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The place for science and research in setting the risk agenda

RISK NZ

JLT

Natural Hazards Research Knowledge for National Risk Profiling

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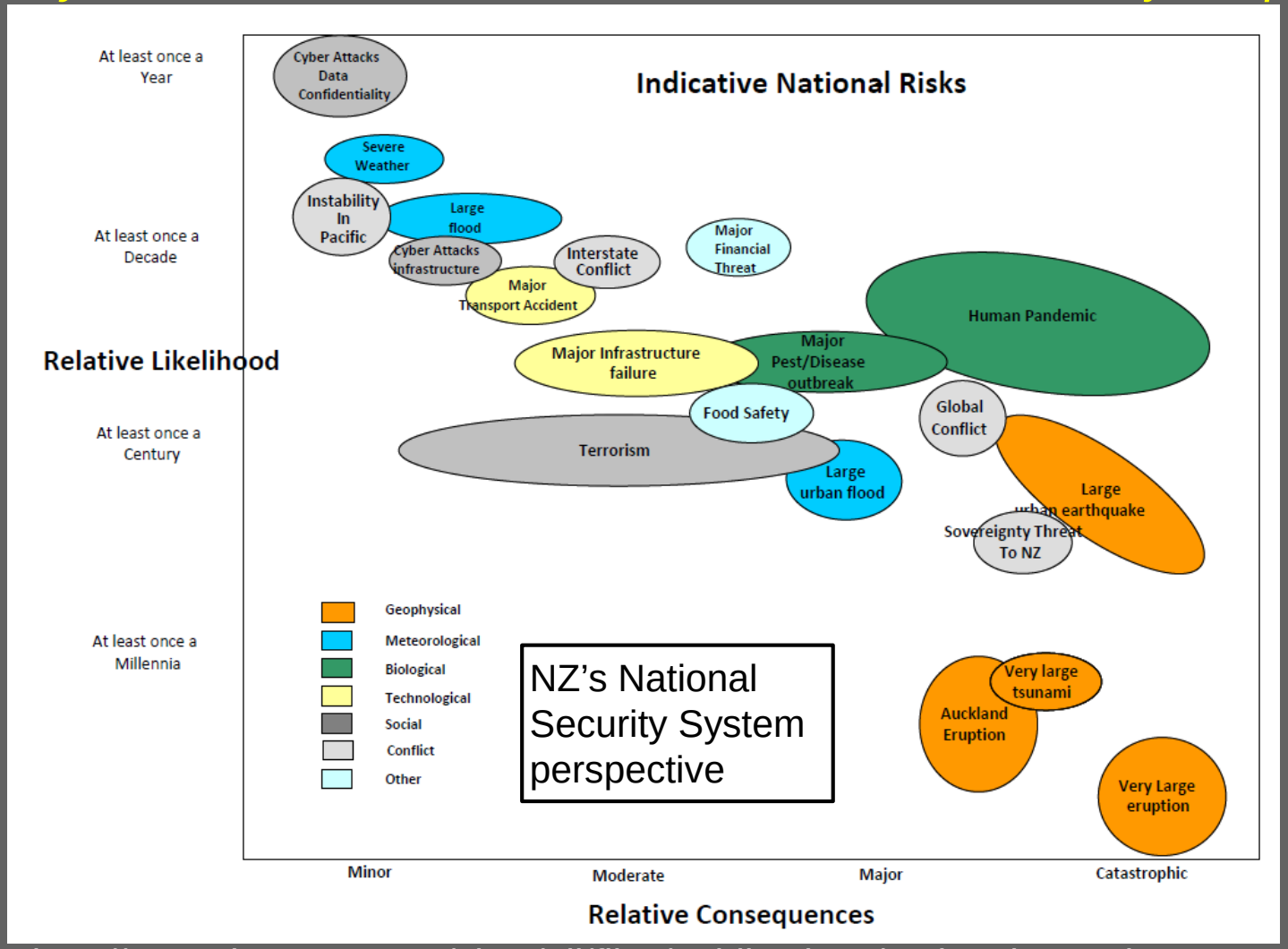
The Presentation

- What comprises our research – analysis of New Zealand's physical, social, built environment, and risk governance
- The state of play in each sector
- How is the research connected
- Further challenges and opportunities

Natural Hazards Research and its Application

What are the natural hazards?

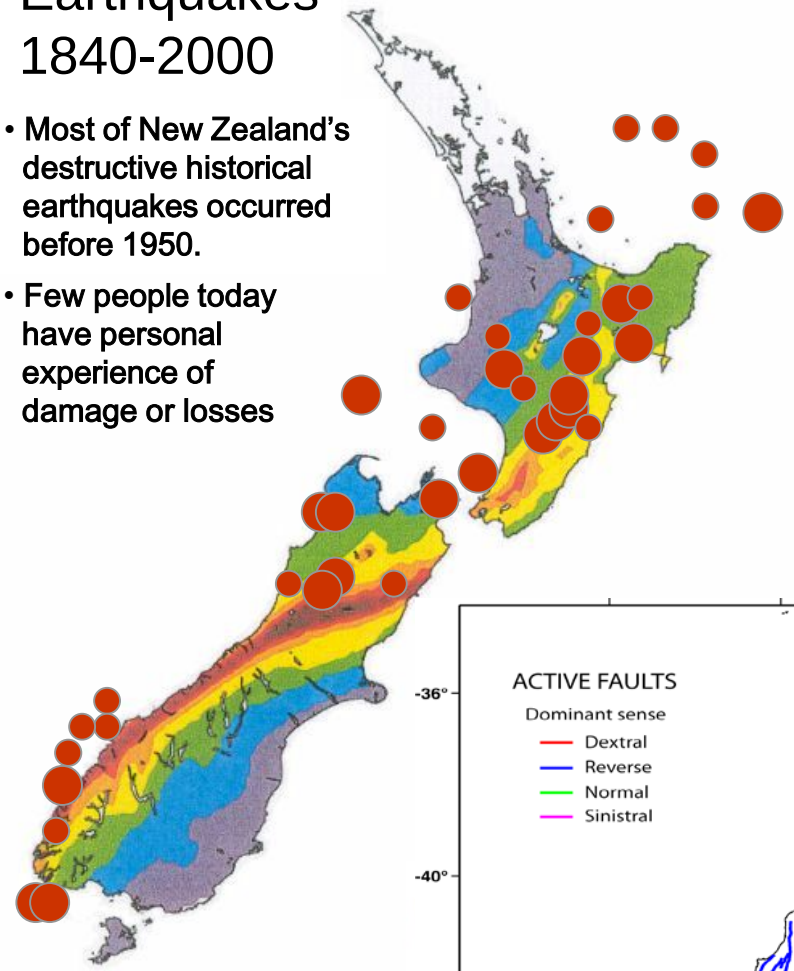
- *generally the extreme events are the ones that have the major impacts*

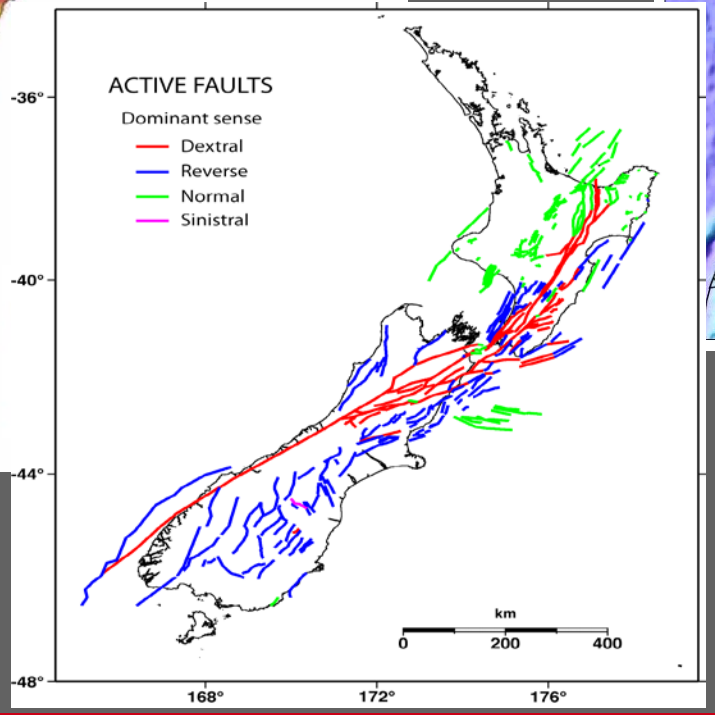


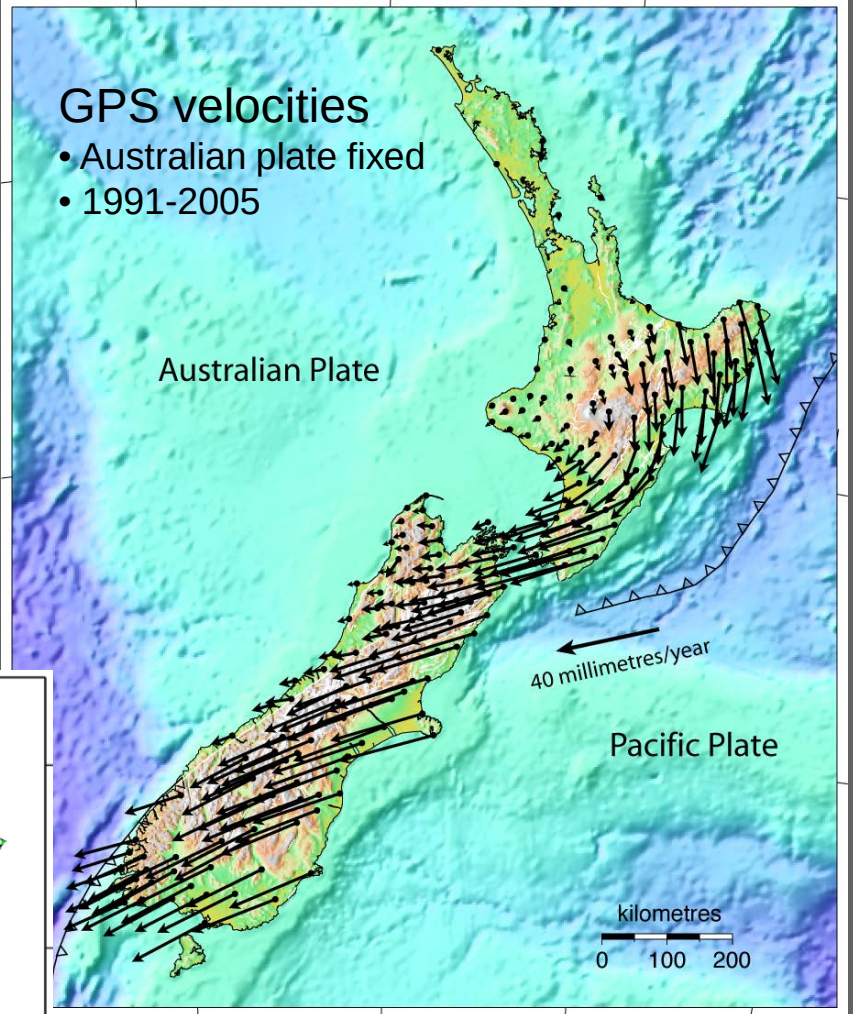
http://www.dpmc.govt.nz/sites/all/files/publications/national-security-system.pdf

Earthquakes 1840-2000

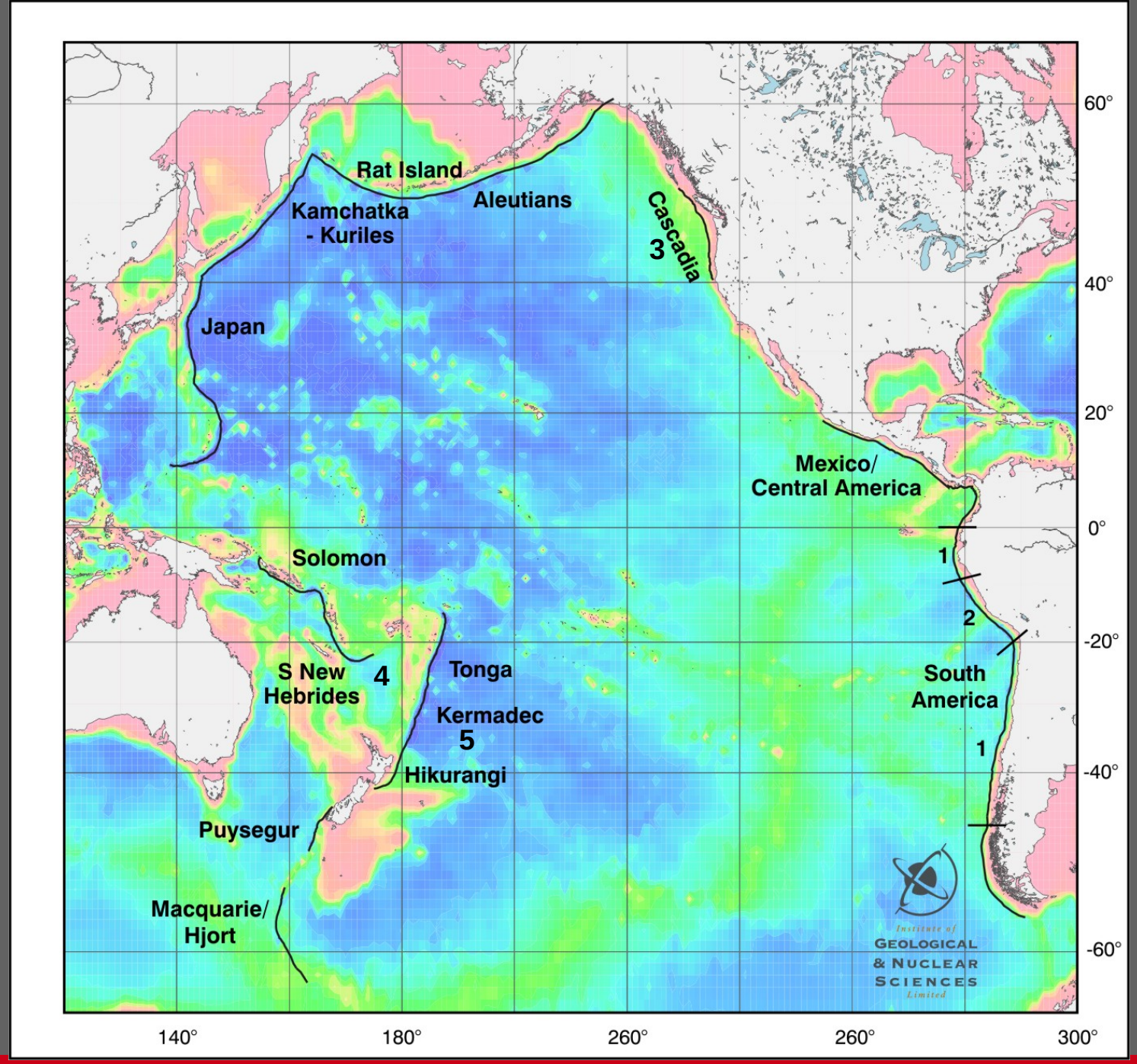
- Most of New Zealand's destructive historical earthquakes occurred before 1950.
- Few people today have personal experience of damage or losses







Data sources for active deformation studies in New Zealand



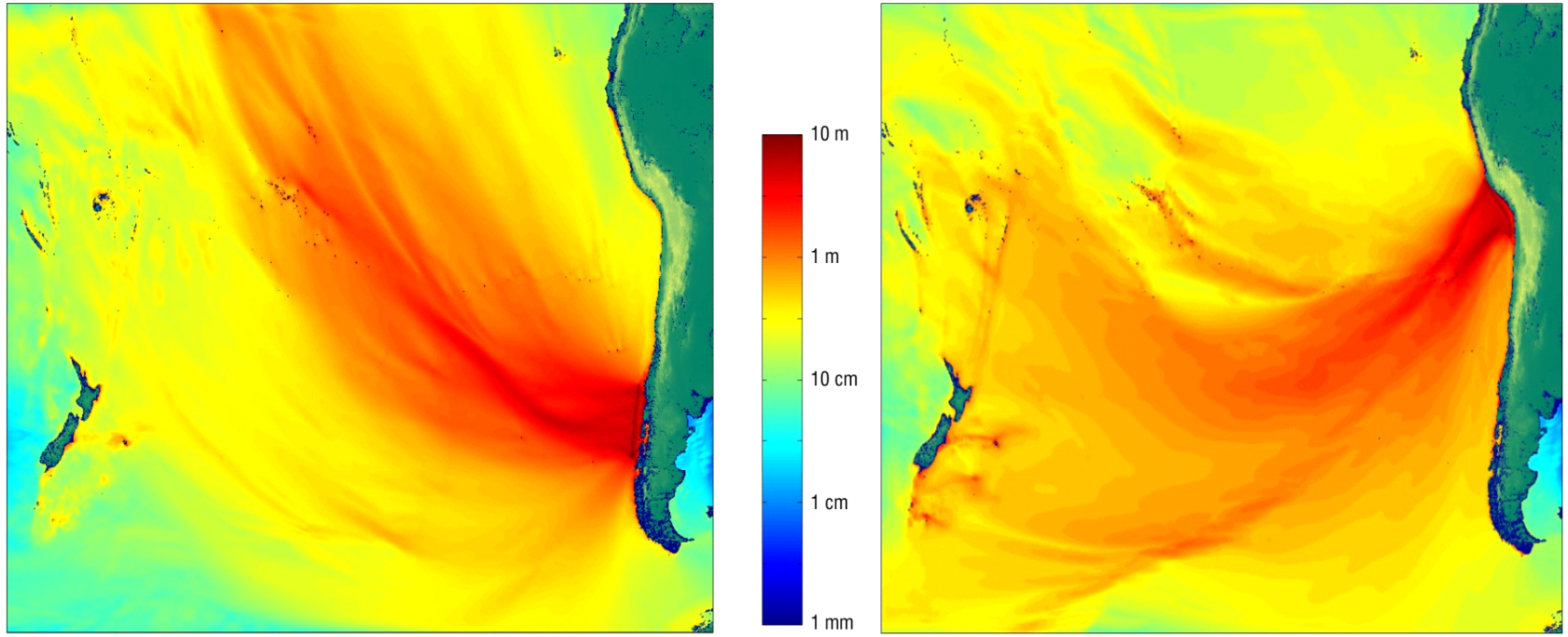
Subduction margins in the circum-Pacific region.

Tsunami modelling - scenarios

Maximum wave height

Chile 1960 M9.5

Equivalent Scenario
M9.5 Southern Peru / Northern Chile

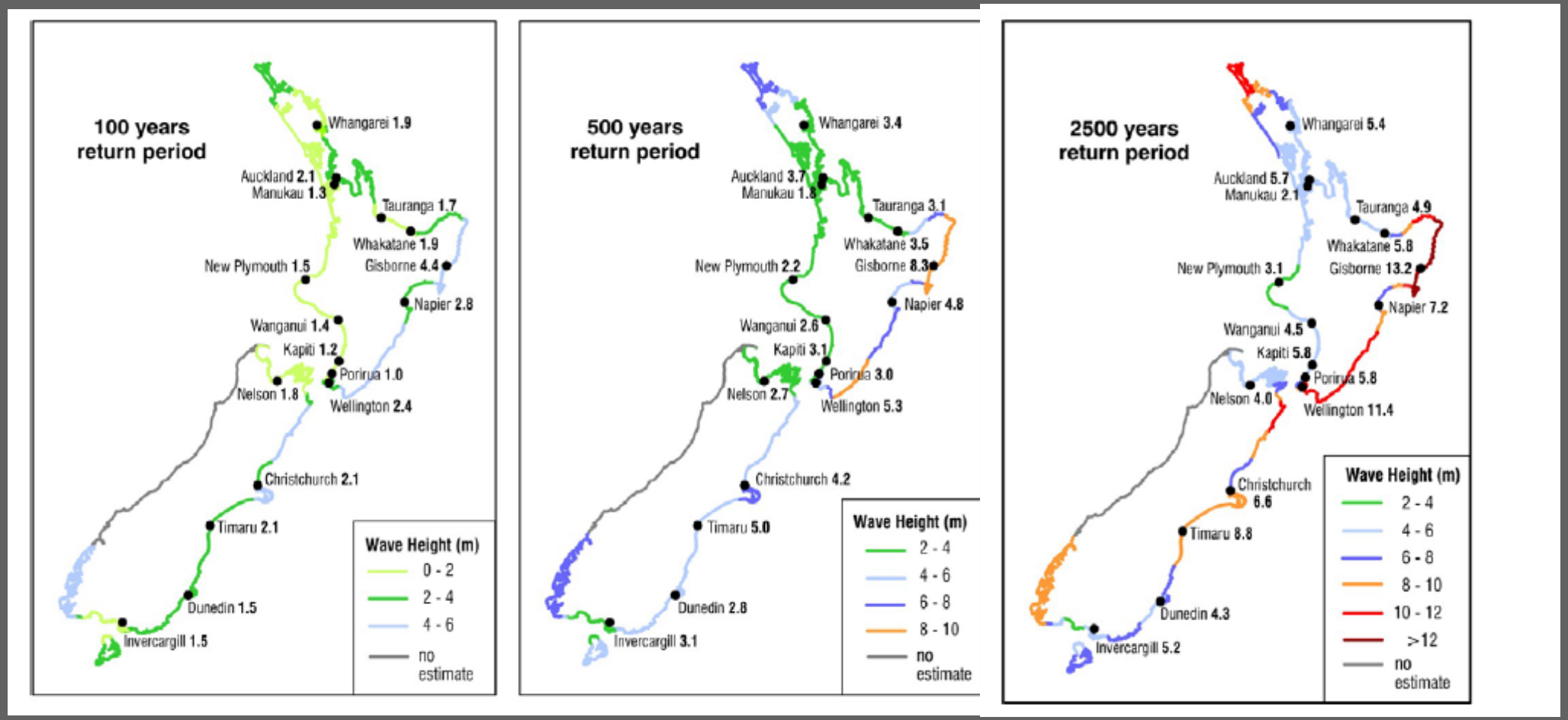


The models shown estimate wave heights offshore (>25 m deep). Wave heights may increase by several times close to the coast. To estimate wave heights at the shore higher resolution 'nested grid' models can be used.

Modelling by William Power (Institute of Geological & Nuclear Sciences)
in collaboration with and using Vasily Titov's (NOAA PMEL) MOST programs.

- earthquakes generally need to be M≥8.5 to result in large tsunami (≥2m) at trans-Pacific distances

Tsunami heights at increasing return times



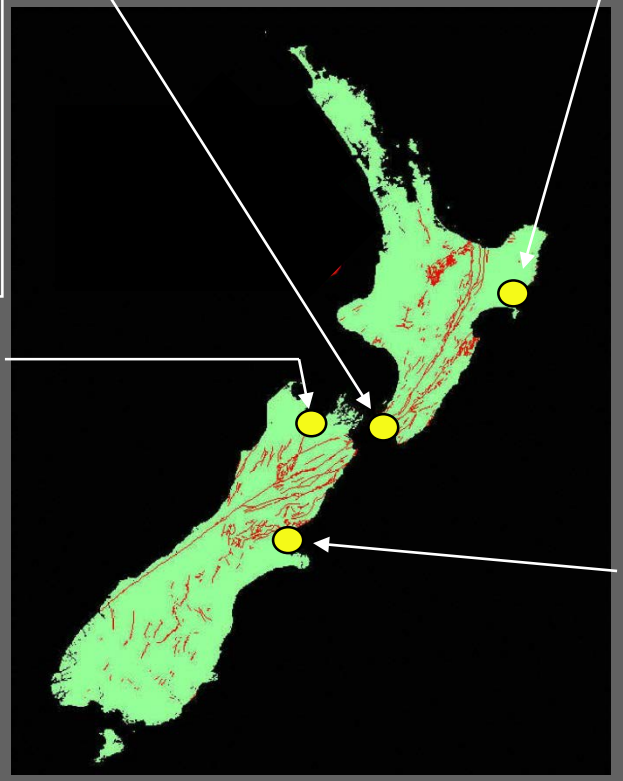
Deaggregation for waves of 2m or more

Wellington

Subduction zone	91%
S America	7%
Local faults	2%

Nelson

S America	50%
Subduction zone	31%
Aleutians	11%
Local faults	4%
Cascadia	3%
S New Hebrides	1%



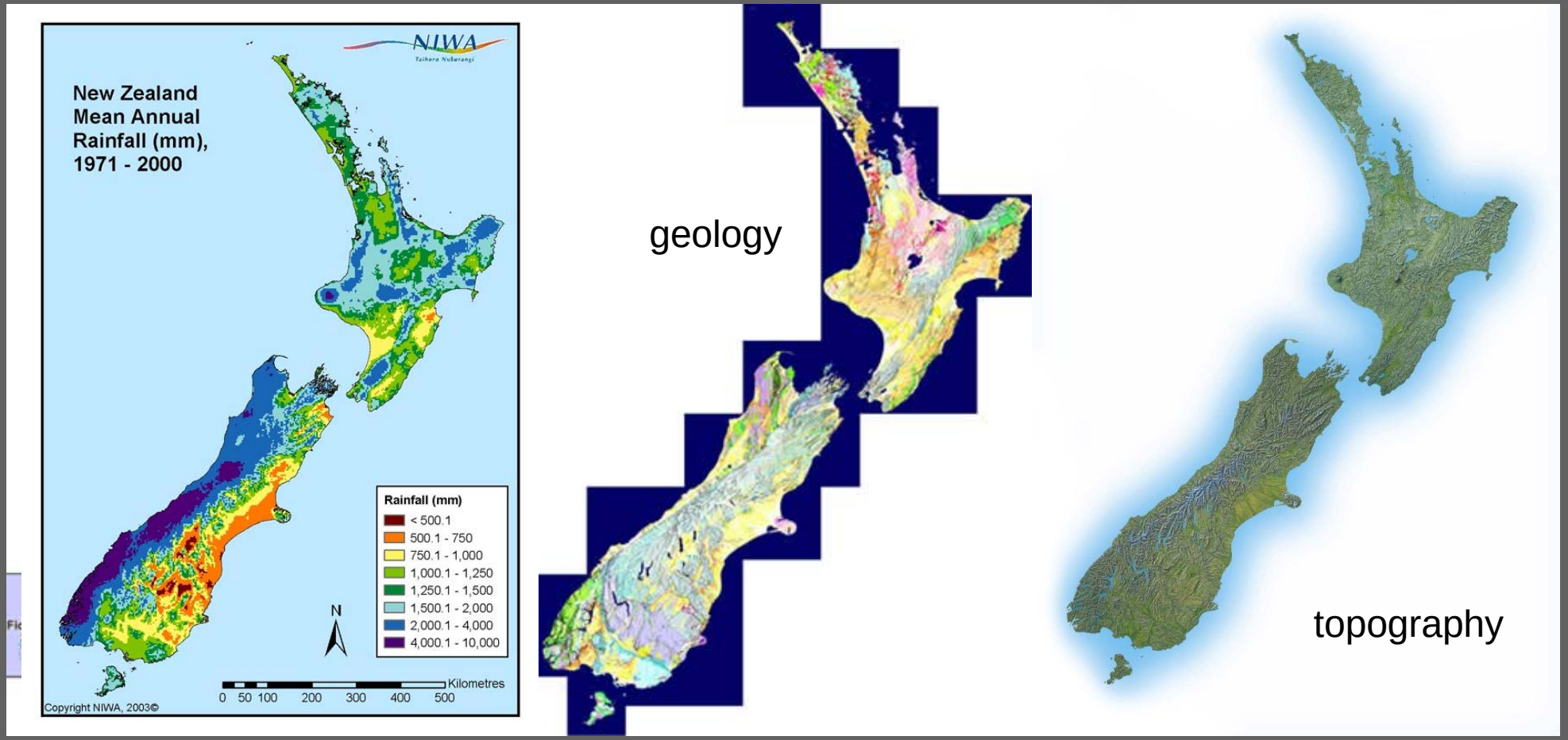
Gisborne

S America	48%
Subduction zone	46%
Local faults	5%
Kermadec	1%

Christchurch

S America	100%

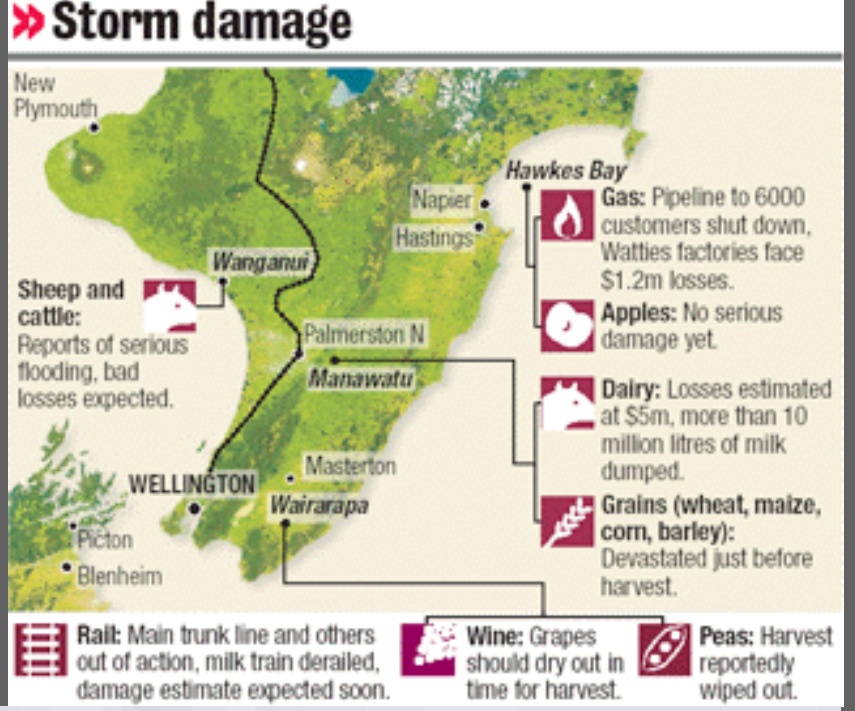
Rainfall, Geology & Topography combine for flood and landslide hazard



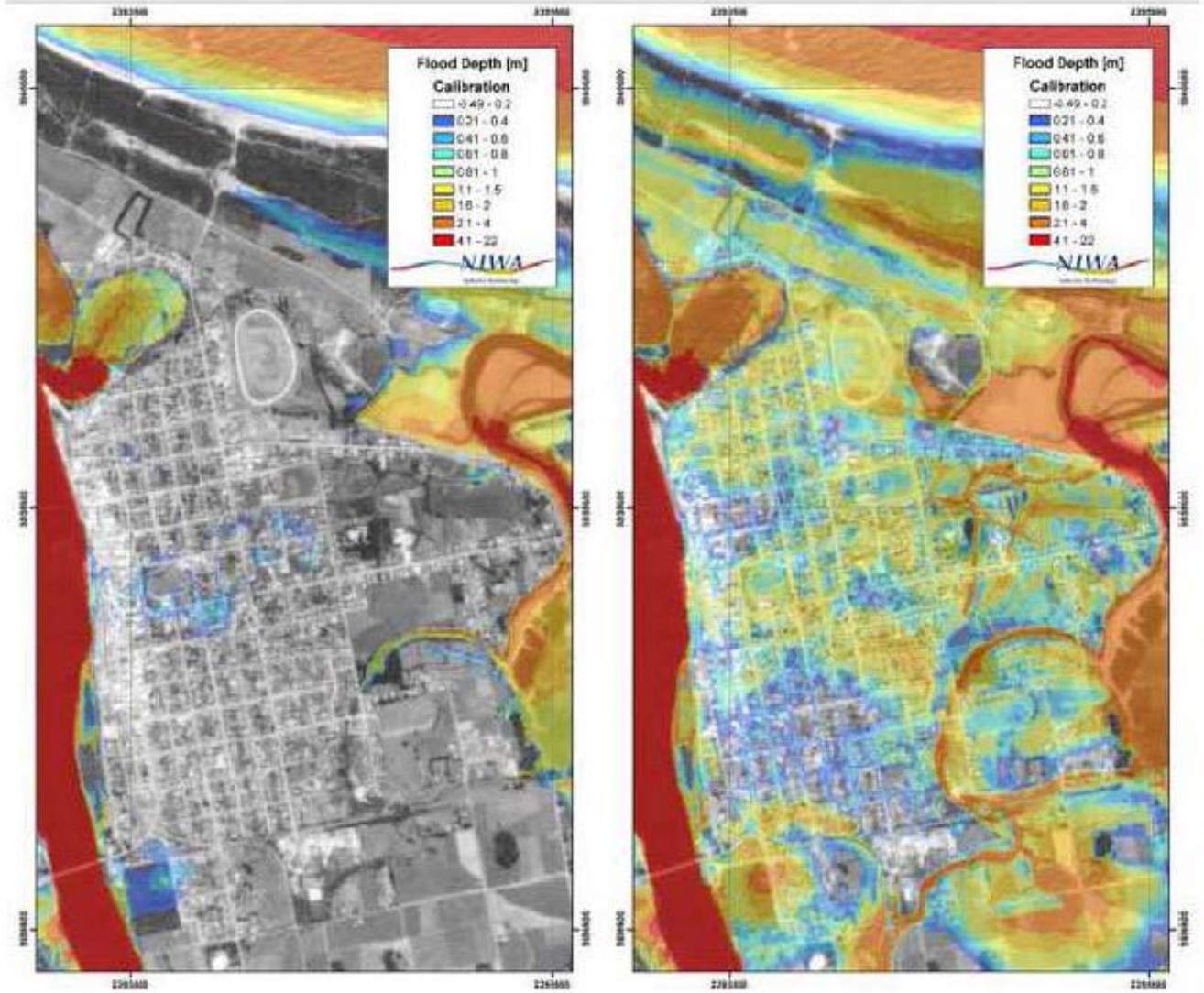
Flood Hazard - 2004 Manawatu

Total cost $355 M (2004 $) for this 150 yr RP event for the region, including:

- Agriculture - $185 M
- Emergency Services & Infrastructure Repairs- $90 M
- Insured losses were $112 M



Flood hazard exposure maps: climate change



2% AEP plus climate change mid-high scenario by 2080

MfE (2010) *Preparing for future flooding: A guide for local government in NZ*

Volcanoes


Raoul Island
Bay of Islands
N
Auckland
Mayor Island
White Island
Edgecumbe
Okataina
Tarawera
Maroa
Taupo
Tongariro
Ngauruhoe
Taranaki/ Egmont
Ruapehu
active in the past 300 years
active in the past 10 000 years
0
100 km

NZ volcanoes have a large range of style, size, recurrence, and impact

Significant natural hazard events in NZ's European history

1843 – Wanganui earthquake, M 7.2
1848 – Marlborough earthquake, M 7.8
1855 – Wairarapa earthquake, M 8.2
1868 – Chile tsunami, eastern NZ; Chatham Is, Christchurch – East Cape
1886 – Mt Tarawera eruption
1888 – Hanmer/north Canterbury earthquake, M 7.2
1901 – north Canterbury earthquake, M 7.2
1929 – Murchison/Buller earthquake, M 7.8
1931 - Napier/Hawkes Bay earthquake, M 7.8
1934 - north Wairarapa earthquake, M 7.4
1942 – Masterton earthquake, M 7.0
1945 – Ngauruhoe eruption
1960 – Chile tsunami, eastern NZ; Chatham Is, Christchurch – East Cape
1968 – Inangahua earthquake, M 7.4
1974/75 - Ruapehu eruptions
1987 – Edgecumbe earthquake, M 6.6. $240 M losses
1988 – Cyclone Bola. $200 M losses
1995/96 - Ruapehu eruptions. $133 M losses
2004 – Manawatu floods, $335 M losses – "150 yr return period event"
2010/11 – Canterbury earthquakes, M 7.1, 6.2, 6.0, 5.9

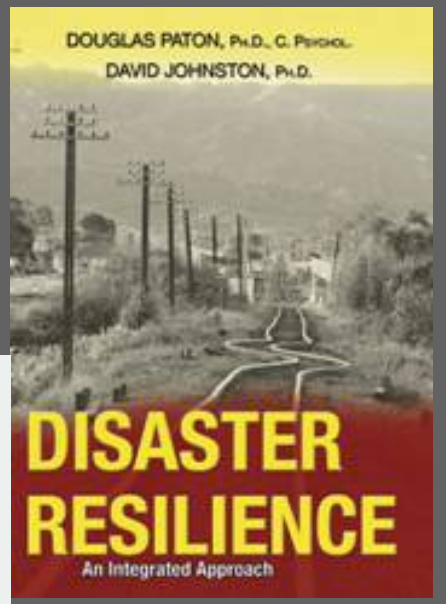
normal typeface ~ $500-900M in today's terms, **bold typeface** ~ $1-10b, large bold typeface > 10b in today's terms

Looking Forward – what should we be preparing for ?

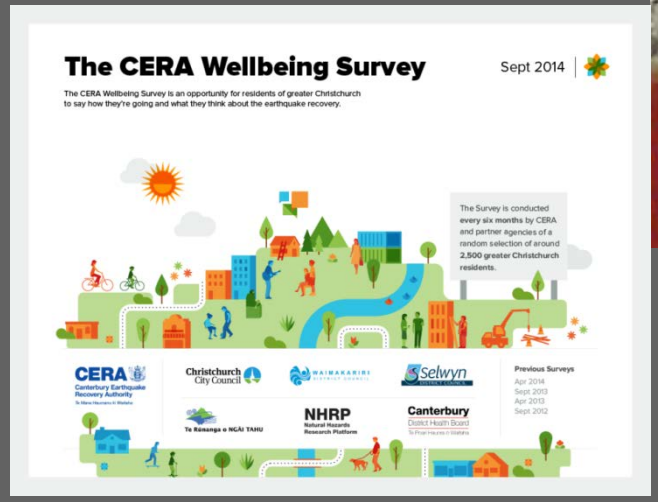
Event	Likelihood in next 50 yrs	Possible economic loss (2015 estimates)
NZ earthquake sequence like 1929-1942	50%	>> $10B
Hikurangi subduction zone M8+ and tsunami	10%	>> $10B
Auckland volcanic eruption	5%	>> $10B
Alpine fault - M8 earthquake	30%	> $10B
Taupo region major eruption	10%	> $10B
Ruapehu/Tongariro/Ngauruhoe White Island major eruption	almost certain	> $1B
South America M9+ earthquake & NZ tsunami	50%	> $1B
Taranaki eruption	80%	~ $1B
Hope fault M7.2 earthquake	50%	~ $1B
Major flood – e.g. Hutt Valley	20%	~ $1B

Note: New Zealand GDP 277B NZD (2013)

Research in Social Science, the Built Environment and Natural Hazard Risk Governance



- A social science research team has wrapped around natural hazard research since the 1995 Ruapehu eruption;
- Social science and the current resilience emphasis are intertwinned;
- Community needs in response and recovery extensively investigated in Canterbury and are key resilience activities;



- Since 2009 the built environment has been within an end-to-end research environment;
- Progressive development of legislation, policies, and guidance for natural hazard risk management is leading to improved governance arrangements.

The state of play in research sectors

Hazard – Emphasising probabilistic approaches and cascading events

Risk – Improved vulnerability estimates, NZ assets and impacts

Social Science – Resilience in community, business, economic and cultural terms

Natural Hazard Risk Governance – disconnects between instruments, Risk in the RMA, NPS for Natural Hazards, Sendai Declaration

Built Environment – Earthquake prone buildings, research to support MBIE guidance, low damage design, more than earthquake engineering – wind, tsunami, flood

How is the Research Connected

- MCDEM & DPMC – driving national resilience conversations
- EQC – the envy of the World
- Insurance & Reinsurance – risk transfer protecting economic and social futures
- CERA – recovery in Canterbury
- The Sendai Declaration – a national commitment
- Local Government New Zealand – a local government risk agency?
- National Engineering Lifelines & National Infrastructure Unit/The Treasury
- Health Research Council – e.g. RHISE – connecting hazards & health
- Ministry for the Environment – A national policy statement for natural hazards
- CRI consultancy – connecting research with agency identified needs
- MBIE Building Performance – regulation & guidance

Further Challenges and Opportunities

- Demonstrating the benefit-cost of risk reduction
- Risk-based land-use planning
- Building social capital for resilient communities
- Private enterprise participation in national risk reduction
- Joined up central and local government including legislation, policy, and risk management

Contact the Natural Hazards Research Platform at:

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Highlights of research in 2014 can be found at:
http://www.naturalhazards.org.nz/NHRP/Publications/Natural-Hazards-Annual-Report