bushfire&natural HAZARDSCRC

FORECASTING IMPACTS FOR SEVERE WEATHER

Harald Richter[1], Craig Arthur[2], Serena Schroeter[1], Martin Wehner[2], Jane Sexton[2], Beth Ebert[1], Mark Dunford[2] ,Jeff Kepert[1], Shoni Maguire[1], Russel Hay[2], Mark Edwards[2]

(1) Bureau of Meteorology, Melbourne VIC (2) Geoscience Australia, Canberra, ACT

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

Australian Government
Bureau of Meteorology
Geoscience Australia

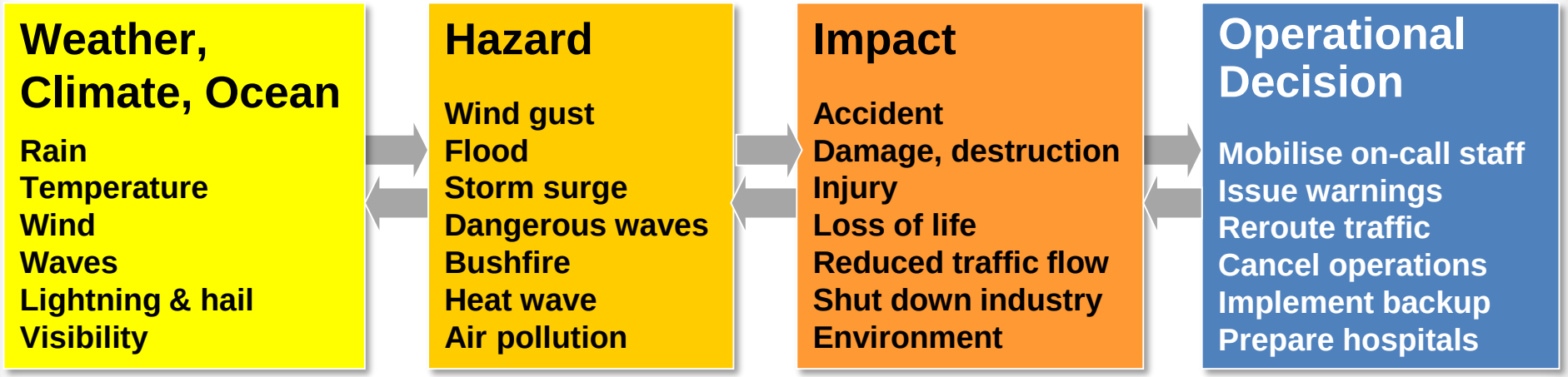
TOWARD MORE EFFECTIVE WARNINGS

Warning #1: "Severe thunderstorms are expected today with wind gusts exceeding 100 kph."	*Hazard only*
Warning #2: "Severe thunderstorms with gusts over 100 kph will result in damage to trees and power lines."	*Hazard and vulnerability*
Warning #3: "Extensive traffic delays in Lidcombe may occur due to the risk of large trees downing power lines and blocking roads as a result of severe thunderstorms."	*Hazard, vulnerability, and exposure*

Adapted from WMO, 2015

FROM PREDICTING WEATHER TO PREDICTING IMPACTS

- Coupling weather information to hazard and impact models
  - Bushfire, flood, inundation, air pollution, etc.
  - Structural damage, economic loss, public health, etc.

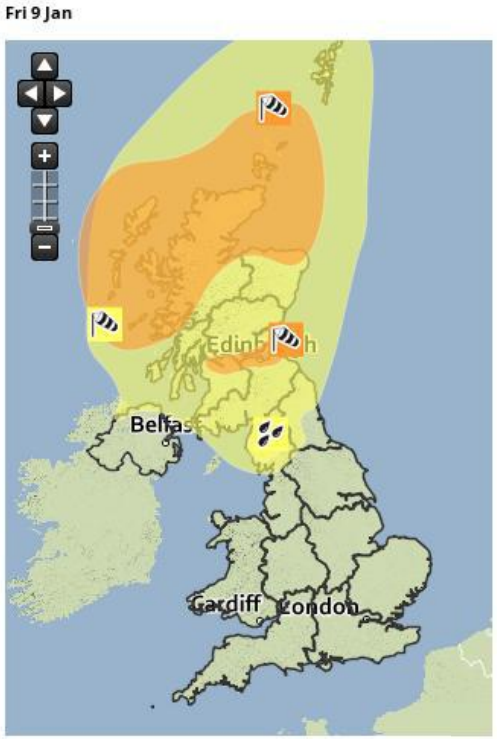


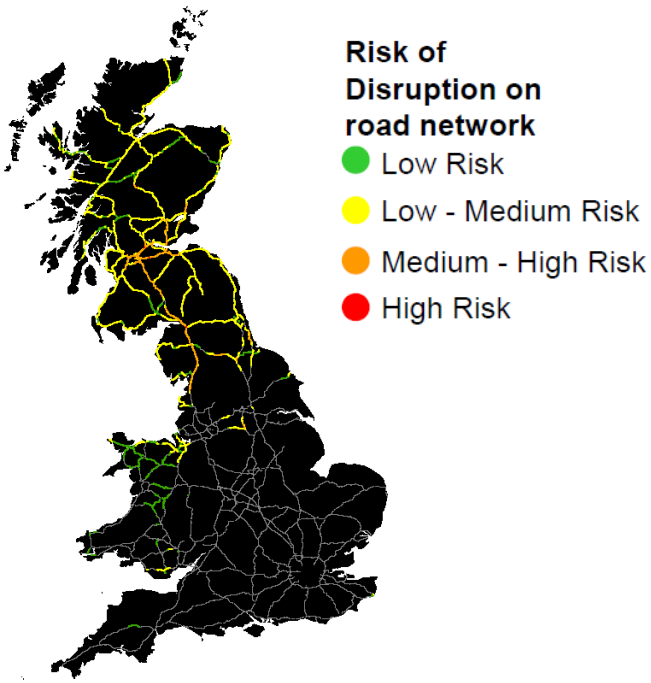
UK EXAMPLE: VEHICLE OVERTURNING MODEL

Hazard: High winds

Vulnerability: Tall vehicles susceptible to blowing over

Exposure: Location and time (e.g. peak hour)





Credit: Becky Hemingway, Met Office

A PILOT CAPABILITY

How can we make useful estimations of community impacts of extreme wind & rain?

Can enhanced forecasts improve timely mitigating actions for our stakeholders?

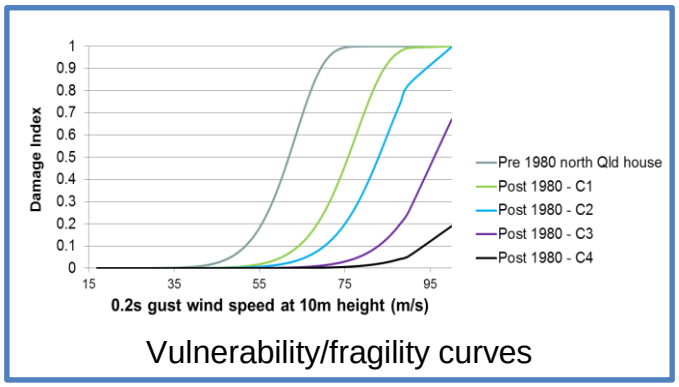
DATA & METHODS

Model output
(e.g. wind speed)
(24 members)

Hazard grids
(e.g. max winds)
(24 members)

Damage survey data (e.g. EICU, Beacon)

Exposure data (e.g. NEXIS)

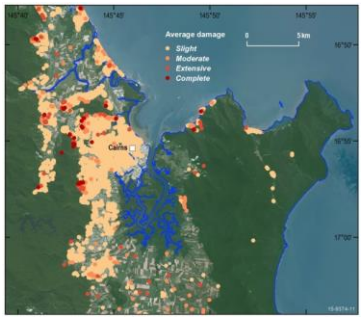


Vulnerability/fragility curves

Impact Model

Impact Forecast

e.g.



WIND/RAIN DATA ⟶ HAZARD

ACCESS output

Hydro-meteorological variables:

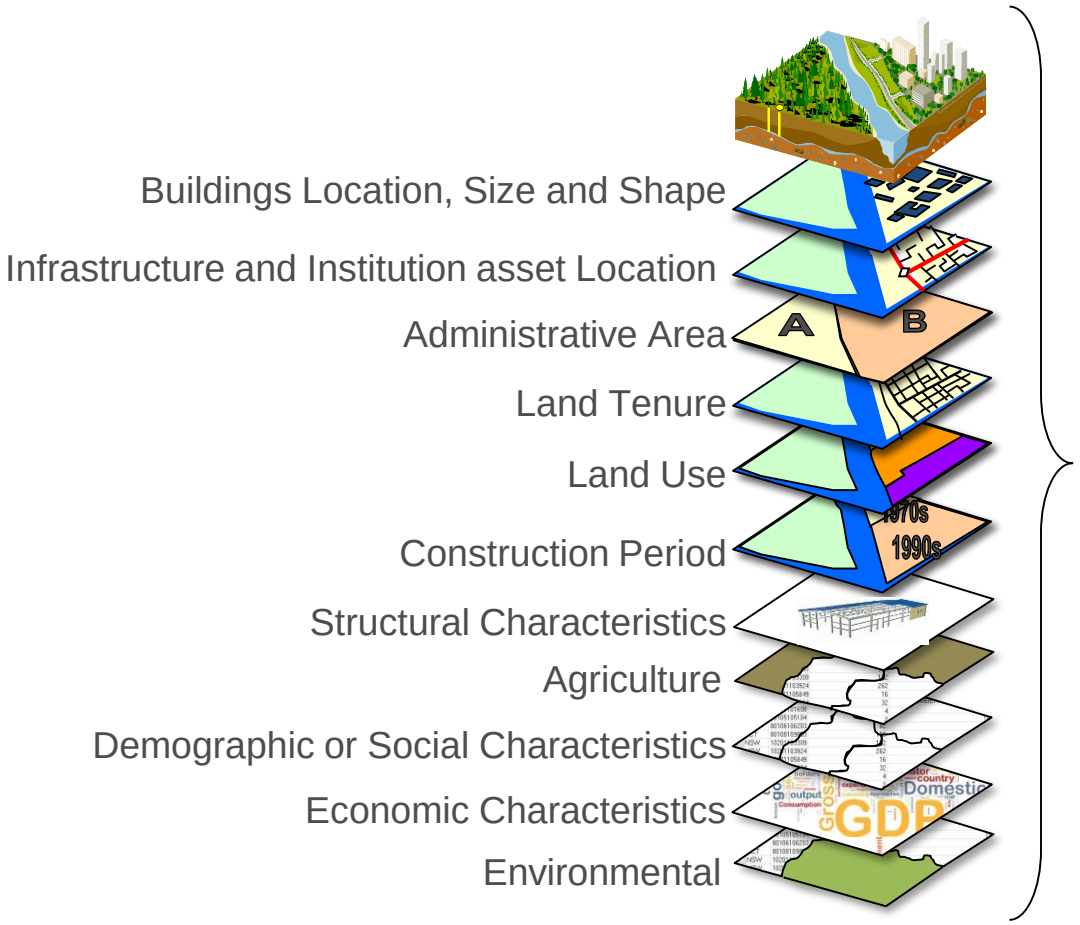
- Wind speed/direction
- Instantaneous rate of precipitation
- Accumulated precipitation

Gridded hazards

Variables that pose a level of threat to built environment:

- Maximum wind speed (and associated direction)
- Maximum rate of precipitation
- Maximum accumulation of precipitation within timespan (e.g. 1 hour/day)

National Exposure Information System (NEXIS)



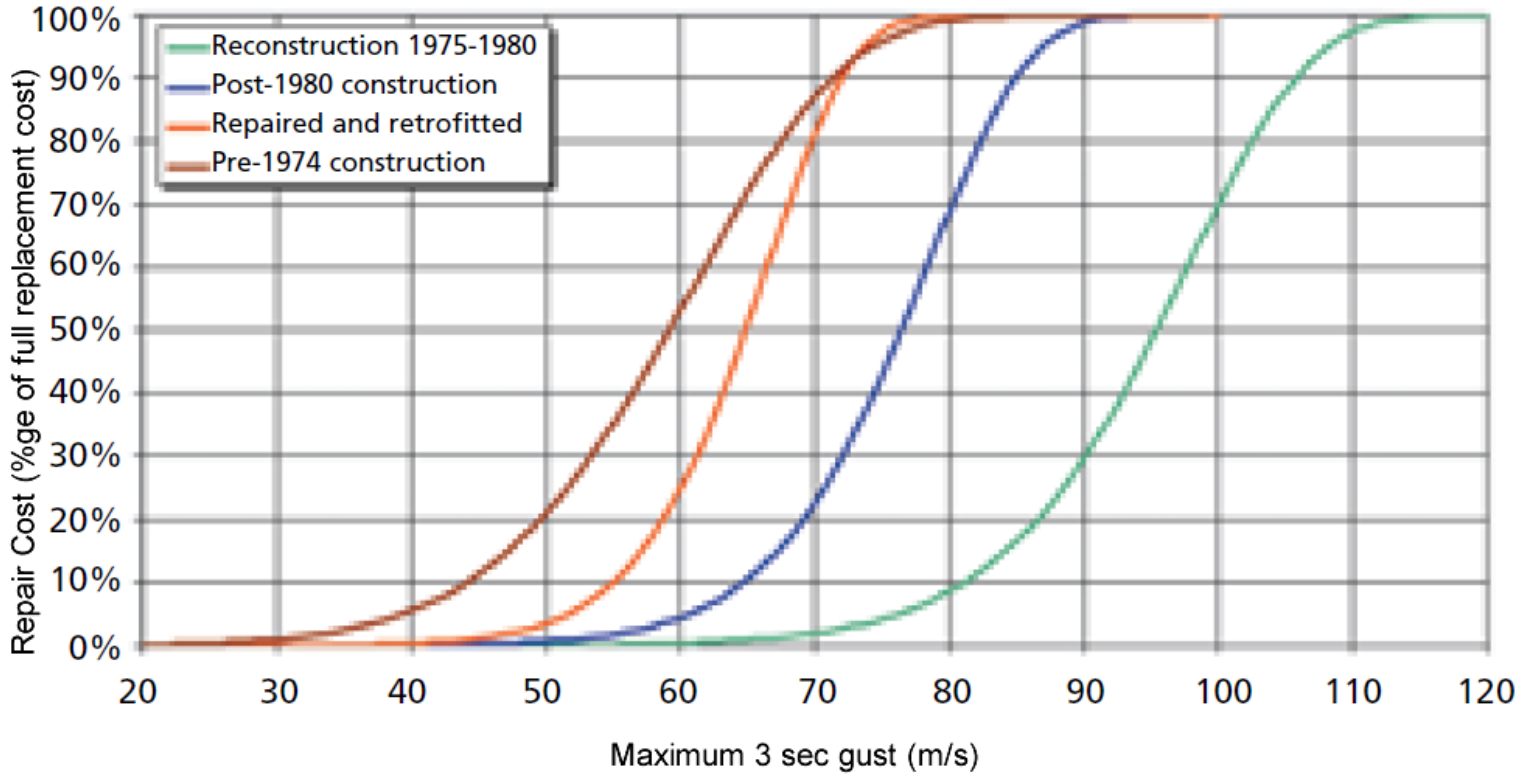
Exposure Elements

Residential
Commercial
Industrial
Institution
Infrastructure
Agriculture
Environmental

USE CASES

Exposure reports
Risk modelling
Risk assessments
Insurance modelling

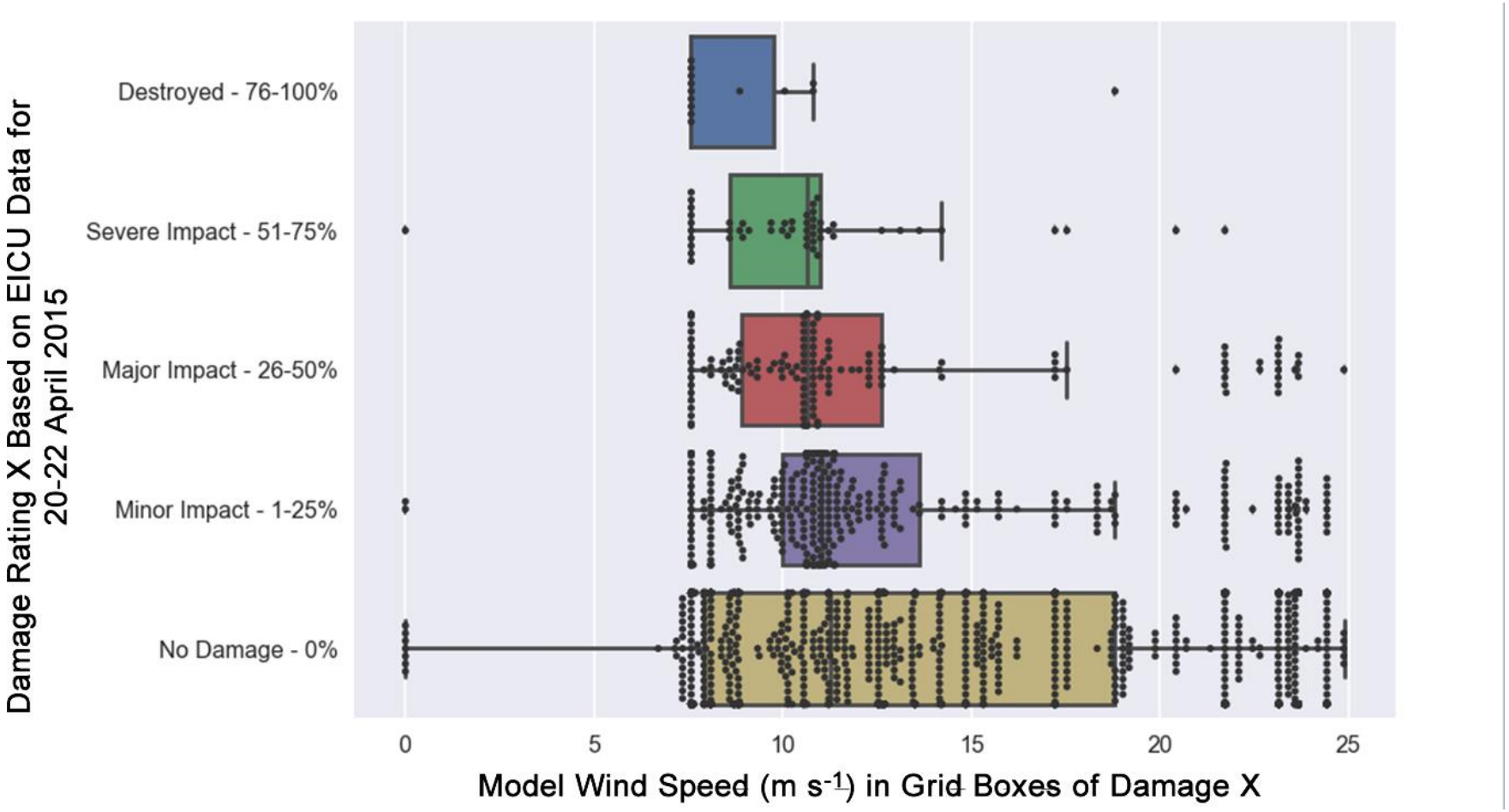
VULNERABILITY ASSESSMENT LINKS LOCAL WIND GUSTS TO DAMAGE



Vulnerability of houses varies with age (on average)

- A TC Tracy peak gust of ~70 m s^{-1} (250 km hr^{-1}) almost destroys a pre-1974 house
- A post-1980 house would only suffer ~25% damage

VULNERABILITY ASSESSMENT
THE UGLY TRUTH THUS FAR



VULNERABILITY ASSESSMENT
THE UGLY TRUTH THUS FAR (Part II)

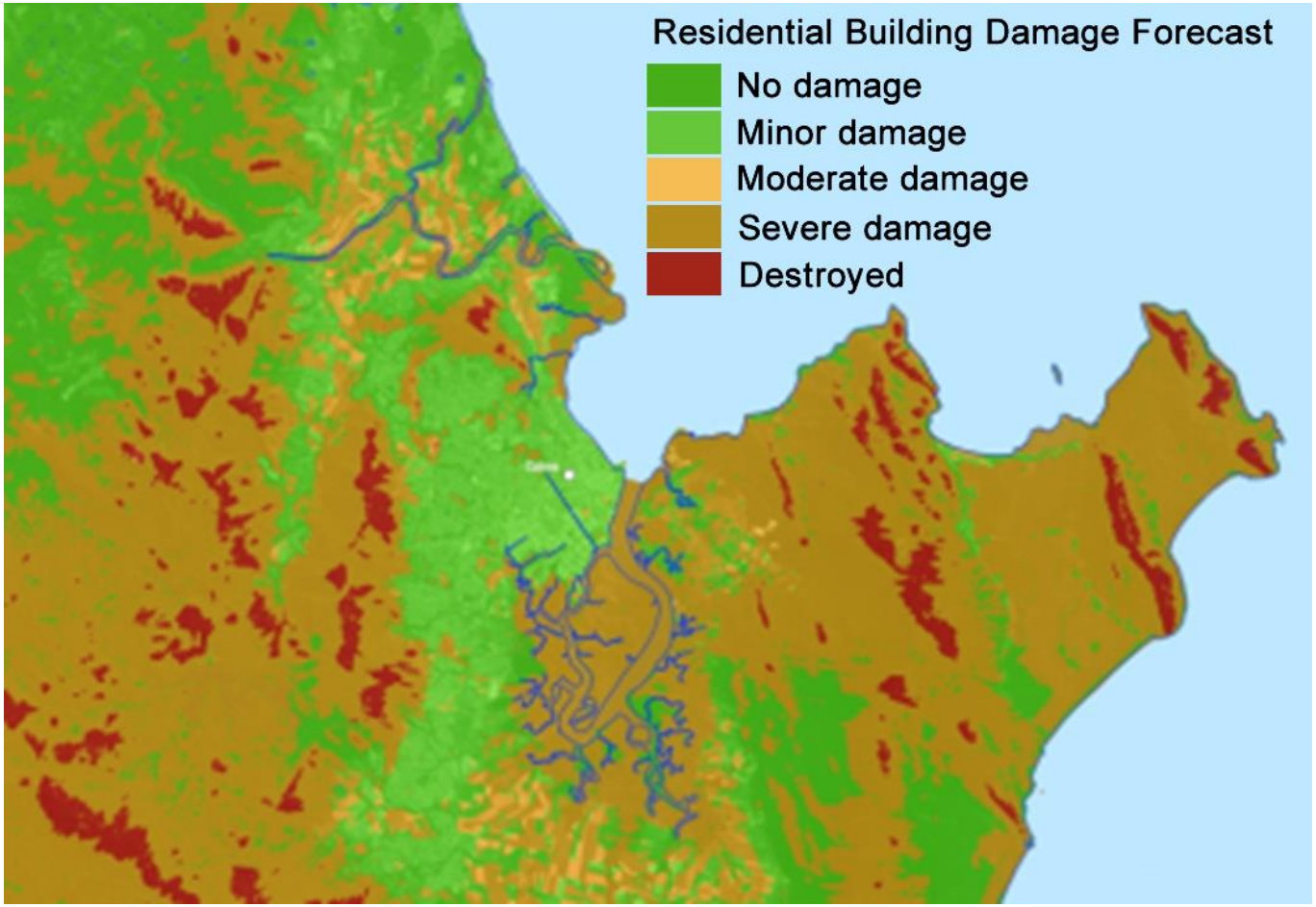
What derails a nice clean wind / house damage relationship?

[1] Building design wind speeds in the area mostly exceed 30 m s^{-1} → need an event with stronger winds

[2] "Building damage" seems to have been inflicted mostly in an indirect manner

[3] Summative damage reporting inside the damage assessment reports does not permit establishment of clear links to individual hazards

SPATIAL IMPACT / DAMAGE ESTIMATE



STEPS FORWARD

1) Consider including additional case studies with stronger winds or cleaner damage report data
   - Can we use a measure from multiple damage datasets merged into one vulnerability relationship to express the damage state?

2) Test a range of wind / rain hazard parameters
   - (e.g. maximum wind gust)

3) Can SES callout data be augmented to provide additional information?
   - (damage magnitude, relation to underlying hazard)

bushfire&natural
HAZARDSCRC

END-USER ENGAGEMENT OPPORTUNITY

Meet in the SNOWGUM room for breakout session at 2:05pm tomorrow