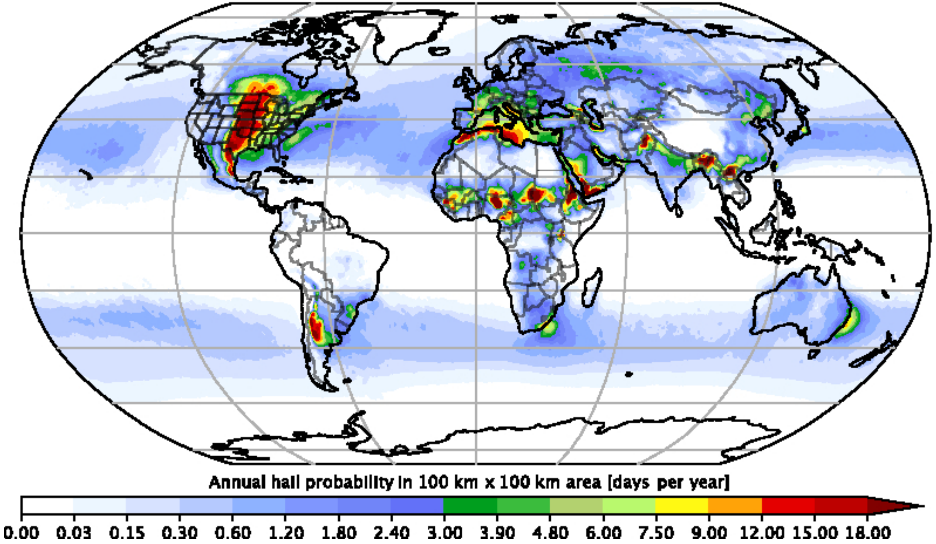


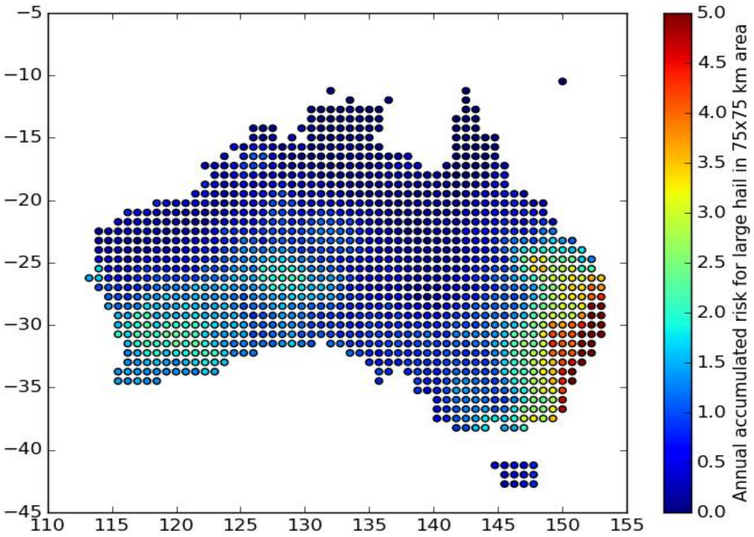
Note: Cyclone Categories relate specifically to the wind component.
Trends exclude the increasing storm surge and intense rain components of all tropical cyclones.

Severe thunderstorms: hail

First step: establish hail climatology from multiple data sources (1)

Global view → **Regional view**



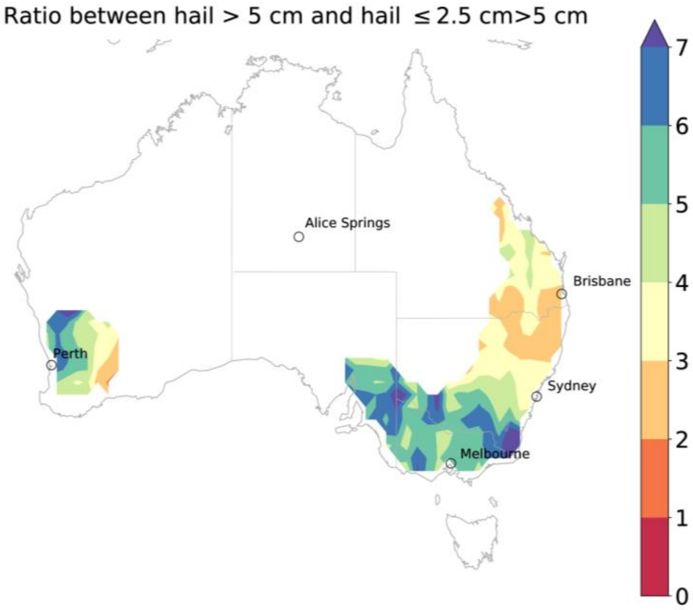


Source: Prein and Holland, 2018

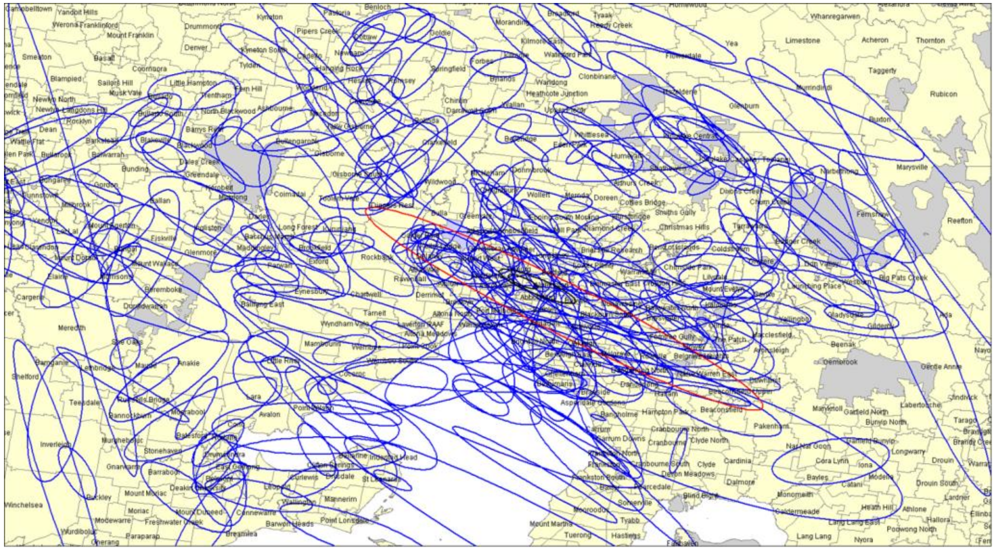
Severe thunderstorms: hail

First step: establish hail climatology from multiple data sources (2)

Bureau of Meteorology – large : giant hail ratios



Radar + claims-based storm paths (Melbourne example)



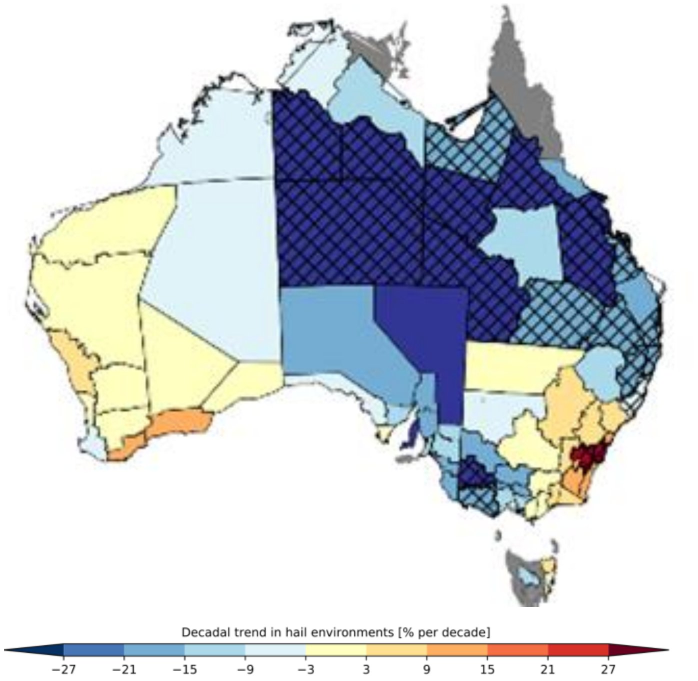
Severe thunderstorms: hail

Second step: apply knowledge of hail science – significant complexity

Range of final scale features influencing large and giant hail

- Poor initial hail / giant hail observational record
- Instability changes
- Melting level rising – small hail affected more than giant hail
- This leads to a southward shift in highest hail risk
- Updraft thunderstorm velocities are rising
- Convective inhibition (CIN) changes
- Low level moisture availability – East Australia Current
- Mid-level dry slots from dry interior will continue
- Trigger factors: heat increasing, weather systems changing
- Climate model resolution critical to representing hail risk

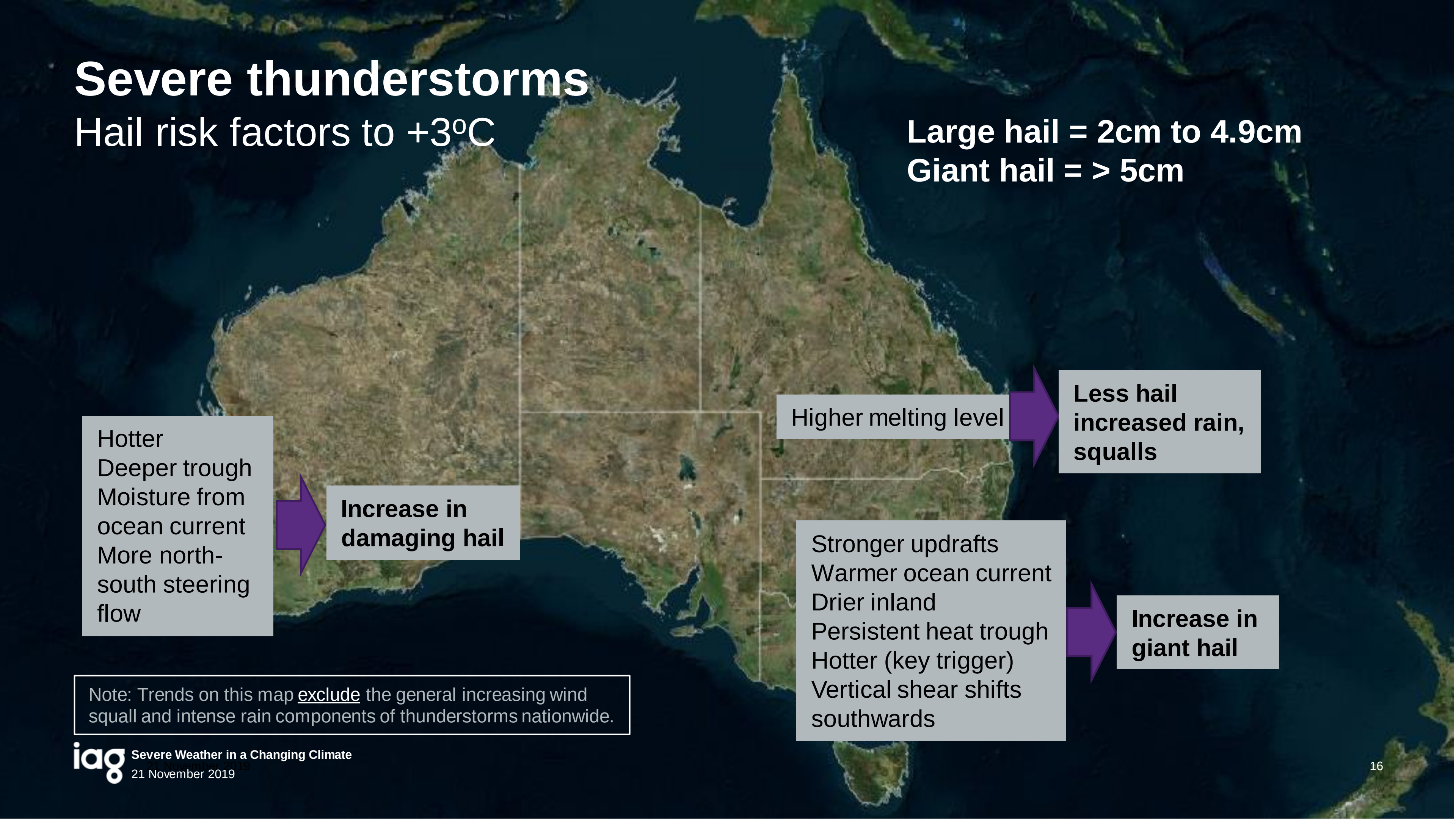
Hail environment frequency trends (1979-2015, % movement / decade)



Source: Prein (personal communications), 2017

Severe thunderstorms

Hail risk factors to +3^{o}C



Large hail = 2cm to 4.9cm
Giant hail = > 5cm

Hotter
Deeper trough
Moisture from ocean current
More north-south steering flow

→ **Increase in damaging hail**

Higher melting level

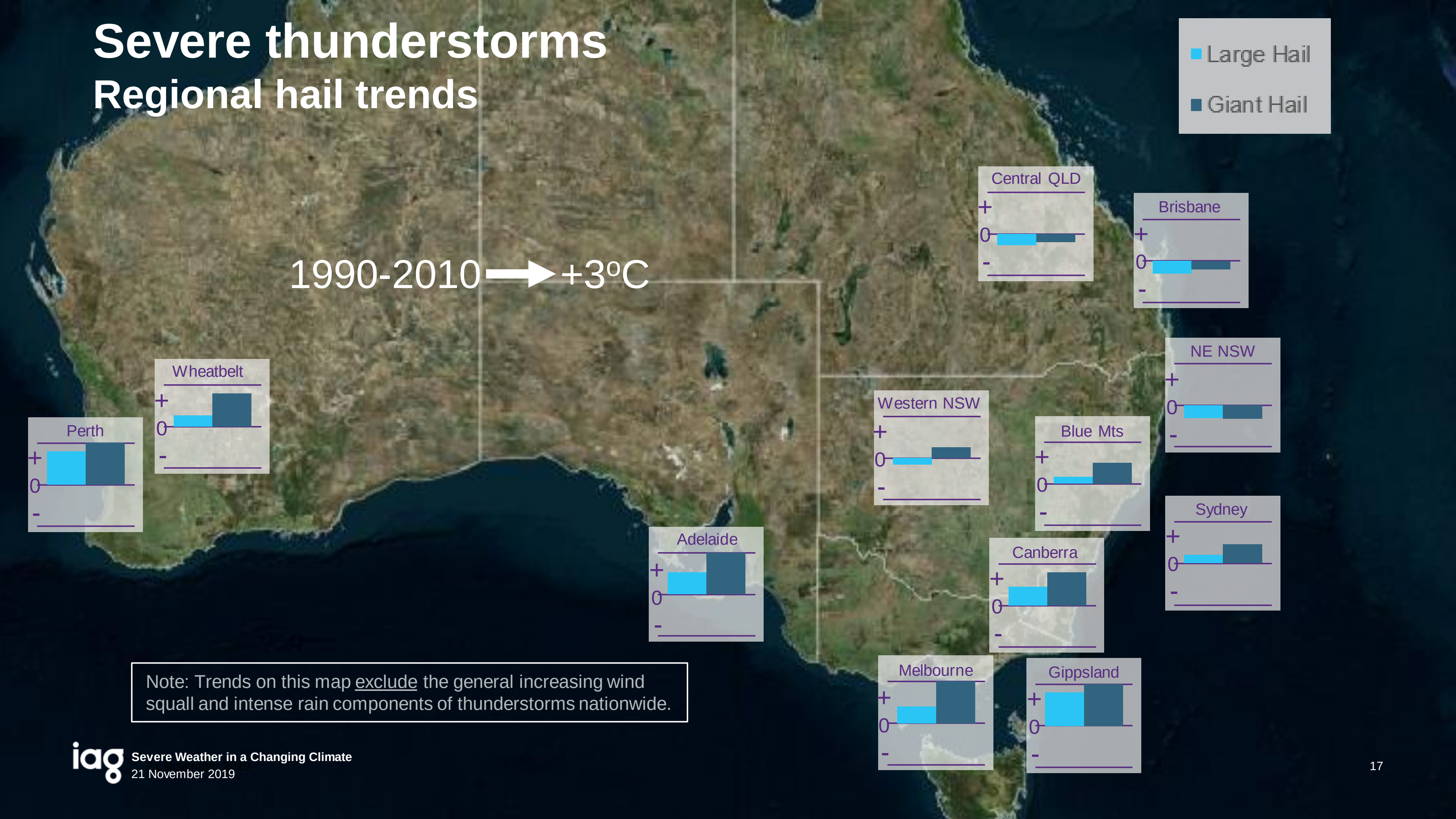
→ **Less hail increased rain, squalls**

Stronger updrafts
Warmer ocean current
Drier inland
Persistent heat trough
Hotter (key trigger)
Vertical shear shifts southwards

→ **Increase in giant hail**

Note: Trends on this map exclude the general increasing wind squall and intense rain components of thunderstorms nationwide.

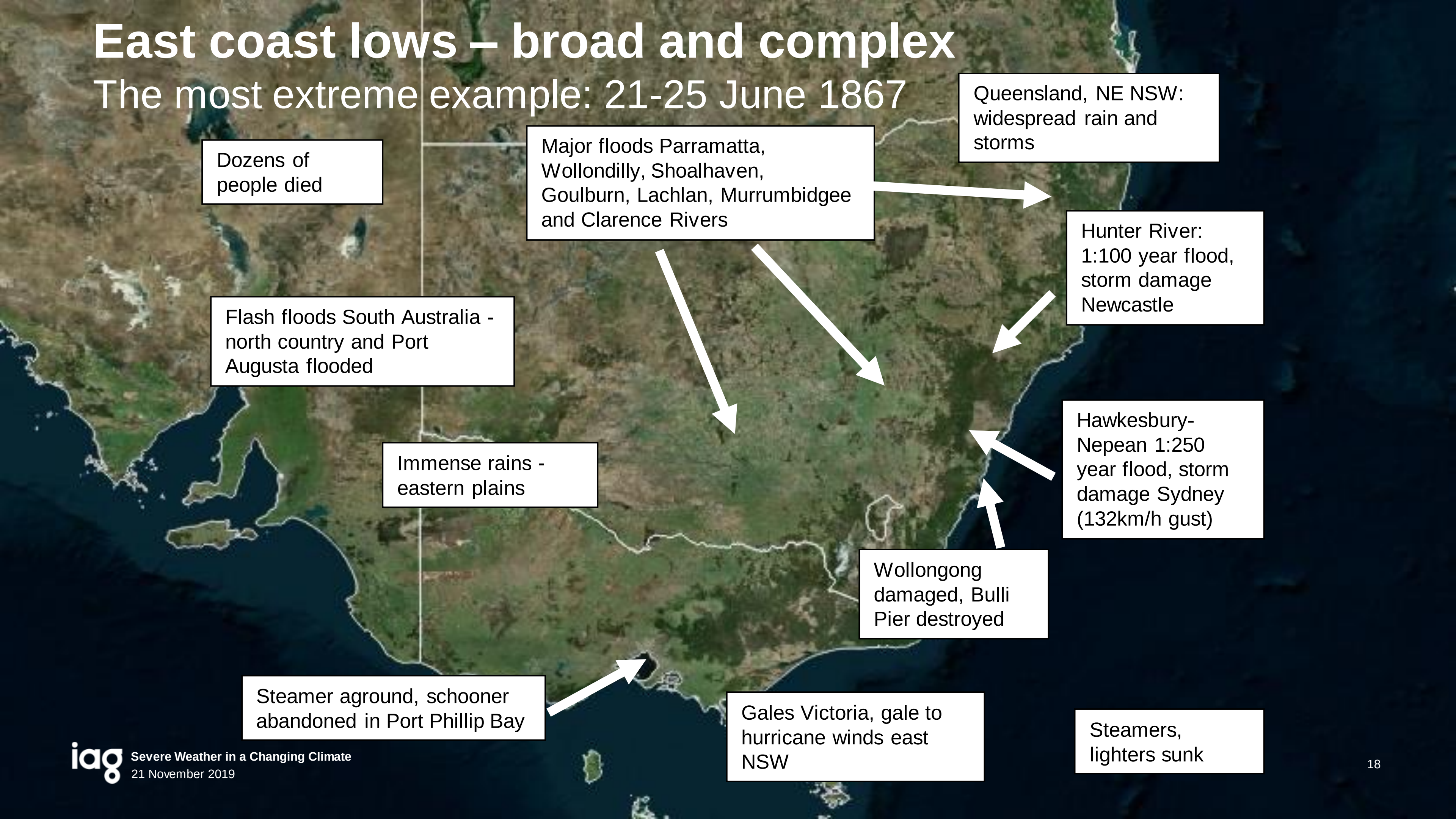
Severe thunderstorms
Regional hail trends



Note: Trends on this map <u>exclude</u> the general increasing wind squall and intense rain components of thunderstorms nationwide.

East coast lows – broad and complex

The most extreme example: 21-25 June 1867

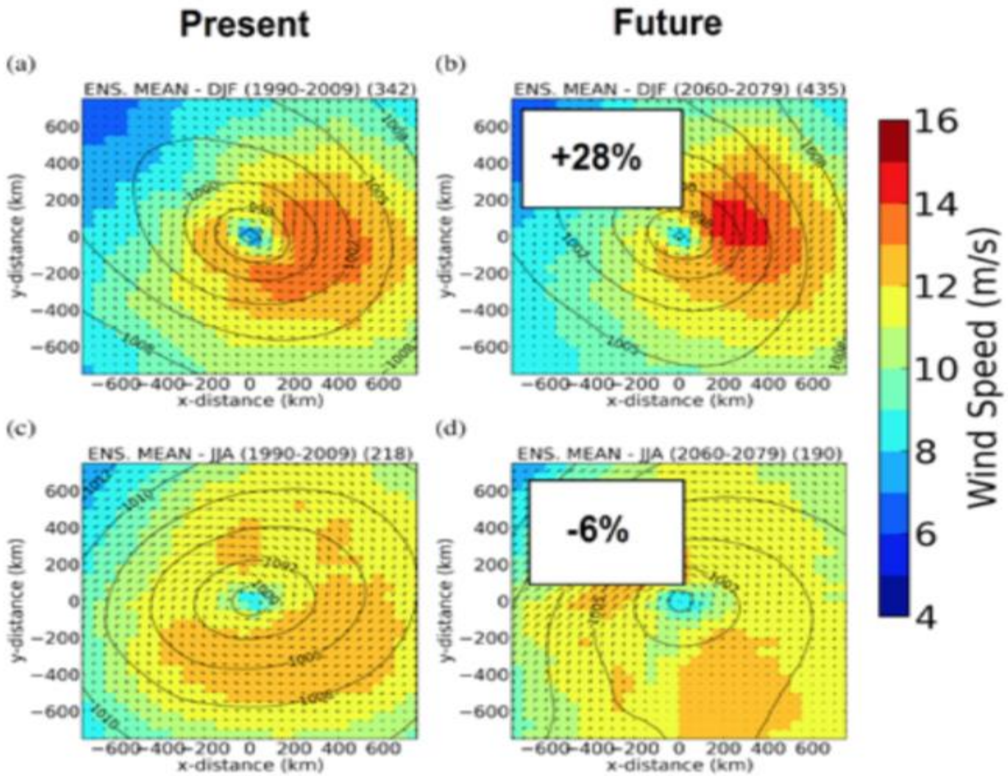


East coast lows: limited research

Modelling indicates increased summer wind impacts

Summer

Winter



Events with a max wind speed >20ms-1

Walsh et al. 2016

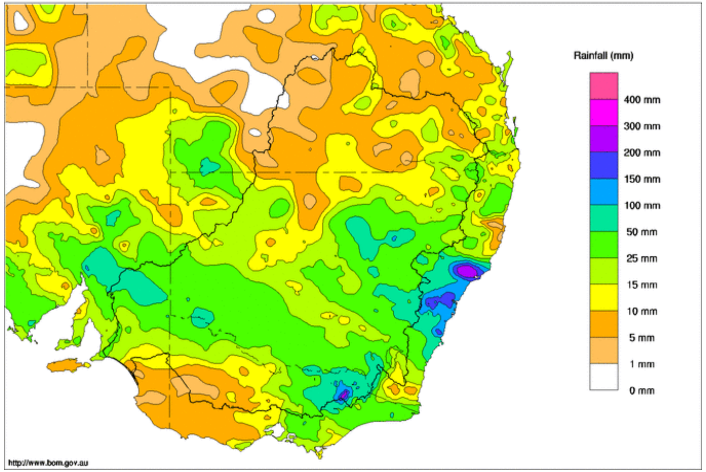
East coast lows – structures matter

Rare but damaging events, with adverse future trends

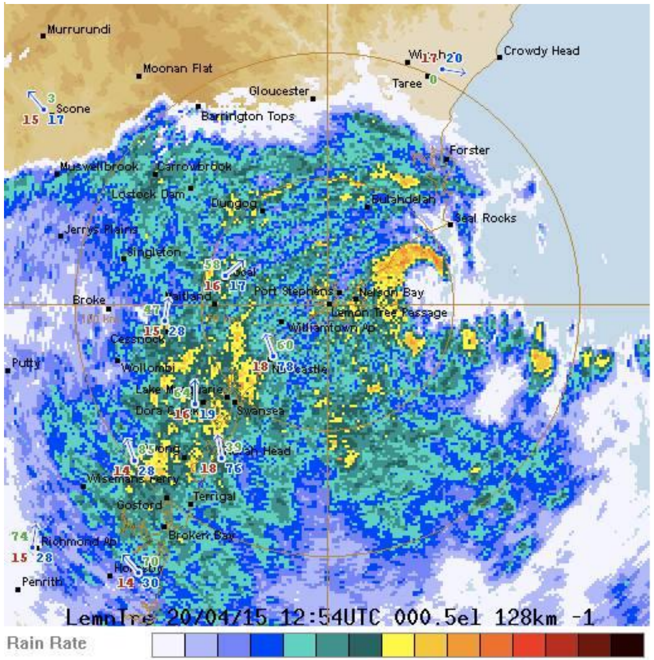
- Rare events – once per decade, produce $1bn+ damage
- Fine scale structure is critical
- Multi-day, multi-state ‘total event’ impacts
- Compound events: rain, wind and ocean contribute

Assessed future trends of increased damage from higher storm total rainfall, increased rain rate, wind-rain impacts and intensifying convection

Murray-Darling rainfall – W/E 21 April 2015



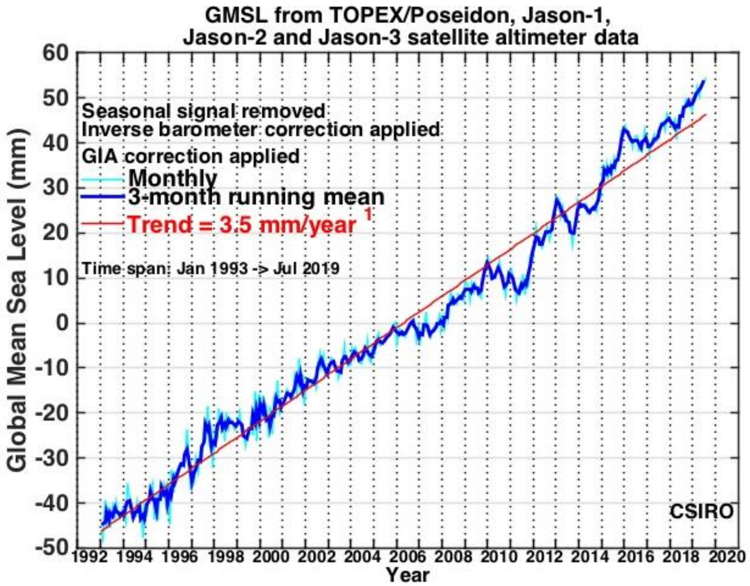
Newcastle radar 12:54 UTC 21 April 2015



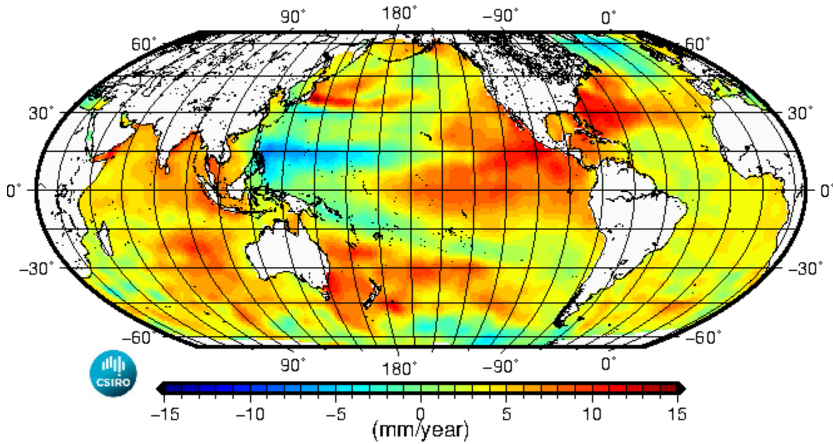
Source: Australian Bureau of Meteorology

Rising sea levels
Global and regional variations

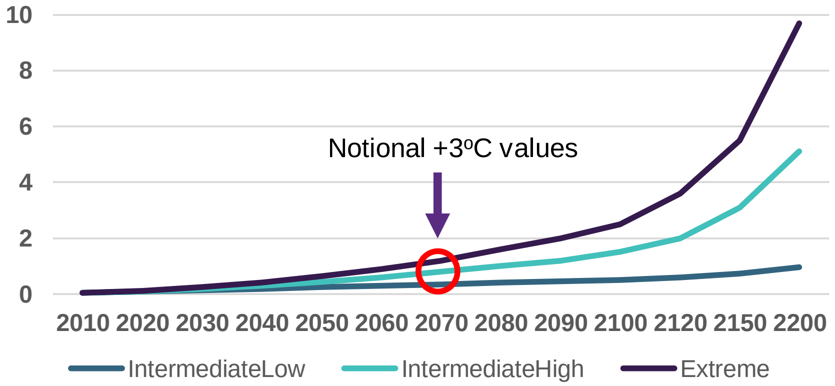
Sea level rise to continue for more than a century



Observed sea level trend 2006 to 2018



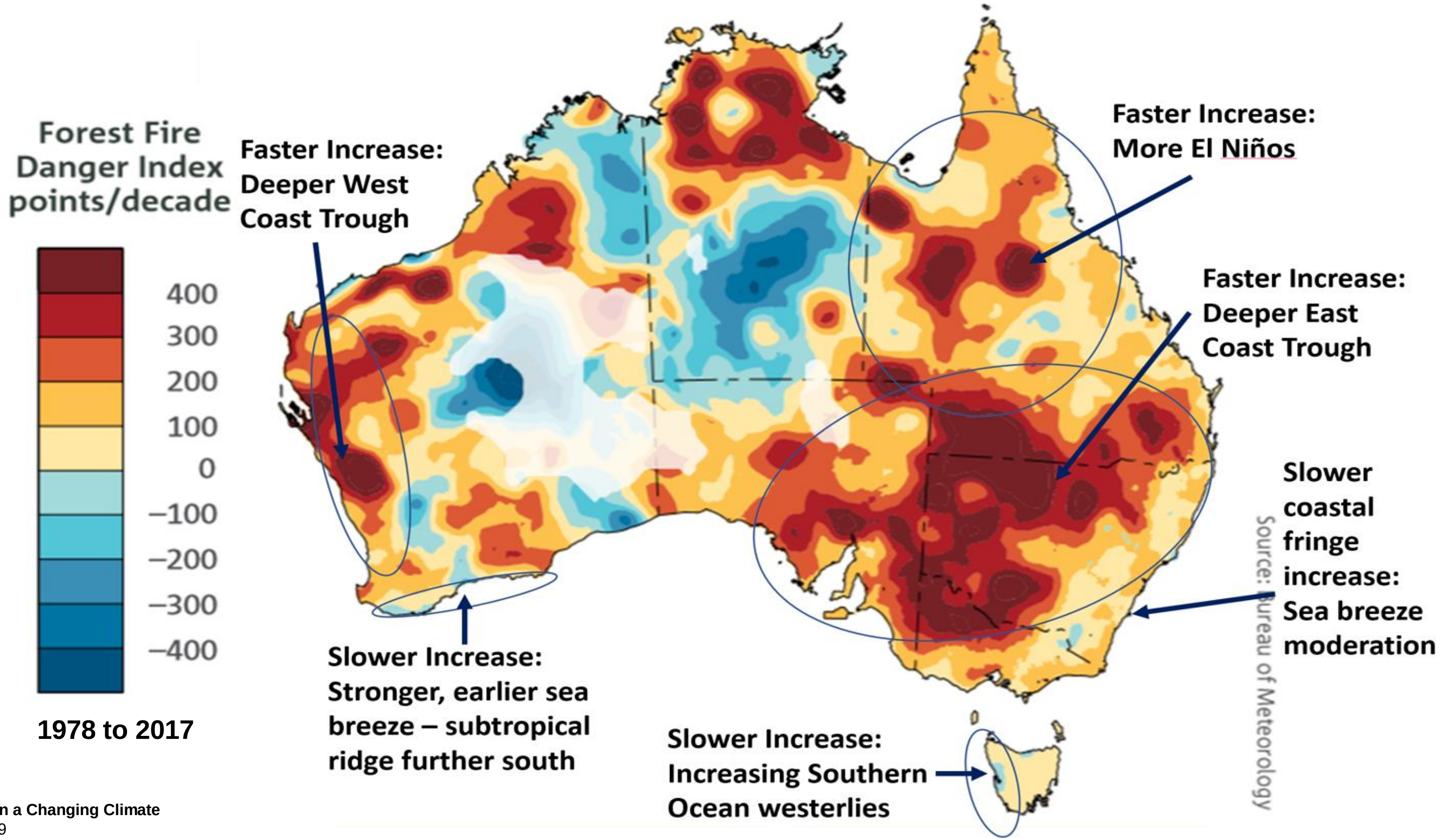
Sea level rise projections: NOAA* report 2017



* National Oceanic and Atmospheric Administration Technical Report - January 2017

Bushfire risk trends

One of the fastest growing climate risks in Australia



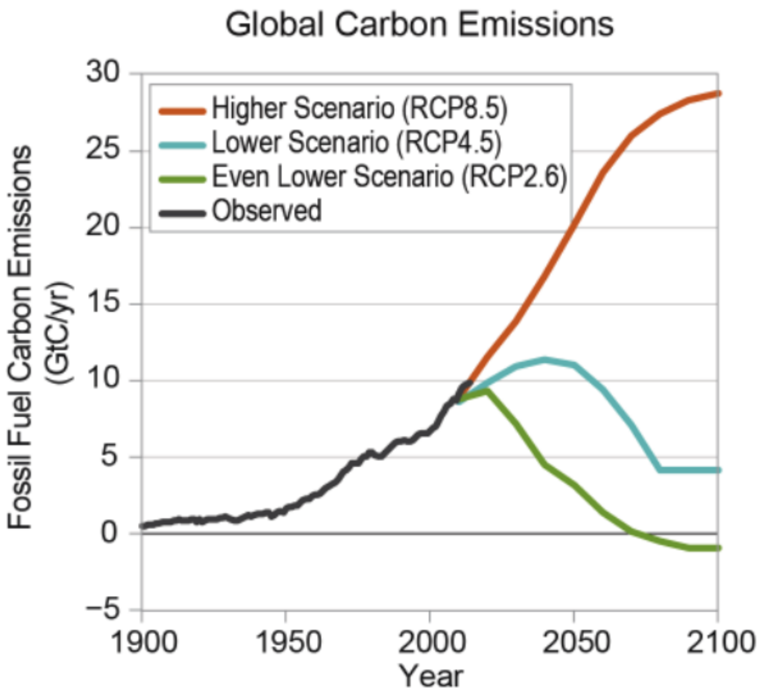
1978 to 2017

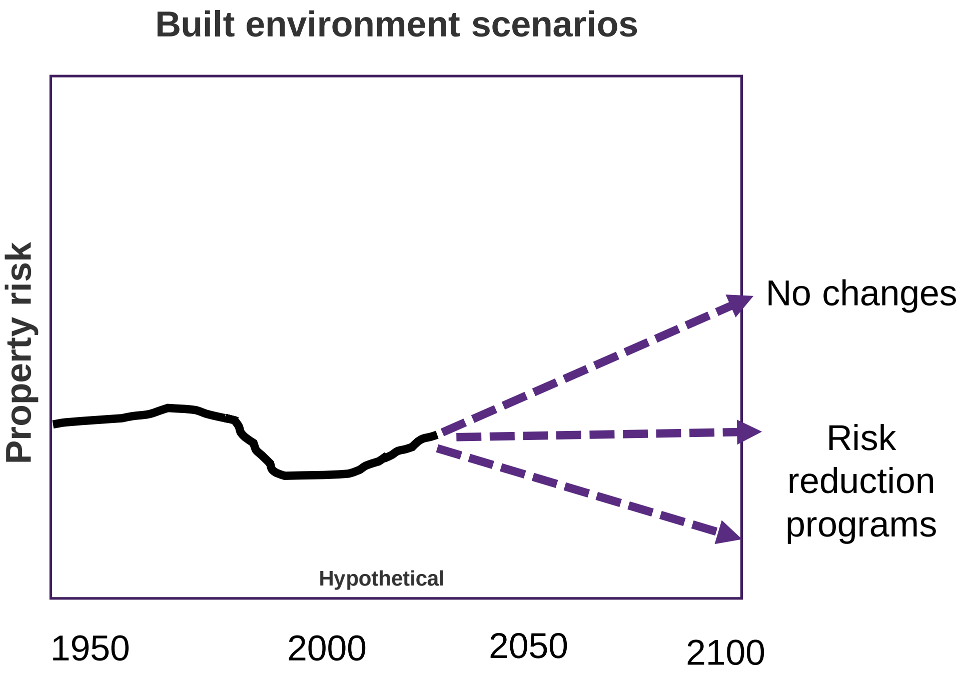
Implications for the Built Environment

Severe Weather in a Changing Climate
21 November 2019

What do we assume about the future built environment?

Increased property risk





Damage to homes – claims from recent cyclones

Major change in residential building codes in 1980

Retrofitting of existing building stock (cyclonic regions)

Resists severe wind loads

Queensland Household Resilience Program commenced 2018

- Upgrades and retrofitting to AS1684
- Work certified to National Construction Code (NCC) reference documents
- Applies to cyclonic regions north of Bundaberg
- Resulting in insurer premium reductions of up to 20%

Household Resilience Program

Queensland Government

CYCLONE TESTING STATION

Current building standards
Ongoing refinements

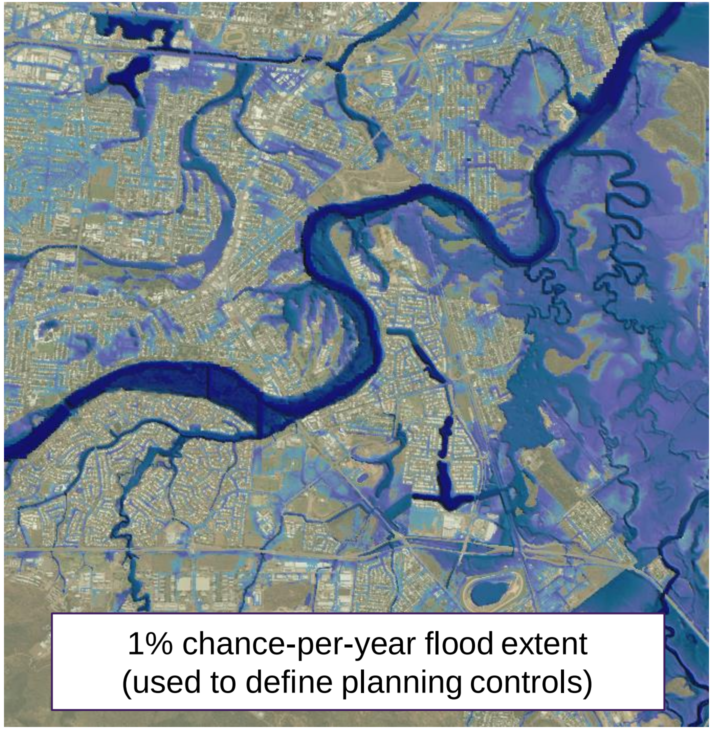
- Changes to cladding standard (AS1562.1) include minimum requirements for material, strength, thickness and fastener spacings for all flashings for all wind regions
- New garage door testing and design requirements for cyclone regions

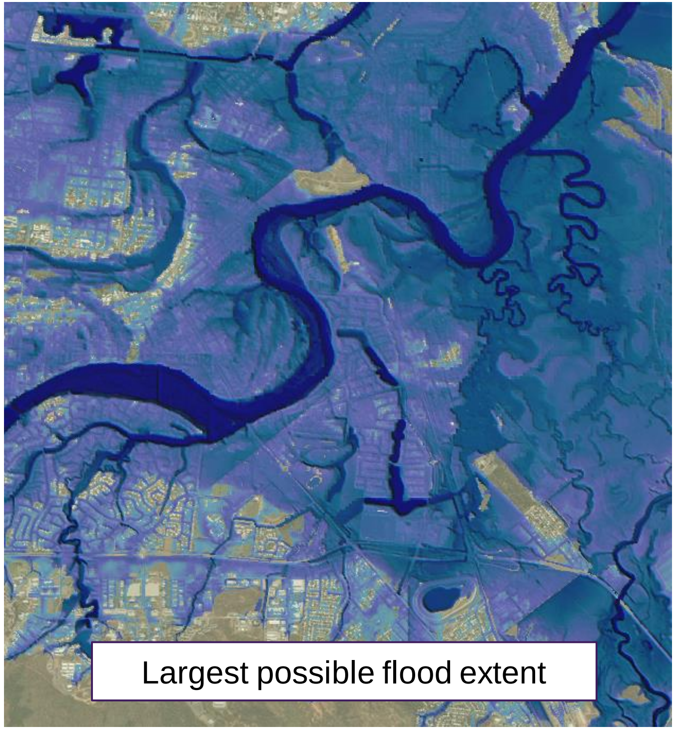
Collaborative water ingress study

iag SUNCORP bushfire&natural HAZARDS CRC

Planning for a resilient future

Working with government to reflect flood risk





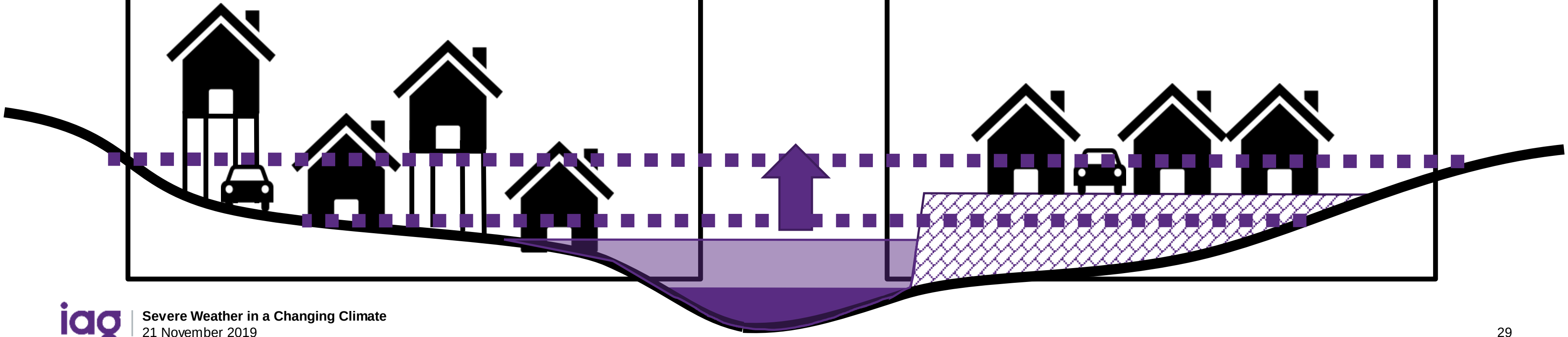
Townsville example

Implications for flood planning

Increased frequency of impacts on new subdivisions

- **Old suburbs** below flood planning level
- Built 1940-2000s
- Mix of high- and low-set homes
- Often resilient construction / materials
- High awareness of risk

- **New subdivisions** filled to minimum flood planning level
- Built 2003-2019
- Mostly slab-on-grade
- Low awareness of risk



Property-level peril risk assessment

Stepped approach to changing risk, starting with science

Scientific review

Change in weather extremes

- Storm surge frequency/intensity
- Sea level rise
- East Coast Low frequency
- Rainfall annual maxima
- Rainfall 20-year intensity
- Rainfall footprint area
- Hail frequency >2.5cm
- Bushfire danger index
- Cyclone wind speed
- Cyclone latitude
- Cyclone lifespan
- Cyclone proportion cat 4/5
- Cyclone rainfall intensity
- Cyclone frequency
- Cyclone size

Catastrophe models

- Tropical cyclone
- Bushfire
- Storm / hail / east coast low
- Flood / storm surge

Property snapshot

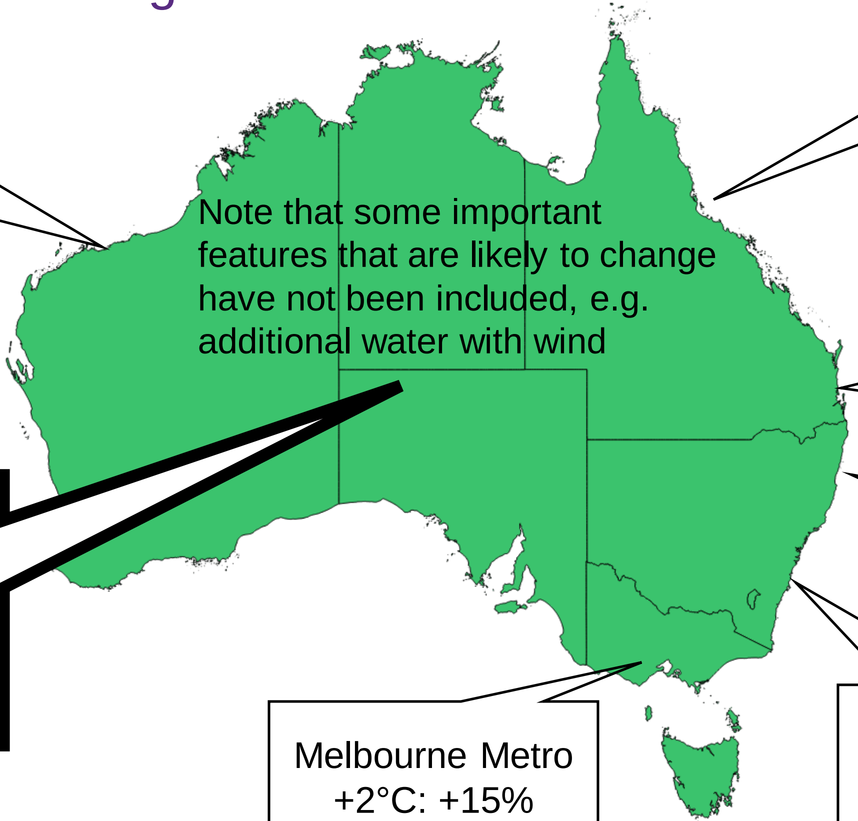
- Domestic property
- Current building stock

Impact on peril risk

- National
- Community
- Individual property

Regional variations in climate sensitivity

Change in annual average loss vs current climate



Broome, Port Hedland
+2°C: -12%
+3°C: -23%

Cairns, Townsville
+2°C: +5%
+3°C: -1%

Gold Coast, Sunshine Coast
+2°C: +50%
+3°C: +110%

Tweed, Byron
+2°C: +80%
+3°C: +170%

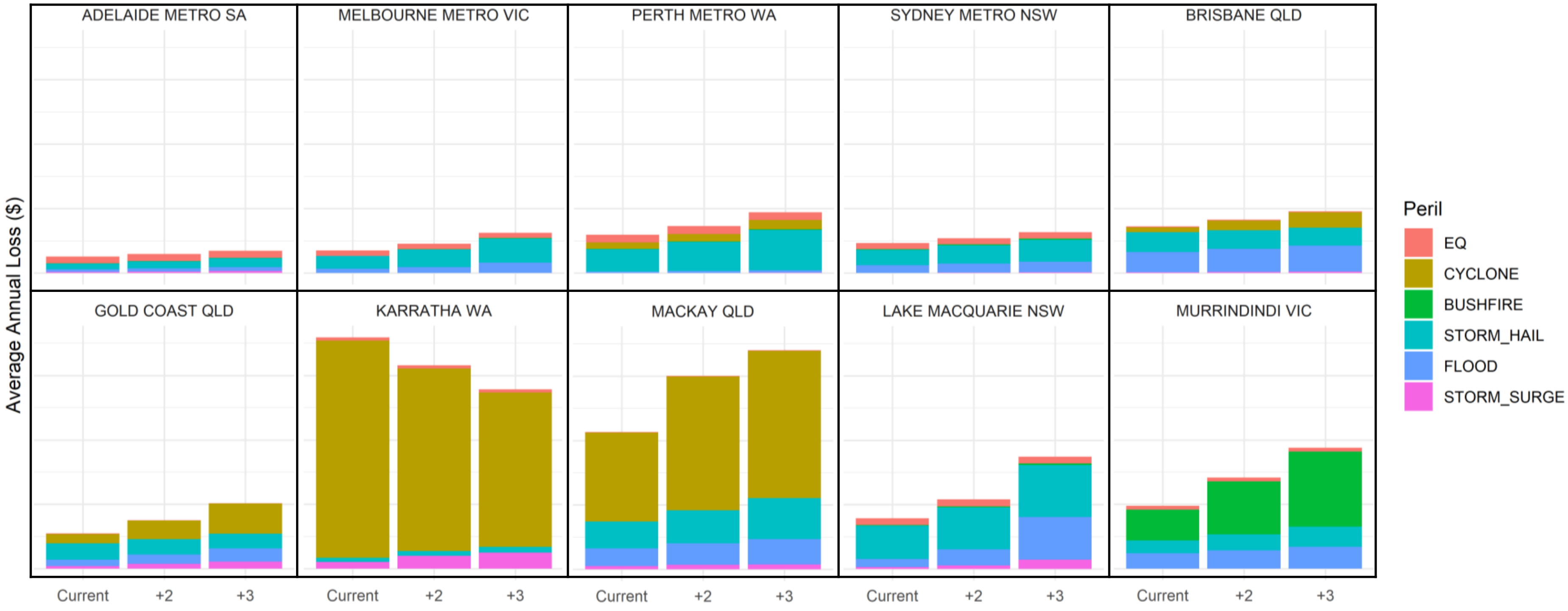
National Average
+2°C: +23%
+3°C: +52%

Melbourne Metro
+2°C: +15%
+3°C: +34%

Western Sydney
+2°C: +15%
+3°C: +30%

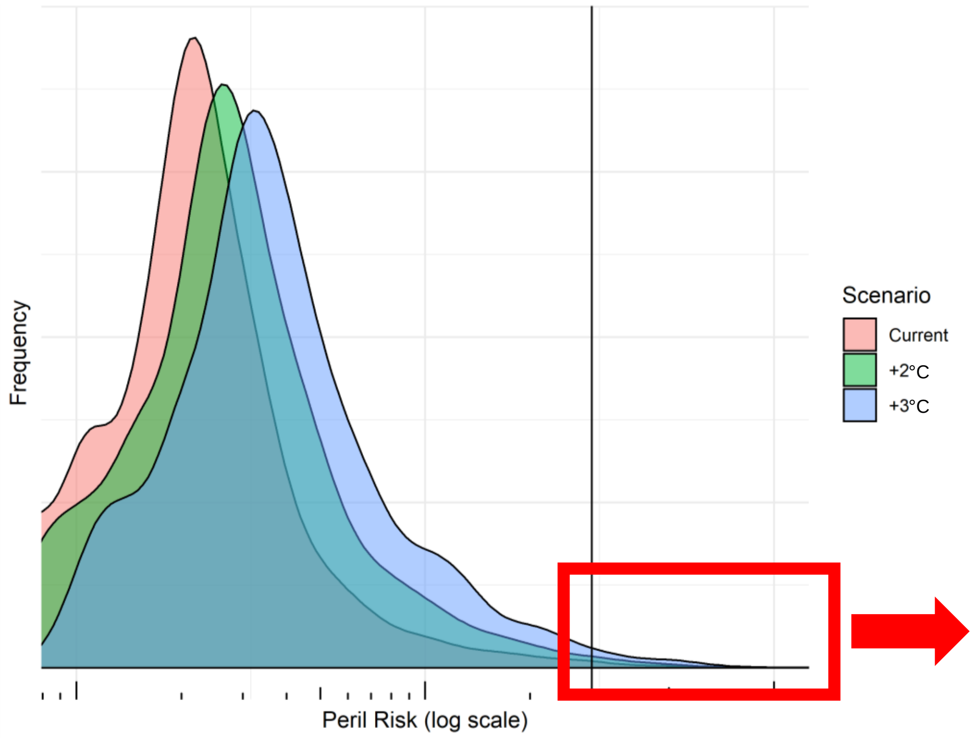
Regional variations in climate sensitivity

Average annual loss per property: current, +2°C and +3°C scenarios

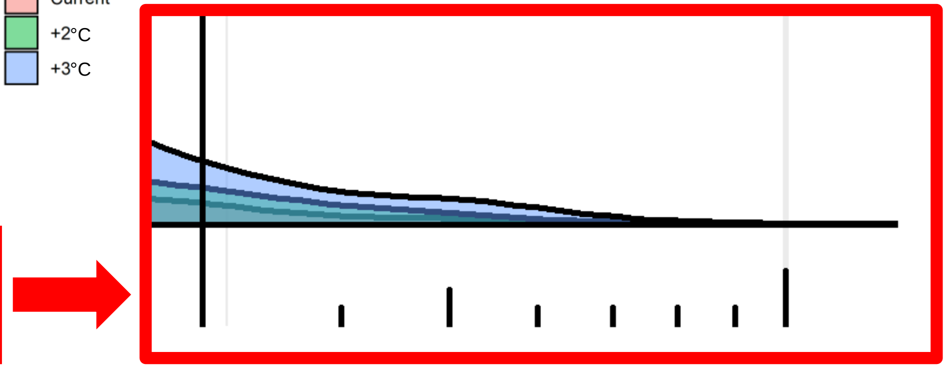


Sensitivity of extreme risks

Gold Coast example

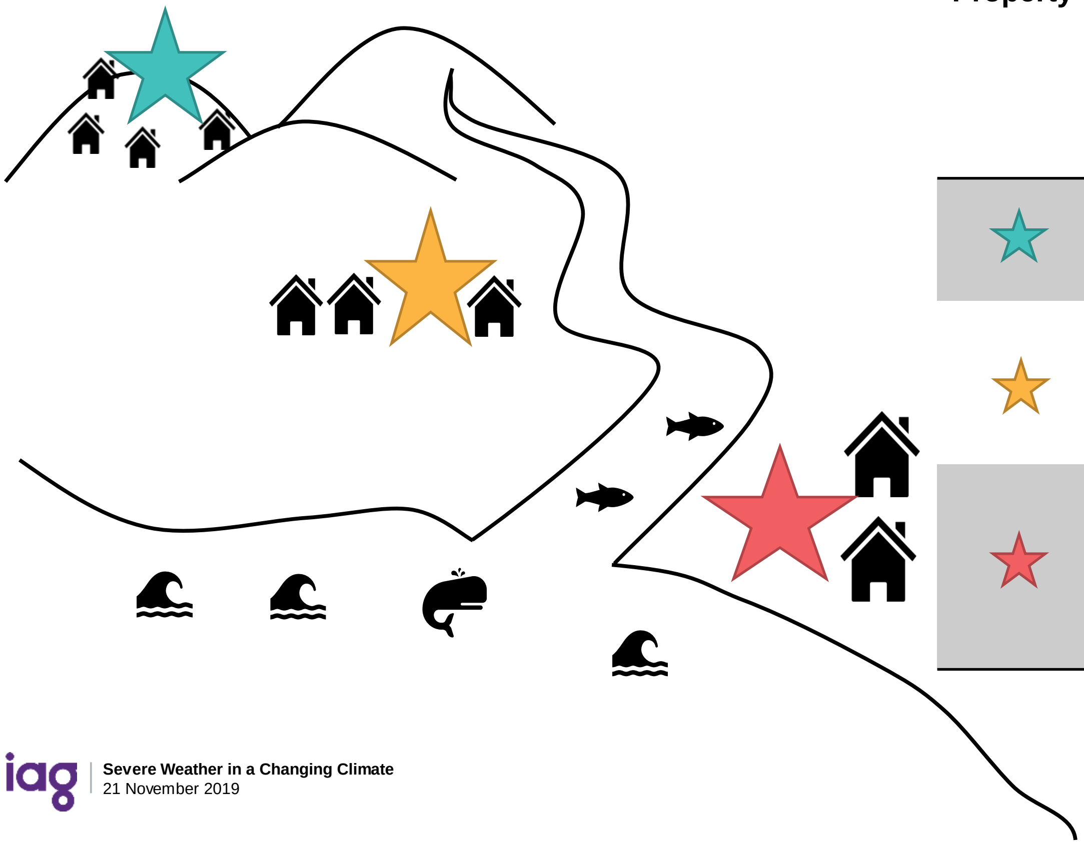


280% increase in properties at extreme risk under +3° scenario



Variation within regions

Hyper-local sensitivity



Based on northern NSW

Property	Characteristics	Change in risk (% of average annual loss) +2°C scenario	Change in risk (% of average annual loss) +3°C scenario
	Not in flood plain or storm surge zones	+33%	+83%
	Within flood plain not affected by sea level	+50%	+250%
	Within flood plain and affected by storm surge and sea level rise	+100%	+317%

Driving risk reduction
Life cycle of a property

Driving risk reduction

Ideal life cycle of a property

Concluding remarks

Science

- Climate change is here, now, accelerating
- Our current trajectory is alarming
- There is enough knowledge to derive indicative future impacts

Different perils, different rates of change, different community sensitivities to peril changes

- Impacts will be highly skewed, disproportionate – require bespoke solutions
- Significant capacity to adapt for the majority

Immediate action required across individuals, communities, business and government

Severe Weather in a Changing Climate

Download report on IAG website
https://www.iag.com.au/severe-weather-changing-climate