

**Mā te haumarū ō ngā puna wai ō
Rākaihautū ka ora mo ake tonu:
Increasing flood resilience across Aotearoa**



Ōtautahi Road Show

Emily Lane

2 November 2022

CENTRAL



- Legislation: RMA, CDEM Act, Building Act, Soil Conservation and Rivers Control Act
- MfE: Guidance for natural hazards
- NEMA: Emergency and post-emergency recovery phases
- MPI: Coordinate rural community after large floods
- Central Government: may provide money to councils to help after large floods
- DIA: Currently coordinating a Community Resilience Work Programme on flooding

REGIONAL



- Manage rivers and catchments, control land use
- Provide information on where flooding occurs
- Operate/maintain flood defence systems
- River flows, lake levels, previous floods
- Issue flood warnings

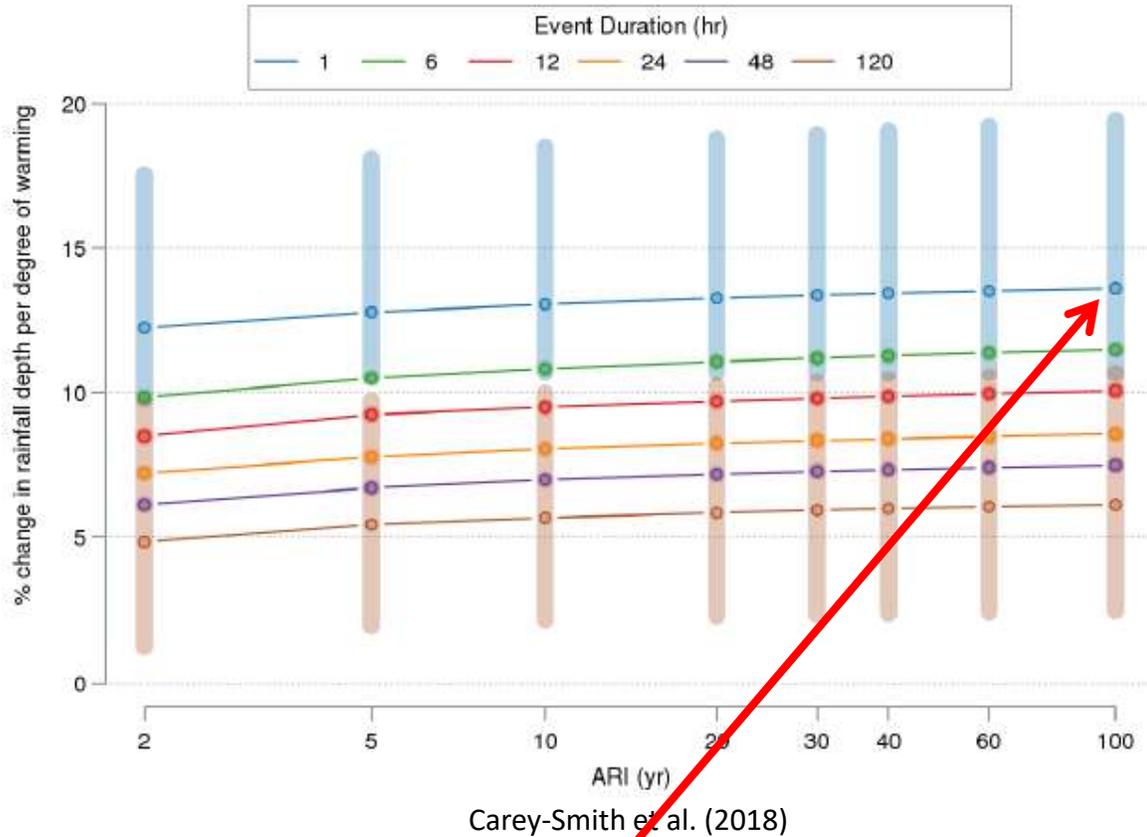
LOCAL



- Control building and effects of land use (e.g. Subdivisions, floor height etc)
- Provide flood information via Hazard Register or District/City Plan
- Coordinate with emergency services during events and assist in recovery

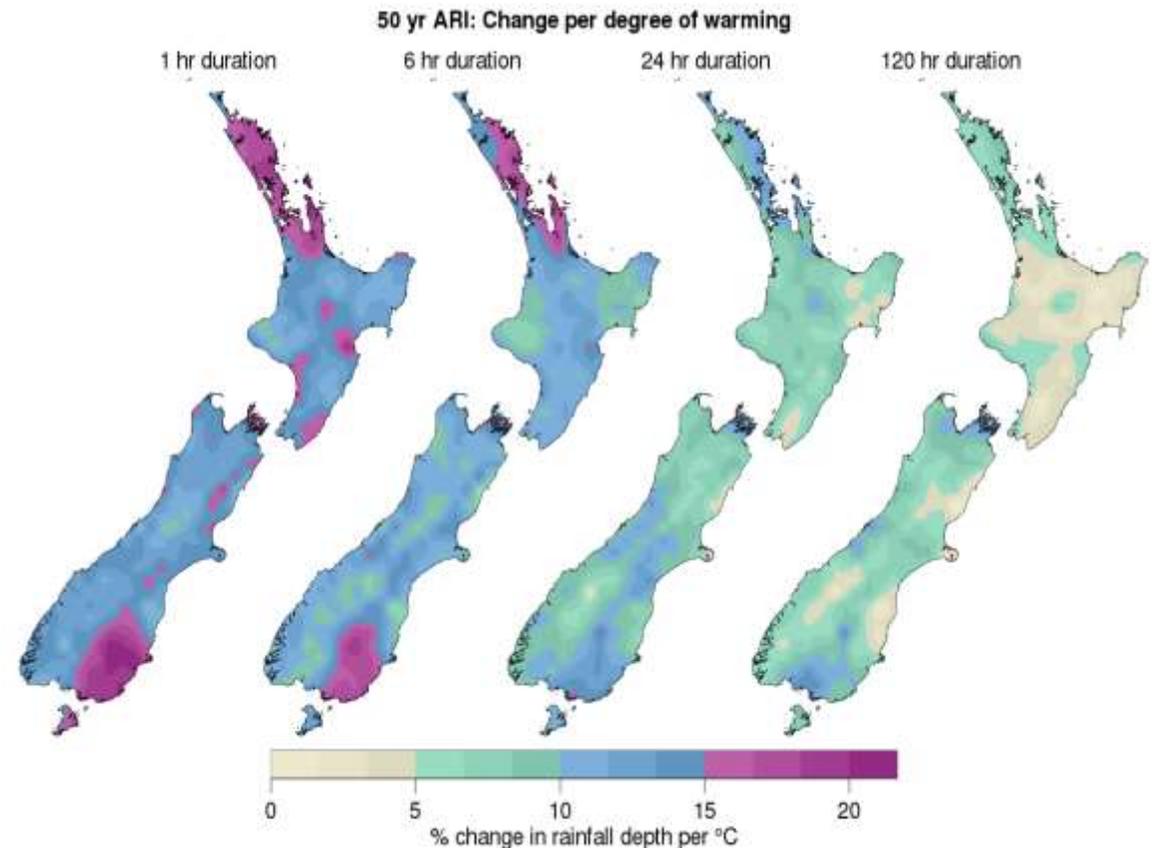
Mā te haumarū ō nga puna wai ō Rākaihautū ka ora mo ake tonu:
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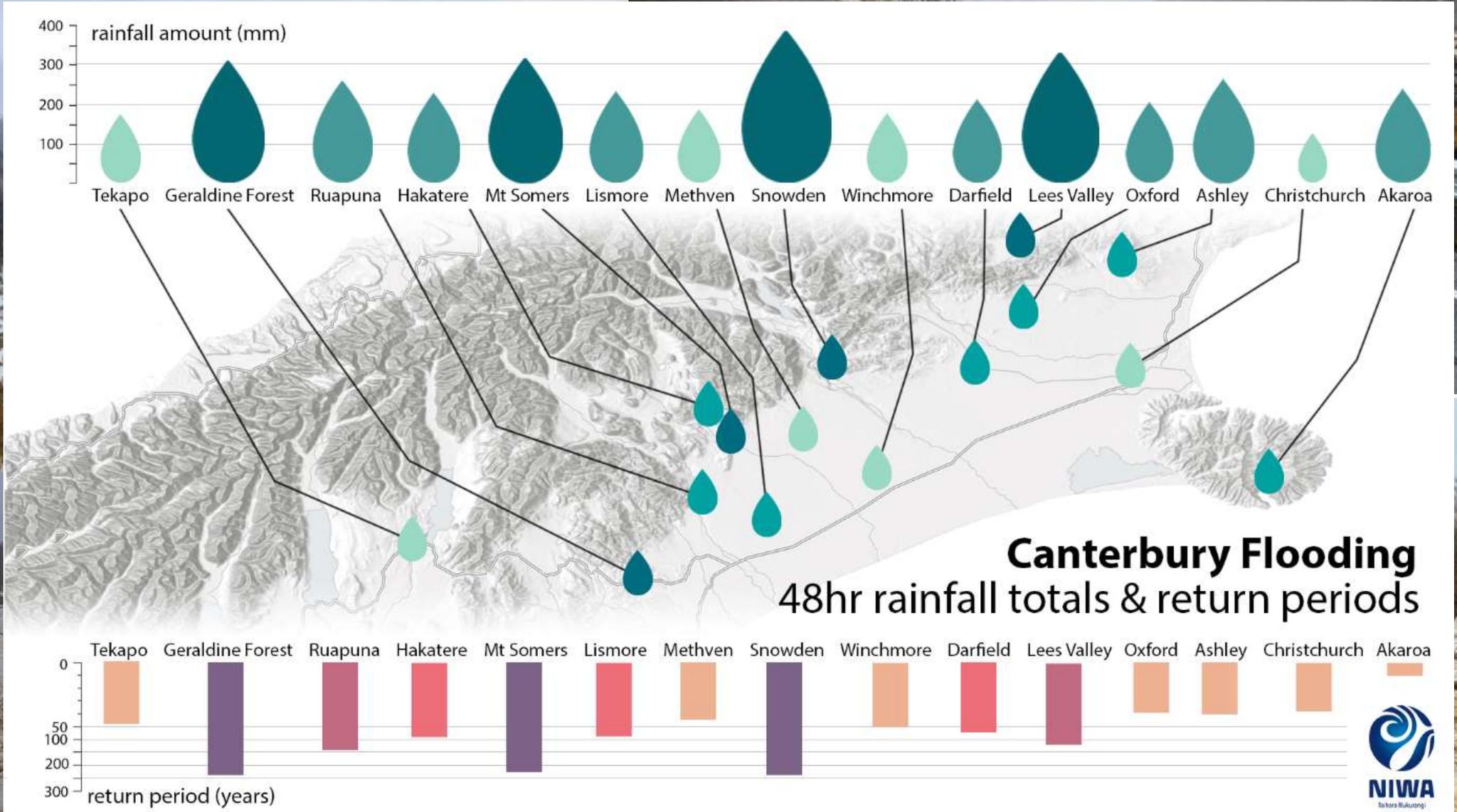
Climate Change: Changes to extreme rainfall



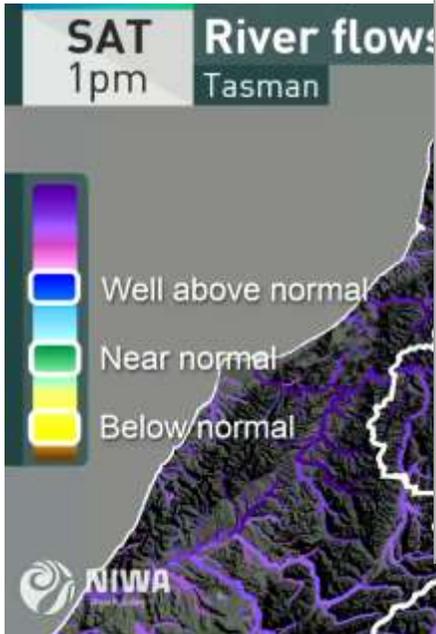
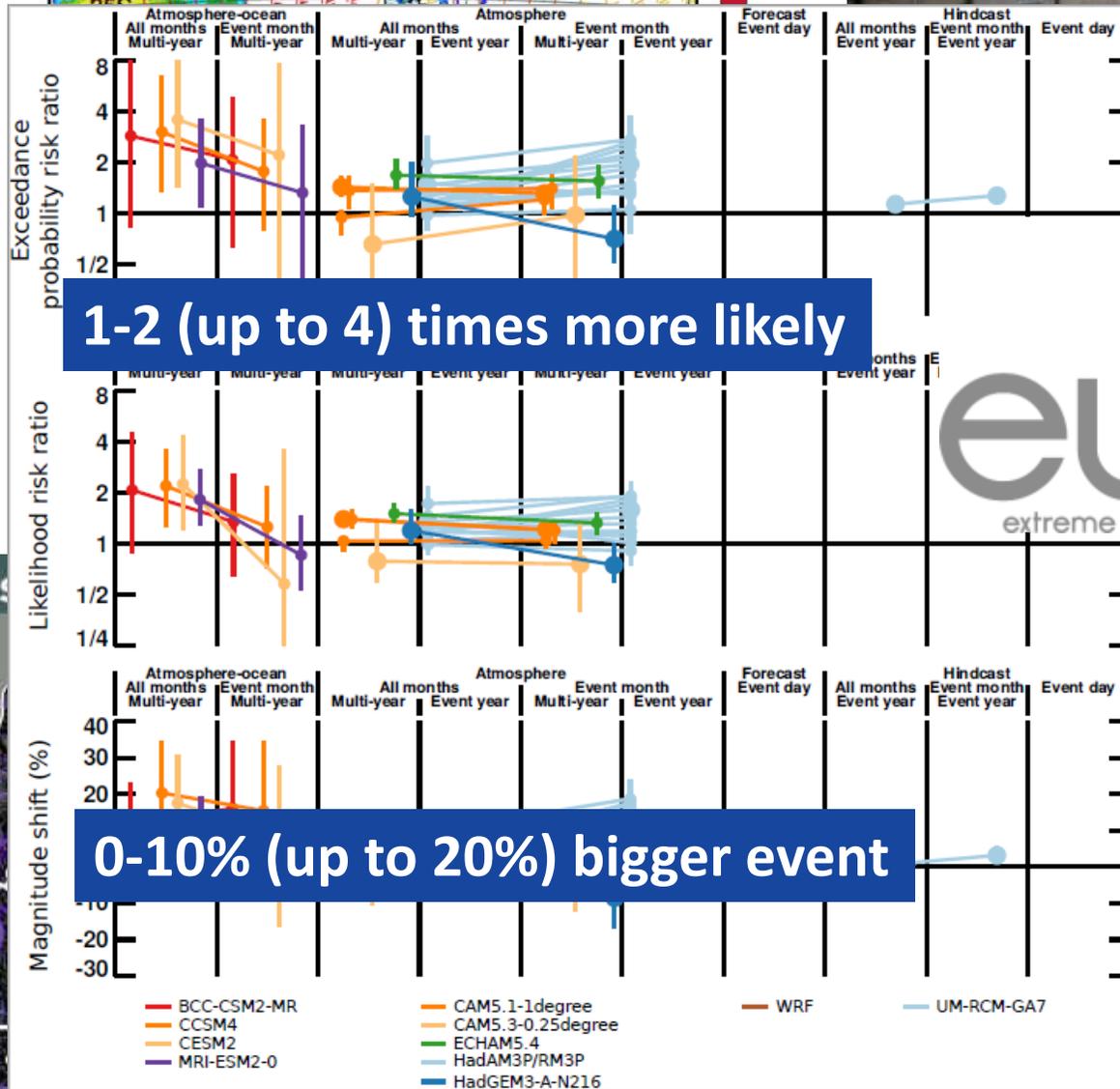
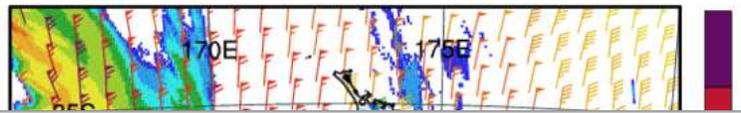
- E.g. 1-hour duration, 100-year return period = 14% increase in event depth per degree of warming
- Large range of model results

- Rainfall intensity will increase across NZ
- Shorter durations increase the most
- Events become more spatially concentrated - 'spikier'
- Larger increase with more warming
- Uncertainty around ex-tropical cyclone numbers, but increasing intensity





Buller River and Westport July 17 2021



nga puna wai o Rākaihautū ka ora mo ake tonu:
Increasing flood resilience across Aotearoa

OVERVIEW OF THE PROPOSED RESOURCE MANAGEMENT SYSTEM



Urutau, ka taurikura: Kia tū pakari a Aotearoa i ngā huringa āhuarangi Adapt and thrive: Building a climate-resilient New Zealand

AOTEAROA NEW ZEALAND'S
FIRST NATIONAL ADAPTATION PLAN



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ADERS
RISKS

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Related work: *managed retreat*

Managed retreat enables people to carefully plan the relocation of homes and other assets, activities and sites of significance away from at risk areas. It is one option communities may need to consider when deciding how to adapt. Work to develop a legislative framework for managed retreat is a critical action within the national adaptation plan and will help local and central government and communities deal with the complex issues that are part of deciding to retreat.



Related work: *flood insurance*

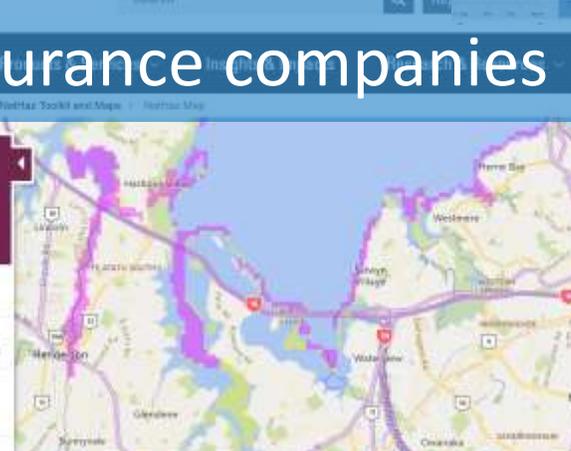
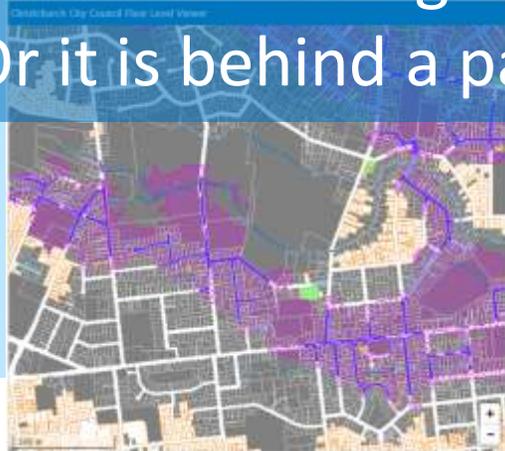
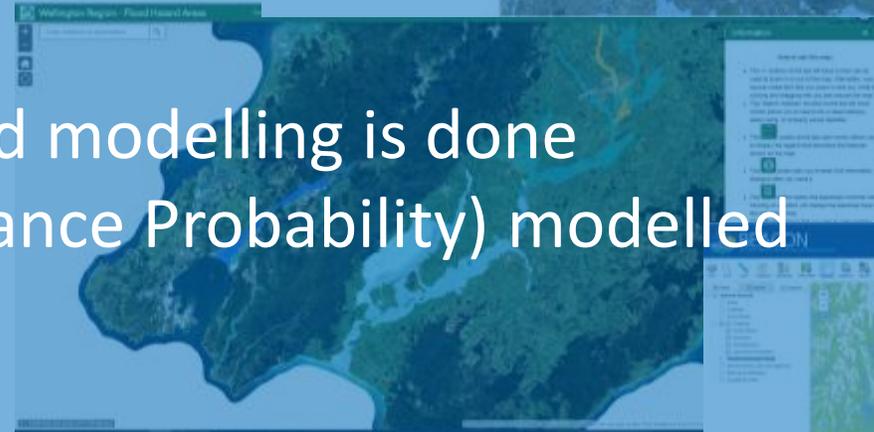
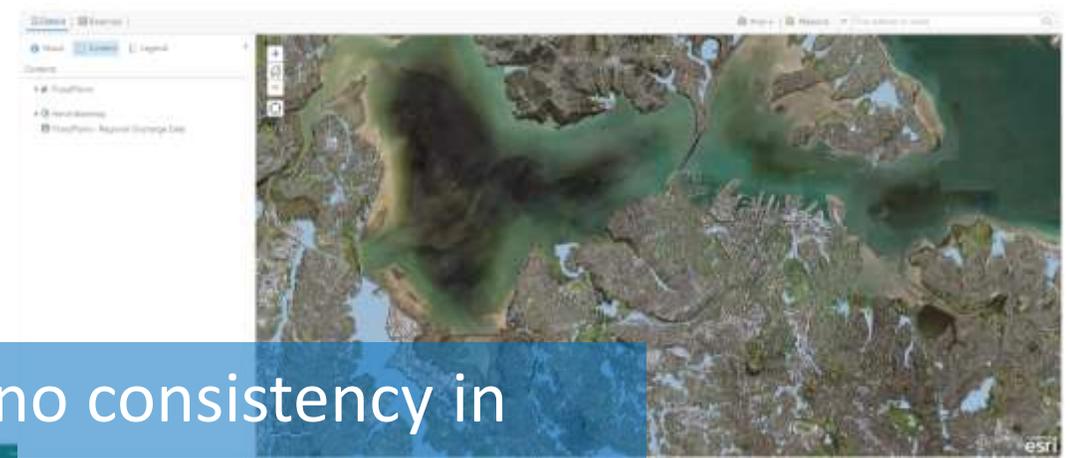
Insurance currently plays an important role in supporting New Zealand's resilience and recovery from natural hazards, including through post-event payments and by sending risk signals through premiums and availability. However, climate change poses challenges for the insurability of assets, such as residential buildings and homes. Climate change will make floods more severe, frequent and costly, while the availability and quality of information, data, and modelling regarding flood risk and climate change is increasing over time. The Government has choices about how it responds to these challenges. As flooding is New Zealand's most frequent hazard, our primary focus is on flood insurance for residential buildings.

This all requires good data...

Current flood hazard data has no consistency in terms of:

- Whether or not flood modelling is done
- AEP (Annual Exceedance Probability) modelled
- Resolution
- Methodology
- Climate change effects

Or it is behind a paywall for insurance companies



MBIE Endeavour 5-year Research Programme:

Reducing flood inundation hazard and risk

Mā te haumarū ō nga puna wai ō Rākaihautū, ka ora mo ake tonu

Overall aim: A more Flood-Resilient Aotearoa New Zealand

Produce an updateable nationally-consistent flood inundation hazard and risk assessment for current conditions and future scenarios under climate change.

Create a forum between science, iwi, policy-makers and stake-holders to ensure desired outcomes

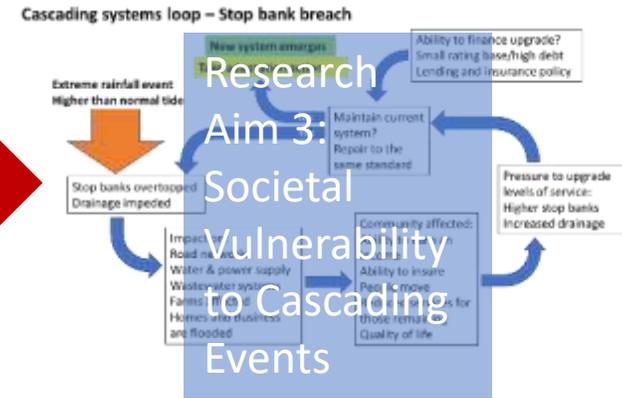
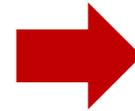
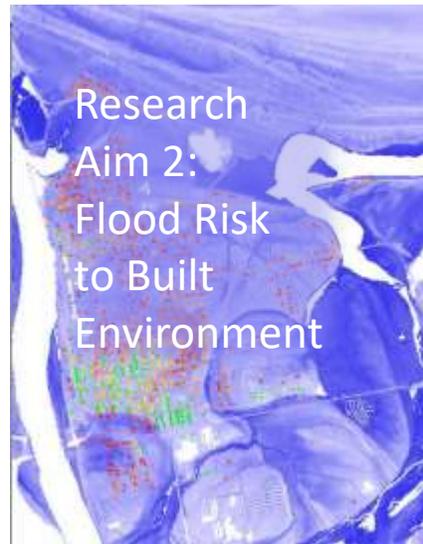
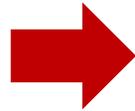
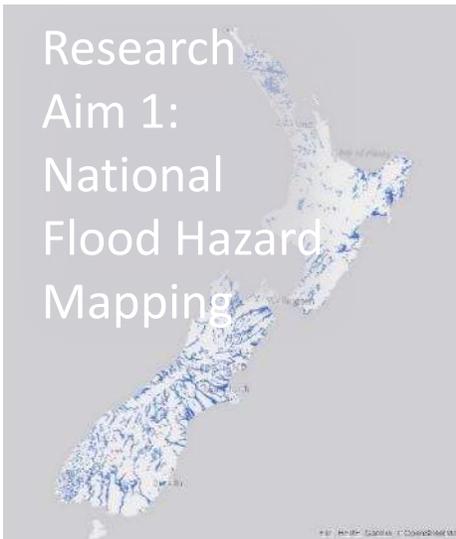
Why?

National screening tool:

- Identify where the flood hazard/risk are high – especially in rural areas where there may not currently be information.
- Identify where the flood hazard/risk may increase under climate change.
- Work with local and central government, iwi, stake-holders to determine how to use this information to increase resilience



Mā te haumarū ō nga puna wai ō Rākaihautū ka ora mo ake tonu:
Increasing flood resilience across Aotearoa



E rere kau mai te awa nui mai i te kāhui maunga ki Tangaroa, ko au te awa, ko te awa ko au.

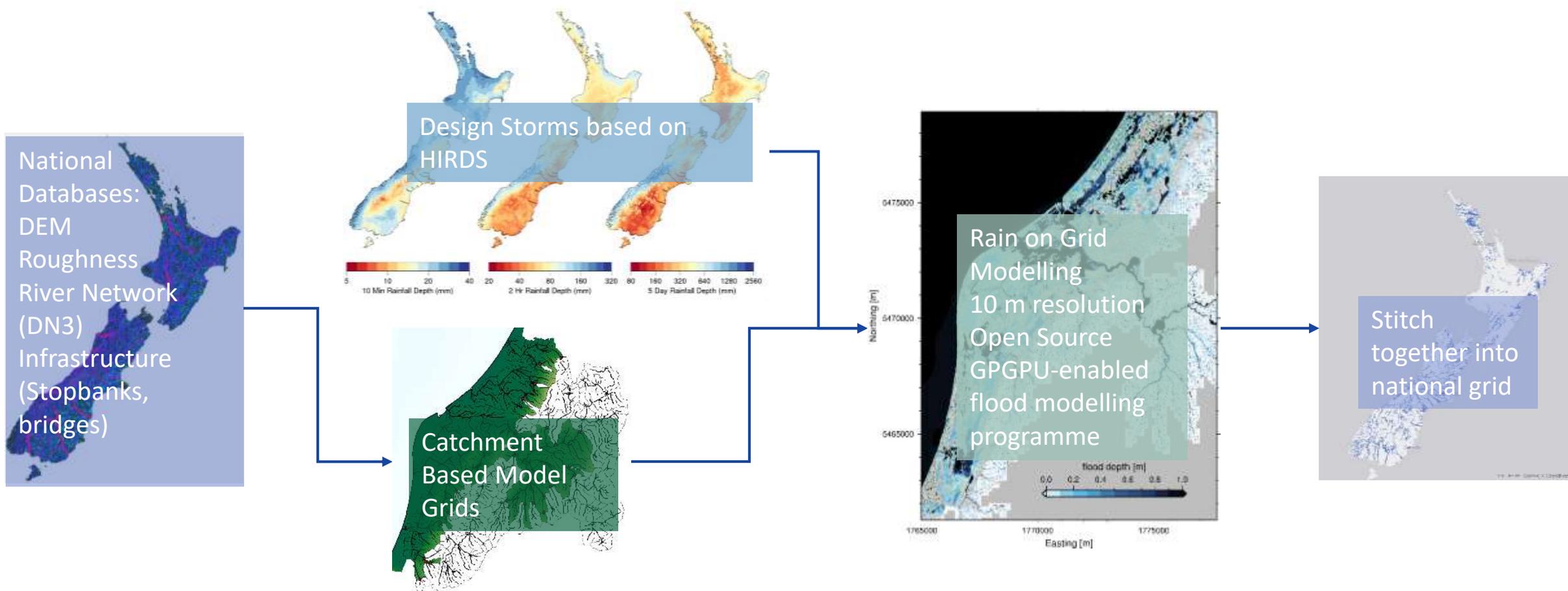
- Deep spiritual connection with the land and the rivers
- Different conceptions of risk (taonga):
 - wāhi tapu,
 - taonga species,
 - marae and other assets
 - Intangibles (e.g. mauri)
- Kaupapa-Māori based solutions that enhance the mauri of the awa
- Ensuring iwi retain sovereignty of their data

- Working with the hapū of Wairewa Rūnanga Kāti Mako and Ngāti Irakehu
 - (Dr Benita Wakefield and Kaitiaki Advisory Group)
- Understanding knowledge of flooding from a Māori perspective - Conducting interviews with kaumatua
- Developing a climate change flooding strategy for the rūnanga following Te Tāhū o te Whāriki.
- More generally, developing a framework for flood risk and climate change for iwi and rūnanga across Aotearoa

Mō tātou, ā, mō kā uri ā muri ake nei

RA1 – National Flood Mapping:

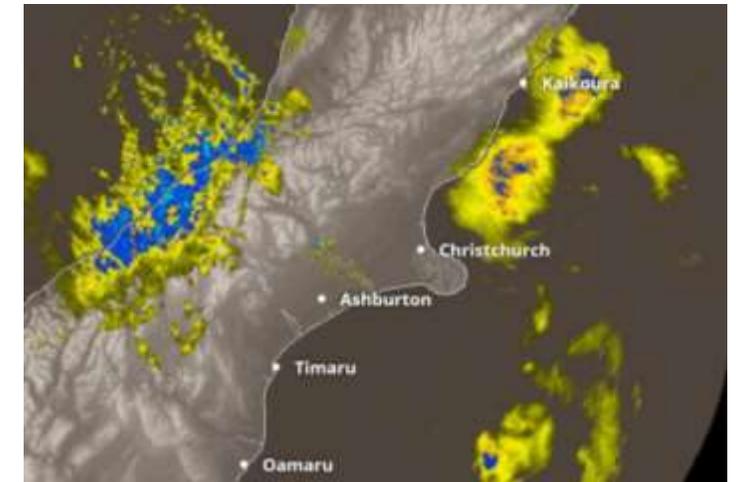
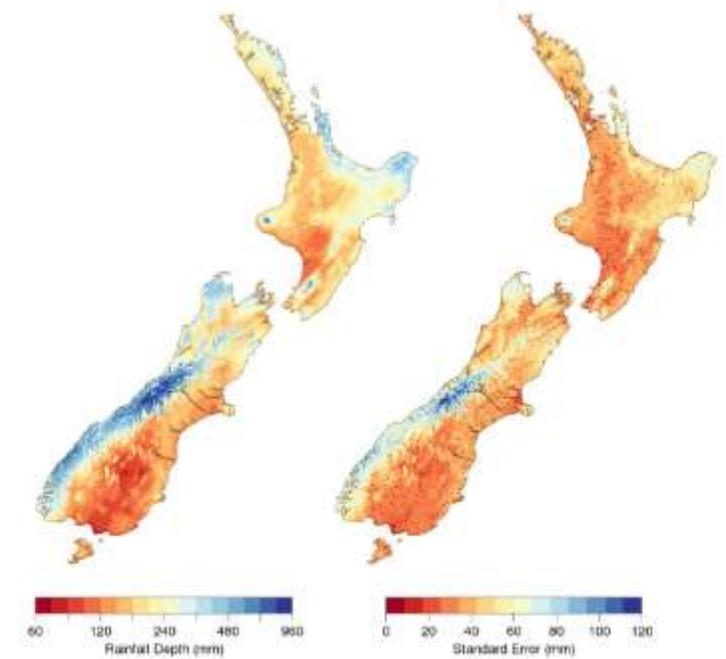
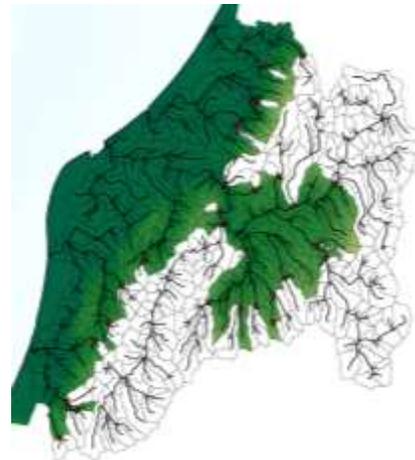
Create a semi-automated system and methodology for nationally consistent flood maps for a range of design storm events, including climate change impacts, validated against a database of historical floods.



Mā te haumarū ō nga puna wai ō Rākahautū ka ora mo ake tonu:
Increasing flood resilience across Aotearoa

RA1 – National Flood Mapping:

- Develop consistent nationwide design storm events based on improved HIRDS (High Intensity Rainfall Design System)
- Using rain radar observations and pattern recognition techniques to better represent the spatial and temporal patterns of rainfall.
- Rainfall in upper catchments will be converted to hydrographs using TopNet – a flow routing model
- Rainfall on the floodplain will directly force the flood model
- BG-Flood – open source GPGPU flood solver



Mā te haumaru ō nga puna wai ō Rākahautū ka ora mo ake tonu:
Increasing flood resilience across Aotearoa

RA1 – National Flood Mapping: Climate Change

- We live in a changing climate
- As temperatures increase, short intense rainfall events will become more frequent and ‘spikier’
- These will be especially problematic in urban areas
- Sea level rise exacerbates flooding in low-lying coastal regions (reduced drainage, increased groundwater level)
- We need to understand how these changes affect our flood hazard

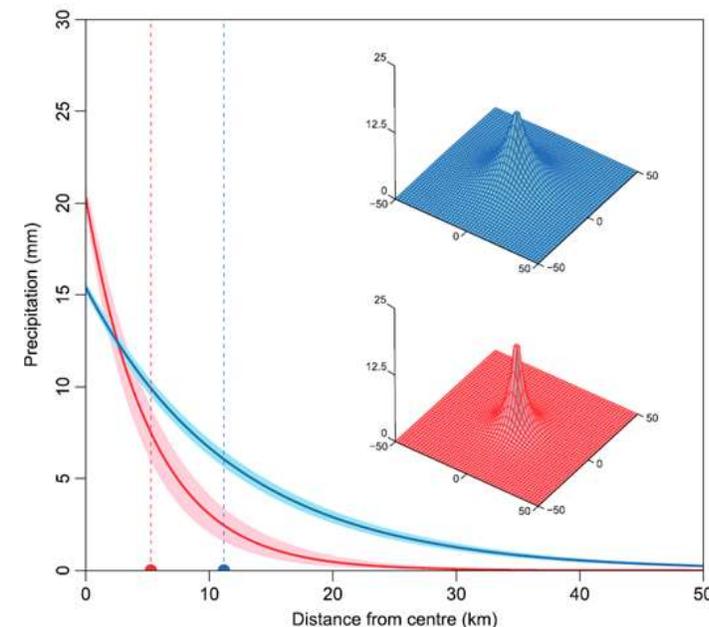
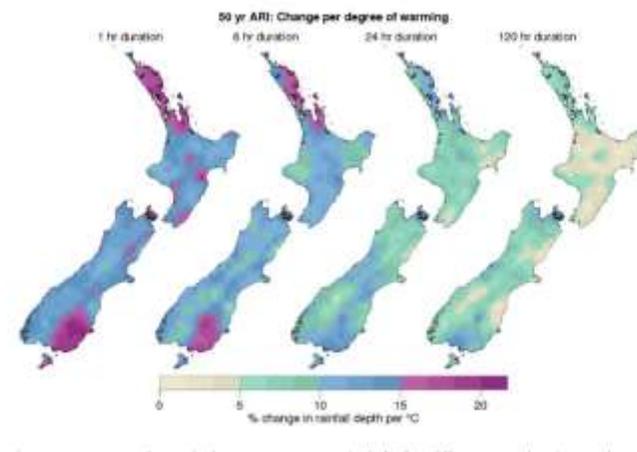
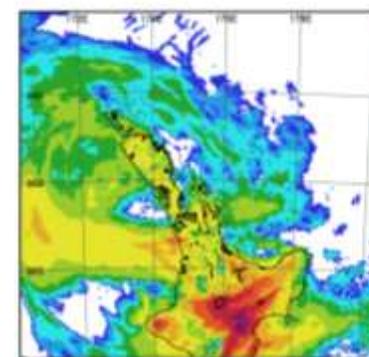


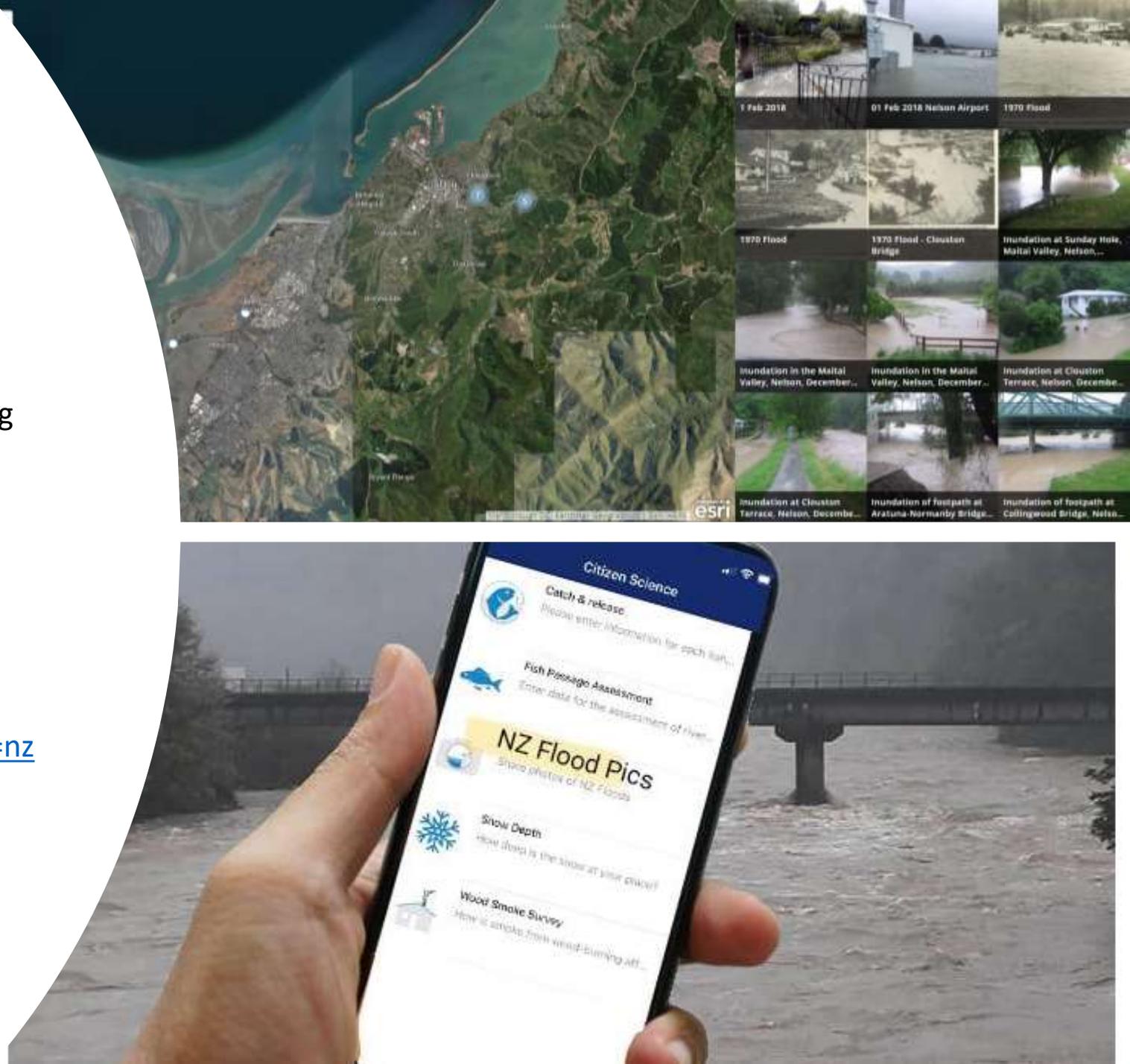
Photo: Warren Buckland via Hawkes Bay Today



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Increasing flood resilience across Aotearoa

Historical and current Floods

- Drew Lorrey (NIWA) and Jon Rix (T&T) collecting citizen science flood photos
- <http://www.nzfloodpics.co.nz/>
- NIWA Citizen Science App downloadable for Apple or Android
- <https://apps.apple.com/nz/app/citizen-science/id1439168937>
- https://play.google.com/store/apps/details?id=nz.co.niwa.citizenscience&hl=en_NZ&gl=US
- Repository of Historical Floods
- Reconstructing flood heights from historical photos

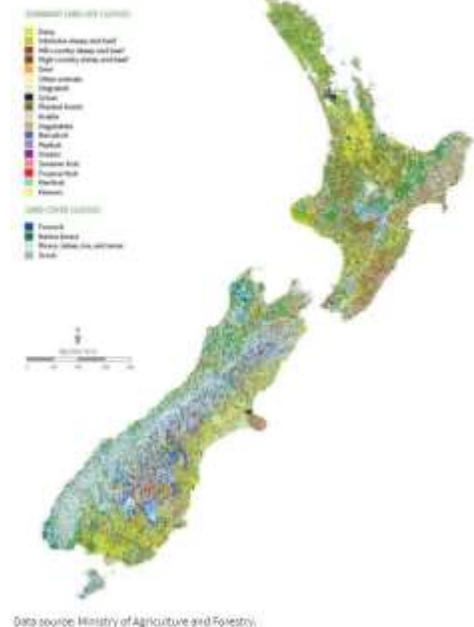


RA2 – Flood Risk to the Built-Environment



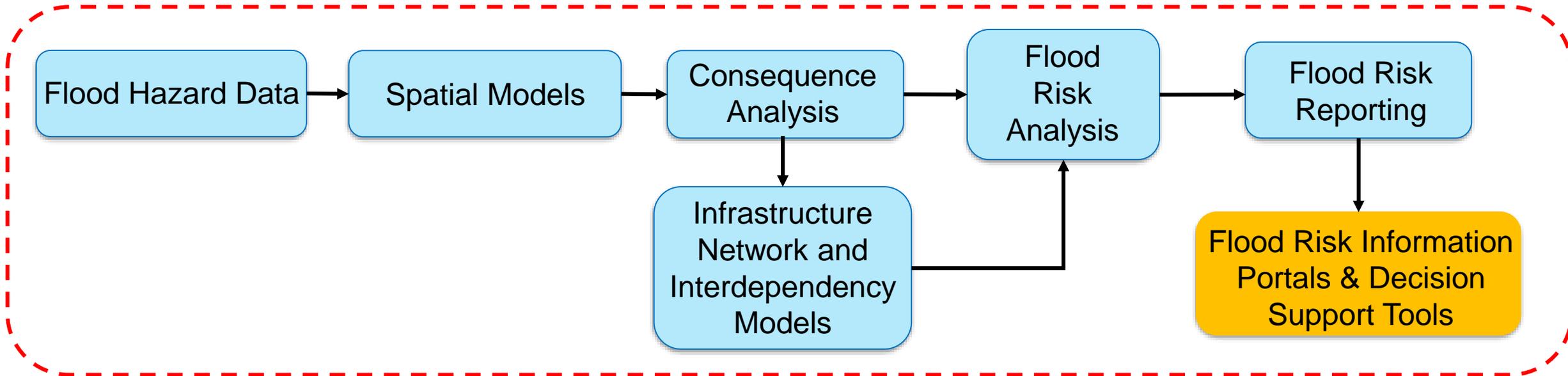
Figure 9.3: Land use in New Zealand, 2004

Return to the point in the document where this figure is located.



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Increasing flood resilience across Aotearoa

RA2 – Flood Risk to the Built-Environment



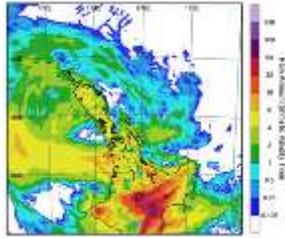
Develop a flexible modelling tool to assess flood risk in Aotearoa New Zealand.

- *Land use*
- *Built environment*
- *Infrastructure networks*
- *Future risk & uncertainty*

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RA 3 Societal vulnerability to cascading events

Step 1: Current system



Cascading systems loop – Stop bank breach

Extreme rainfall event
Higher than normal tide



Stop banks overtopped
Drainage impeded

Impact on:
Road networks
Water & power supply
Wastewater systems
Farms affected
Homes and Business
are flooded



Community affected:
Ability to earn an
income
Ability to insure
People move
Reduced services for
those remaining
Quality of life



Pressure to upgrade
levels of service:
Higher stop banks
Increased drainage

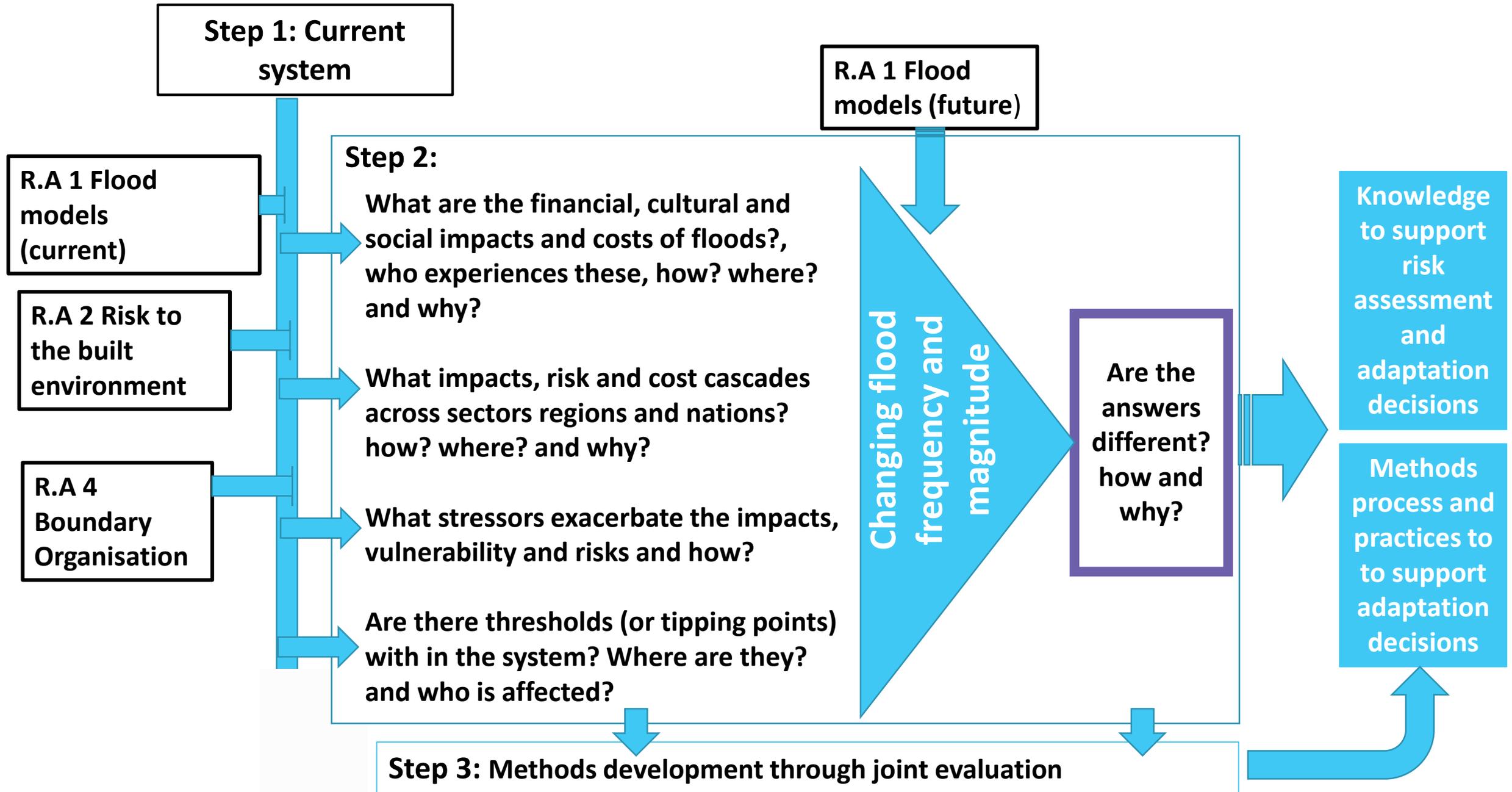
Maintain current
system?
Repair to the
same standard

Ability to finance upgrade?
Small rating base/high debt
Lending and insurance policy

New system emerges
Take adaptation action

No
Yes

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RA4. Reducing Flood Risk and Adapting to Change

Are maps and information enough?
What does it take to increase resilience?

Hamilton 2012

Thousands of residents responded angrily after **receiving letters** warning their homes are at risk of flooding...

An internal council email said the letters were **deliberately vague** to prevent widespread panic. But the strategy backfired, with **residents criticising the way the council** released the information.

[a resident said] “adding flood risk to a LIM report was unreasonable and **would impact on property value and insurance costs**. All this is doing is protecting themselves ... it is **devaluing our house**...It is one thing to identify the risk, but you must be 100 % correct before you start playing with people's livelihoods.”

Accepted: 1 October 2017
DOI: 10.1111/ma.12227

REGULAR PAPER

WILEY 

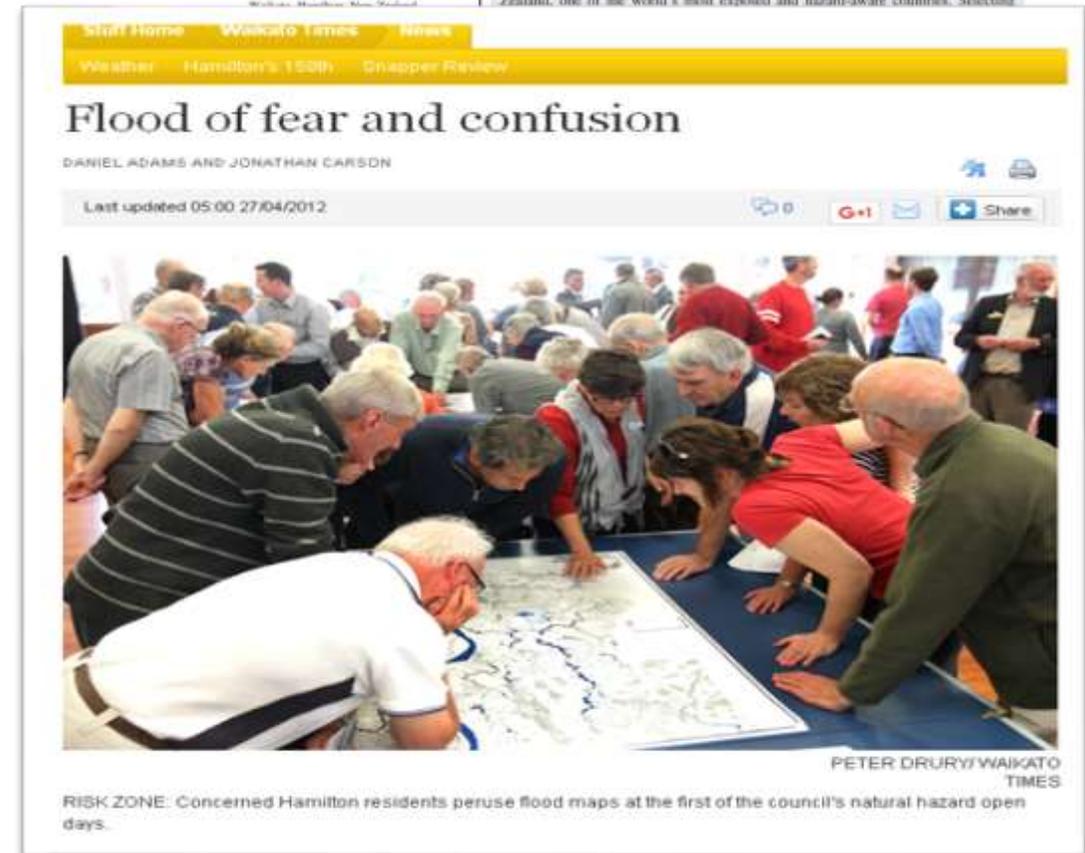
Risky spaces: Creating, contesting and communicating lines on environmental hazard maps

Graham Haughton¹ | Iain White²

¹School of Environment, Education and Development, University of Manchester, Manchester, UK

²Geography, Environmental Planning, Tourism Studies, Faculty of Arts & Social Sciences, The University of Waikato, Hamilton, New Zealand

This paper examines the tensions involved in the production, presentation and revision of hazard maps, focusing on the controversies that have become increasingly common when they are used to change government policy. Our scope includes all the major environmental hazards currently being mapped in New Zealand, one of the world's most exposed and hazard-aware countries. Selecting



RA 4 Reducing Flood Risk



Dr. Silvia Serrao-Neumann



Prof Iain White

Te Whāriki ō te Wai

How does our modeling fit with local and regional modeling?

Hierarchy of Models

- High resolution
- Bespoke
- High level of detail (drainage networks etc)

Sub-catchment Stormwater scale

Catchment scale

- Large scale/Broad brush
- Subgrid scale parametrisations
- Intended for:
 - high level comparisons
 - Screening purposes

Regional/National Scale

Learn more about flood risk

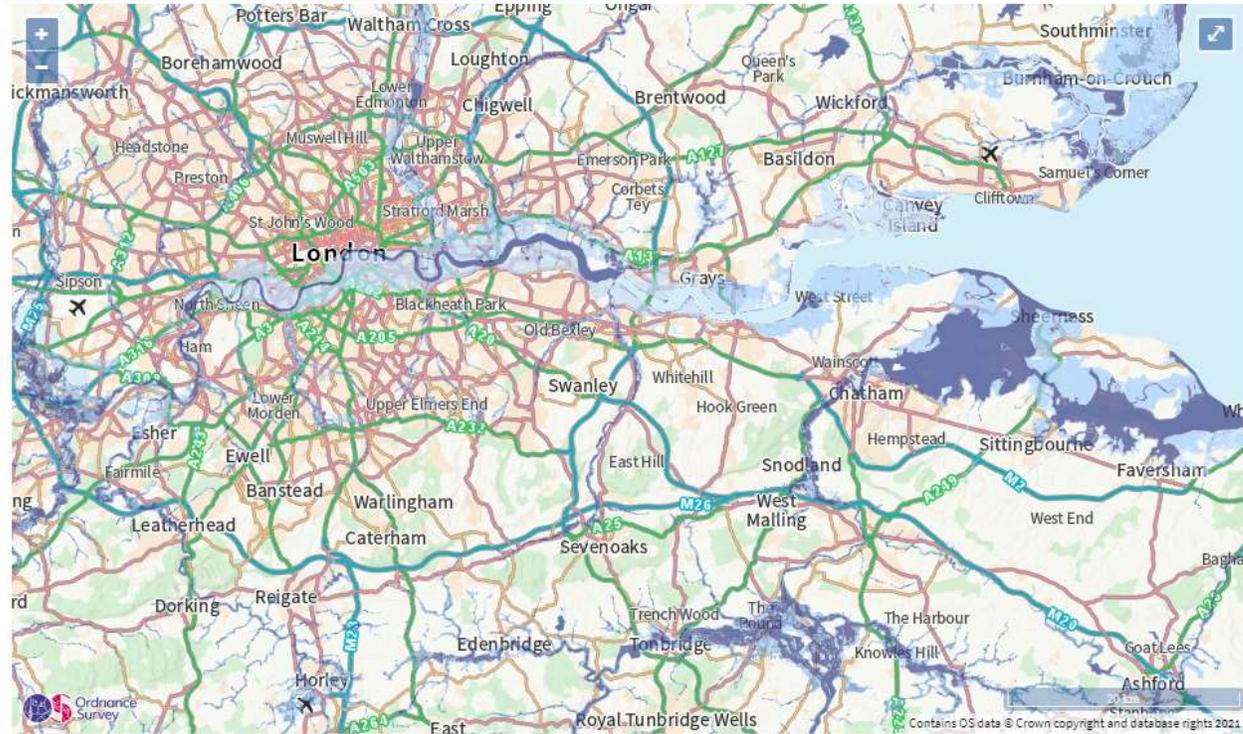
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

London



- High > 3.3%
- Medium 1% - 3.3%
- Low 0.1% - 1%
- Very Low < 0.1%

Extent of flooding from rivers or the sea

- High
- Medium
- Low
- Very low

<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

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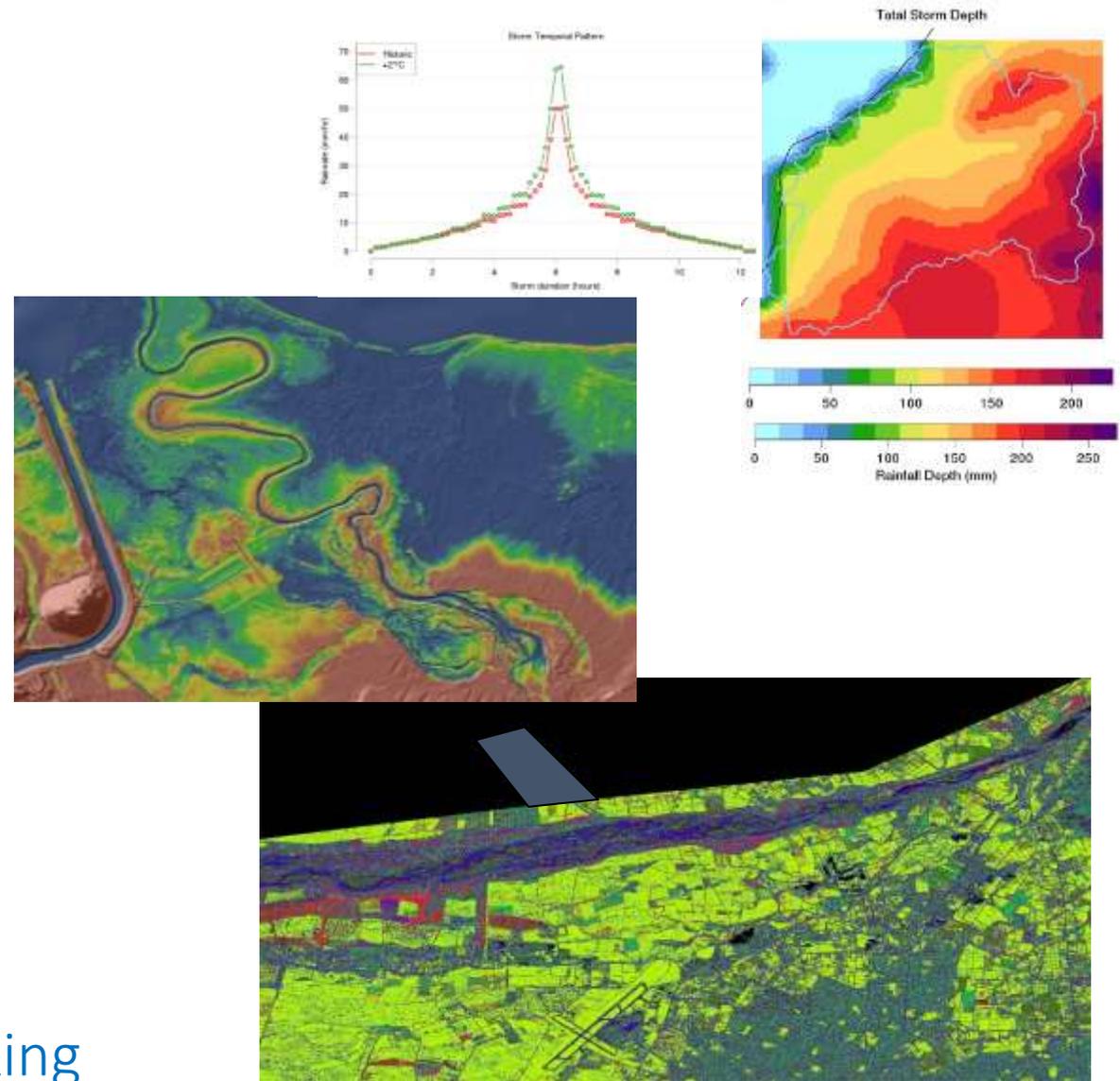
Local and Regional Benefits

- Forum to discuss flooding issues and solutions
- Development of next generation methodologies:
 - Climate change
 - Could become national guidance depending on MfE
 - Risk (especially to infrastructure networks)
 - Understanding cascading impacts of flooding
 - Economic, social and cultural
 - Community engagement
 - Treatment of uncertainty
- Provides flood hazard maps for locations without data
- Open-source interim and final outputs



Open Source Outputs:

- Flood hazard and risk layers
- Website and GIS layers
- Consistent regionally-appropriate design storms for all Aotearoa
- Current and Climate Change Scenarios
- Hydraulically-conditioned DEM
- Z_0 roughness maps (equivalent to depth dependent Mannings N)
- Methodology for incorporating climate change
- Guidance for national scale modelling
- National scale risk assessments
- Assessment of stopbank benefits
- Tools to support adaptation decision-making



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Richie Goldsbury

Long term

- This Endeavour will set up the framework for continued flood hazard and risk assessments, methodologies for community engagement and a platform flood issues , Te Whāriki ō te Wai
- This is an iterative process – it won't be finished at the end of the Endeavour, we are focused on continual improvement
- NCCRA requires re-evaluation every 6-year
- Envisage updating flood hazard and risk on a similar timeframe (additional LiDAR, infrastructure data, improved methodology, climate change etc.)
- Will be looking to government to fund this ongoing work

If you are interested in receiving ongoing information from this programme or you wish to be involved in Te Whāriki ō te Wai please contact:

Belinda Sleight belinda.sleight@waikato.ac.nz



Thank you

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