RNC Monthly Meeting
November 2020

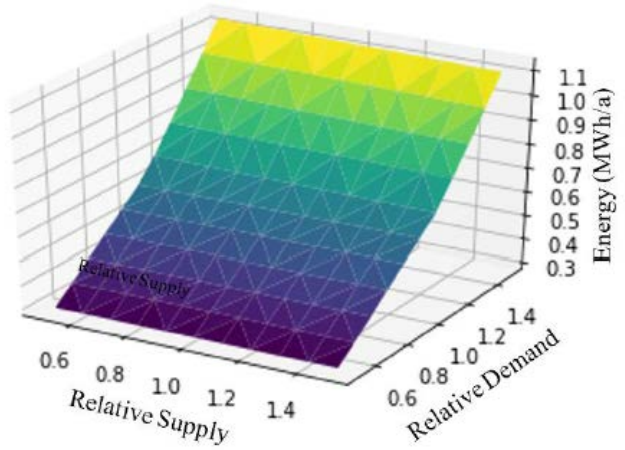
Drought: Water-Energy Nexus

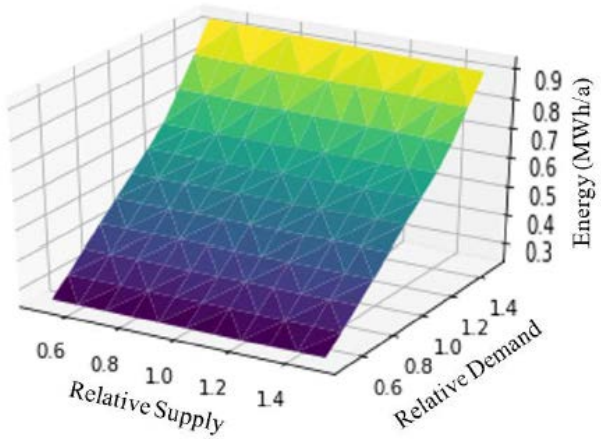
- Watercare
  - Net zero emissions by 2050
  - Reduce operational GHG by 45% by 2030

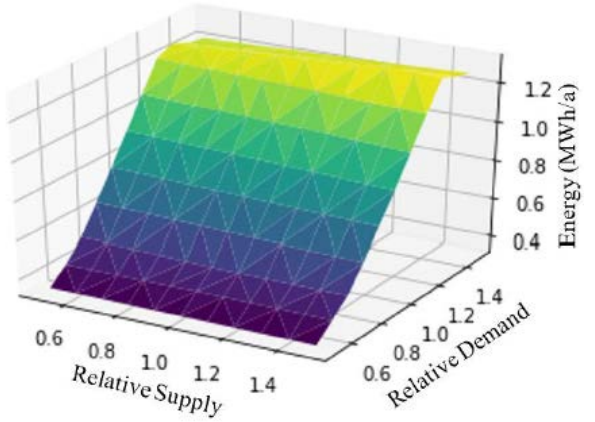
- Python model – transmission network
  - Demand-side impacts
  - Supply-side impacts
  - Impacts on energy

- Multi-Criteria Decision Making
  - Quantity (L/day)
  - Quality
  - Emissions
  - Cost (new *vs* reactivate *vs* increasing supply)
  - Long-term sustainability

- Demand-side reductions







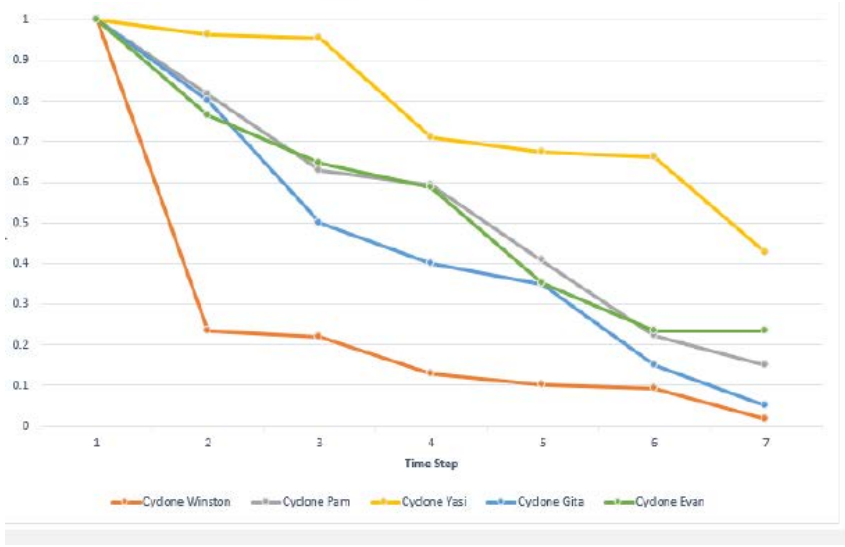
Pacific Shipping – Network Vulnerabilities

- Increasing reliance on external sources
  - Pacific sees little focus (size, location)
  - Implications on populations aren't accounted for
  - Cyclones highlight: vulnerabilities, recovery, closures

- Data
  - 122 ports, 504 edges
  - Shipping routes, trade values, CO_2, past disruptions

- Modelling/Simulation
  - Python model to route trade flows balance supply/demand, minimising disruptions
  - Multi-scenarios, historic/hypothetical

- Outcomes
  - Relatively constrained (little flexibility/redundancies in some areas)
  - Consider human factors (being able to work/repair from t_0?)
  - Issue if you study islands as closed systems (like we do with regions in NZ)



Coastal Vulnerability of Transport Infrastructure in Rarotonga

Rarotonga

- TC ~3.5 years ($6 million EAD)
- 1986 (TC Sally) ~66% GDP

Existing Work

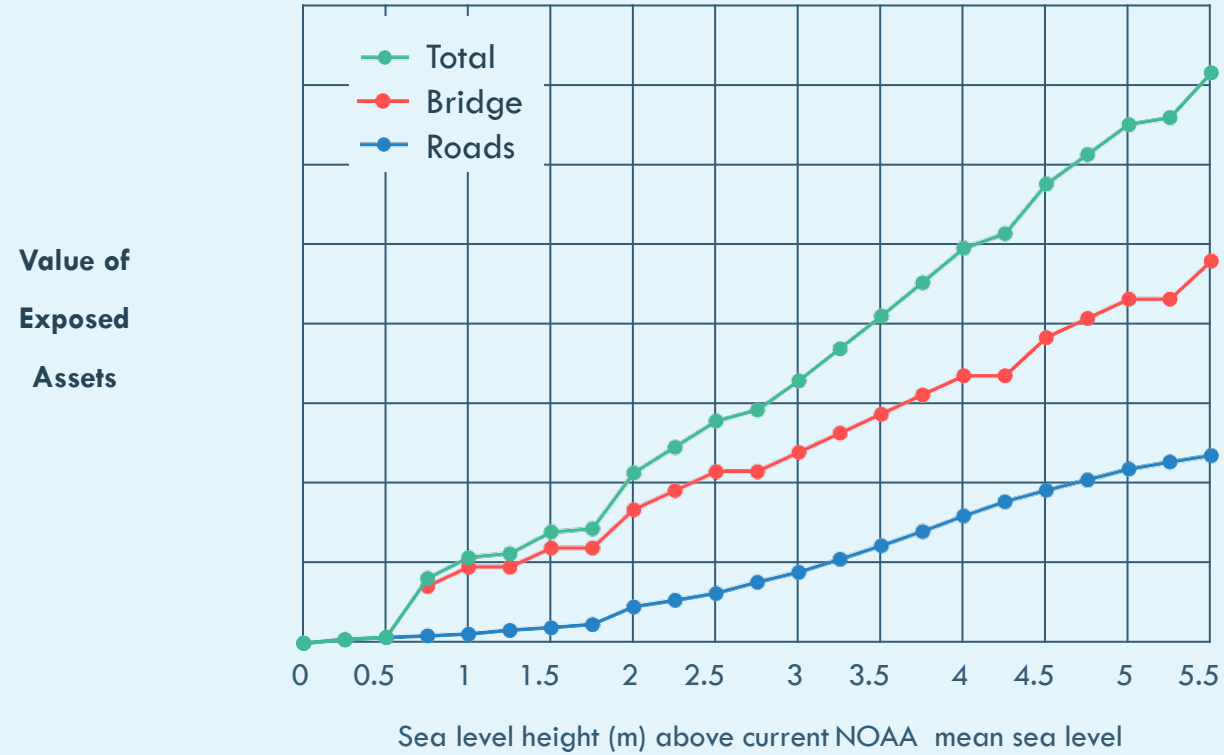
- Fragmented work across the Pacific in this space
- A lot of frameworks, little follow up or quantification
- Issues with access/sharing

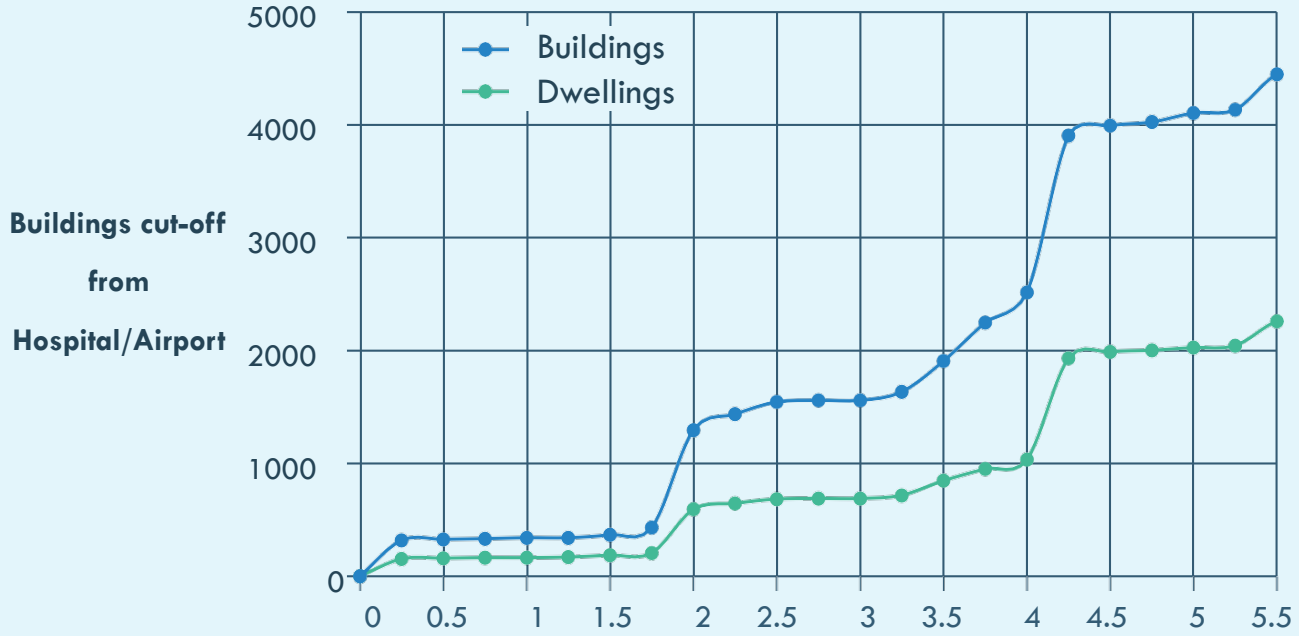
Data

- NOAA (1”)
- 0.25 m increments
- 5.5 m scenario combines 0.5 m SLR and 5 metre storm surge
- OSM – road classes
- PCRAFI – buildings, bridges

IMPLICATIONS

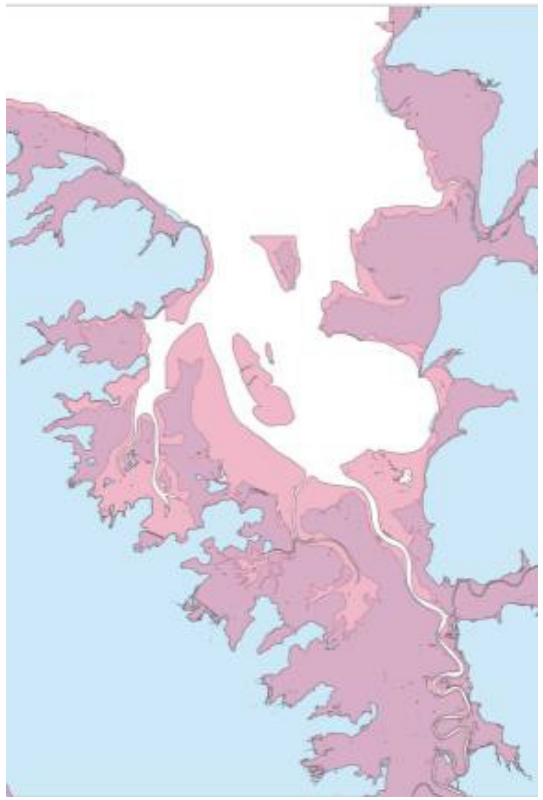
- Low exposed value initially (as expected)
- Linear increases, typically would expect stepping
- Less redundancy leads to greater societal impacts (Hospital/Airport as critical facilities)
- Up to 2/3 affected in some scenarios
- Importance of focusing on the '*so-what*' rather than # of assets or $ damage
- Inland road extension has significant benefits, although ↑$ (3km, 5 bridges)



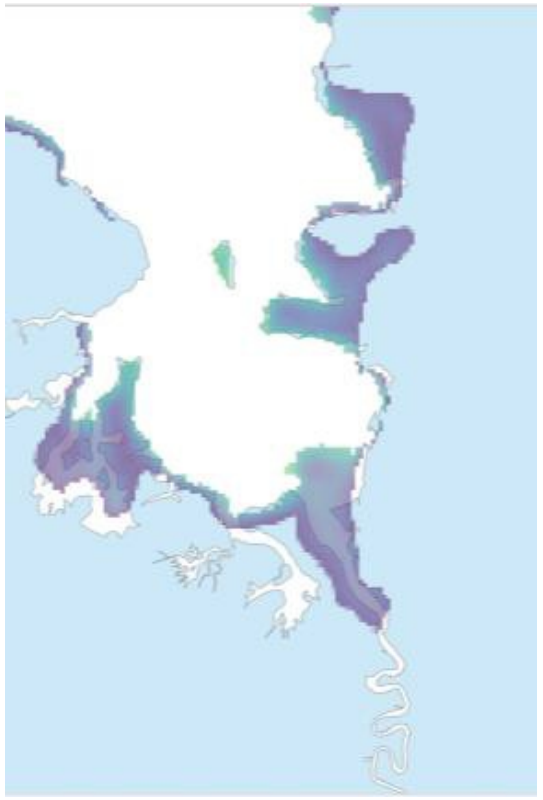


Coastal flooding – DEM importance

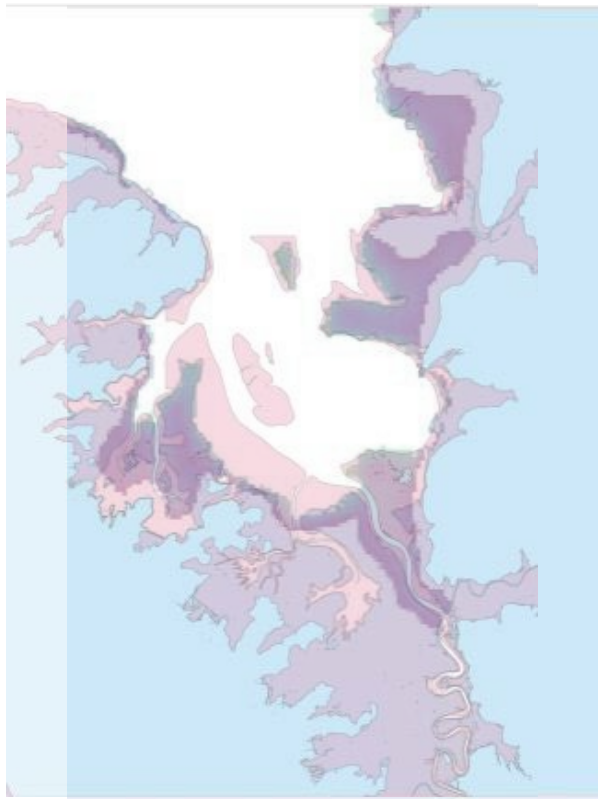
- Global resolution models for all types of flooding and climates
- Typically validated to areas of interest
- Significant variation on local data



Local
(Paulik et al.)

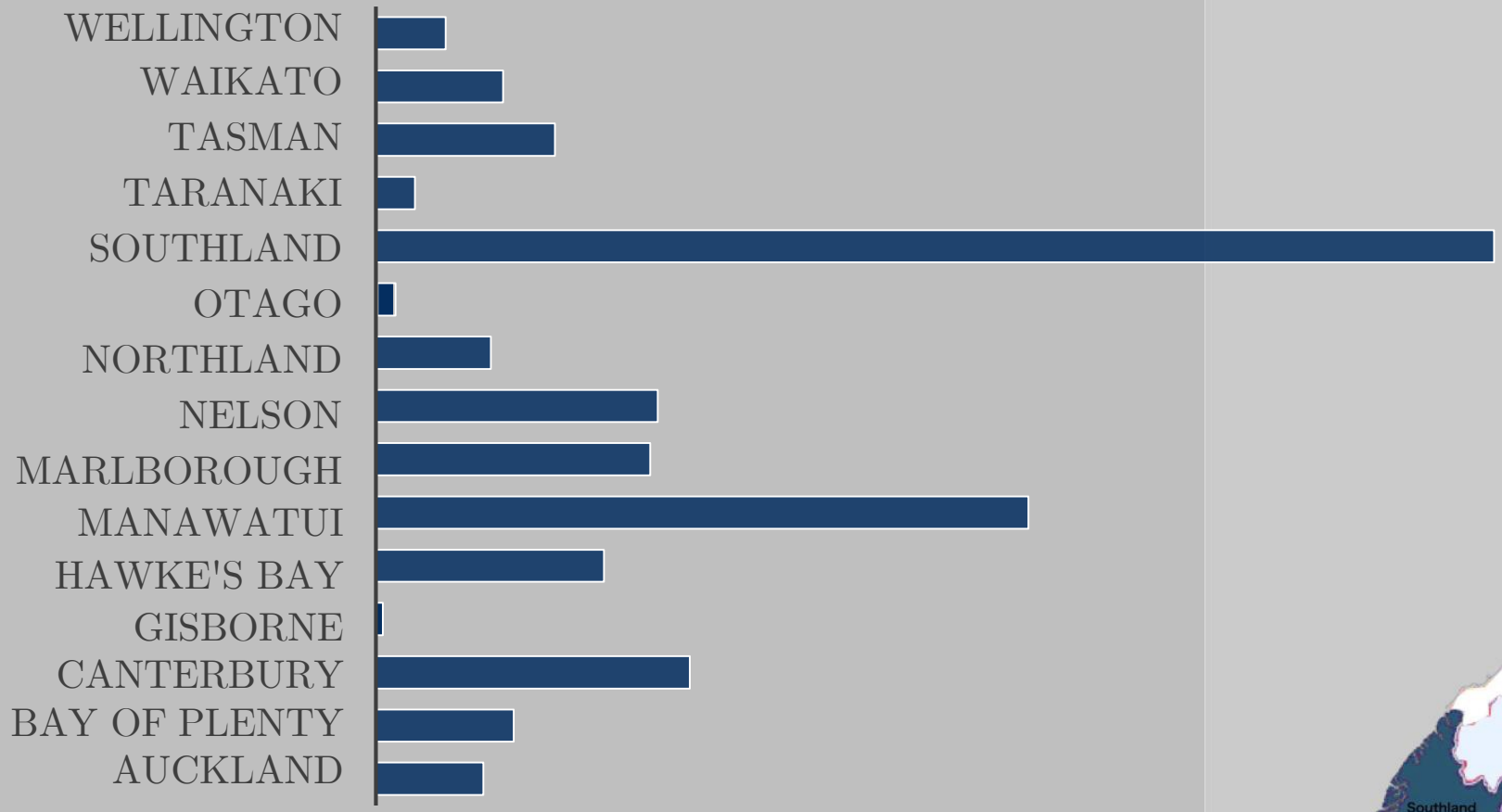


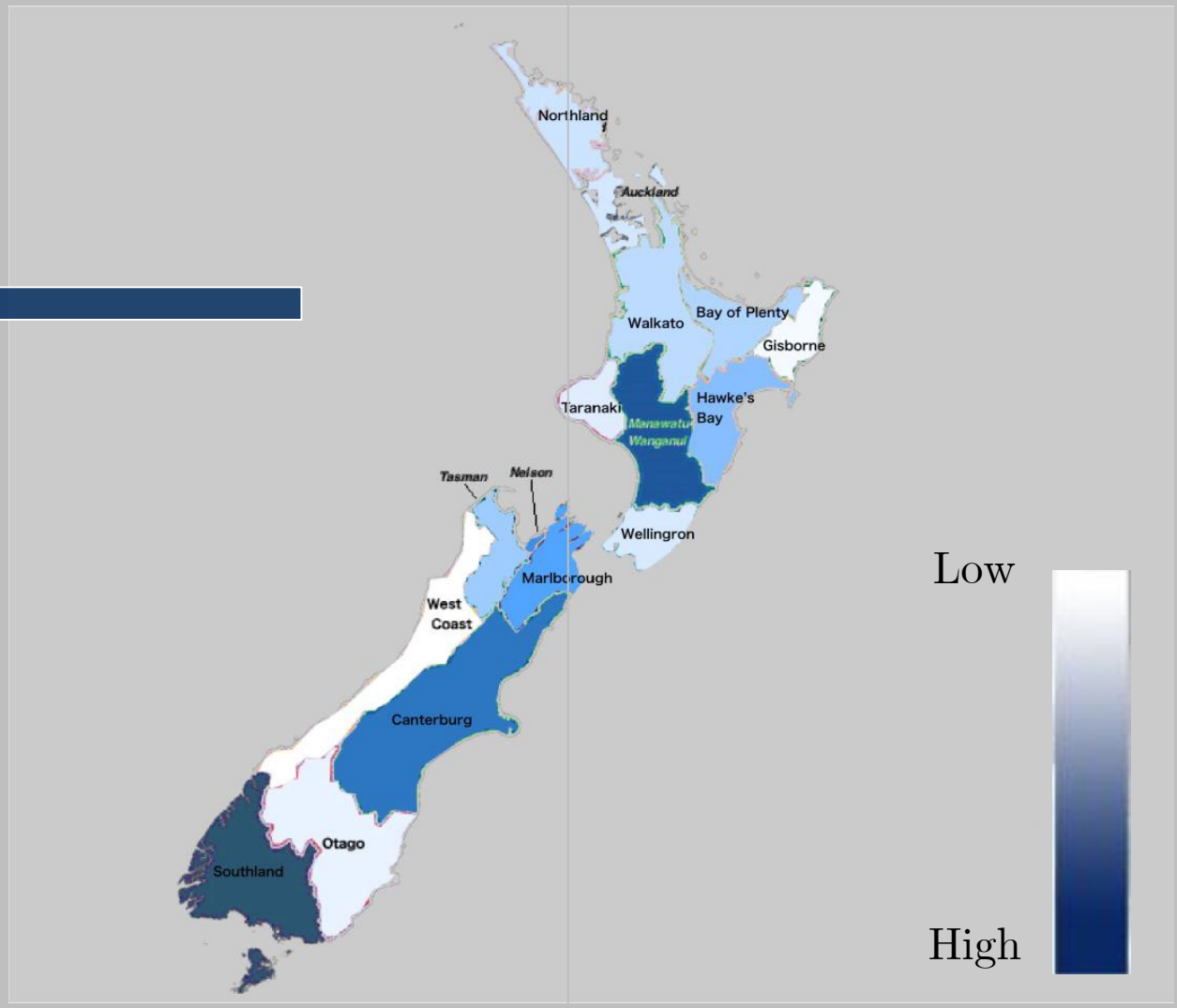
Global



Difference

Agreement between models





National Assessment of Critical Infrastructure Network Service Disruption from Future Coastal Flooding

October 2020 - October 2023

Previously:

- Exposure assessment of:
  - 100-year return period extreme sea levels
  - +0.1 m increments (up to +3.0 m) to incorporate sea-level rise
  - Building and infrastructure exposure

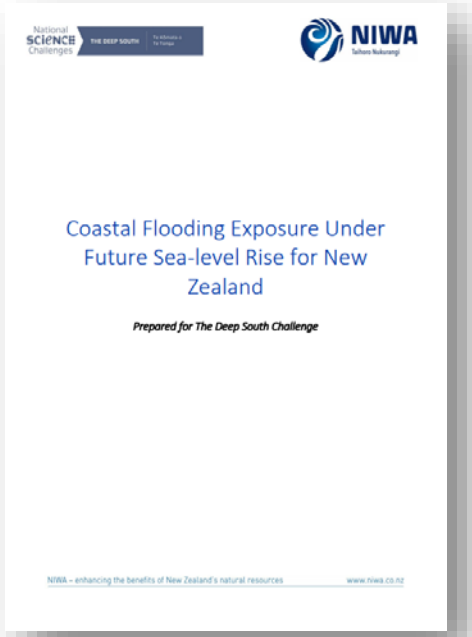
- Open Access Publications


sustainability

MDPI

Article

National-Scale Built-Environment Exposure to 100-Year Extreme Sea Levels and Sea-Level Rise

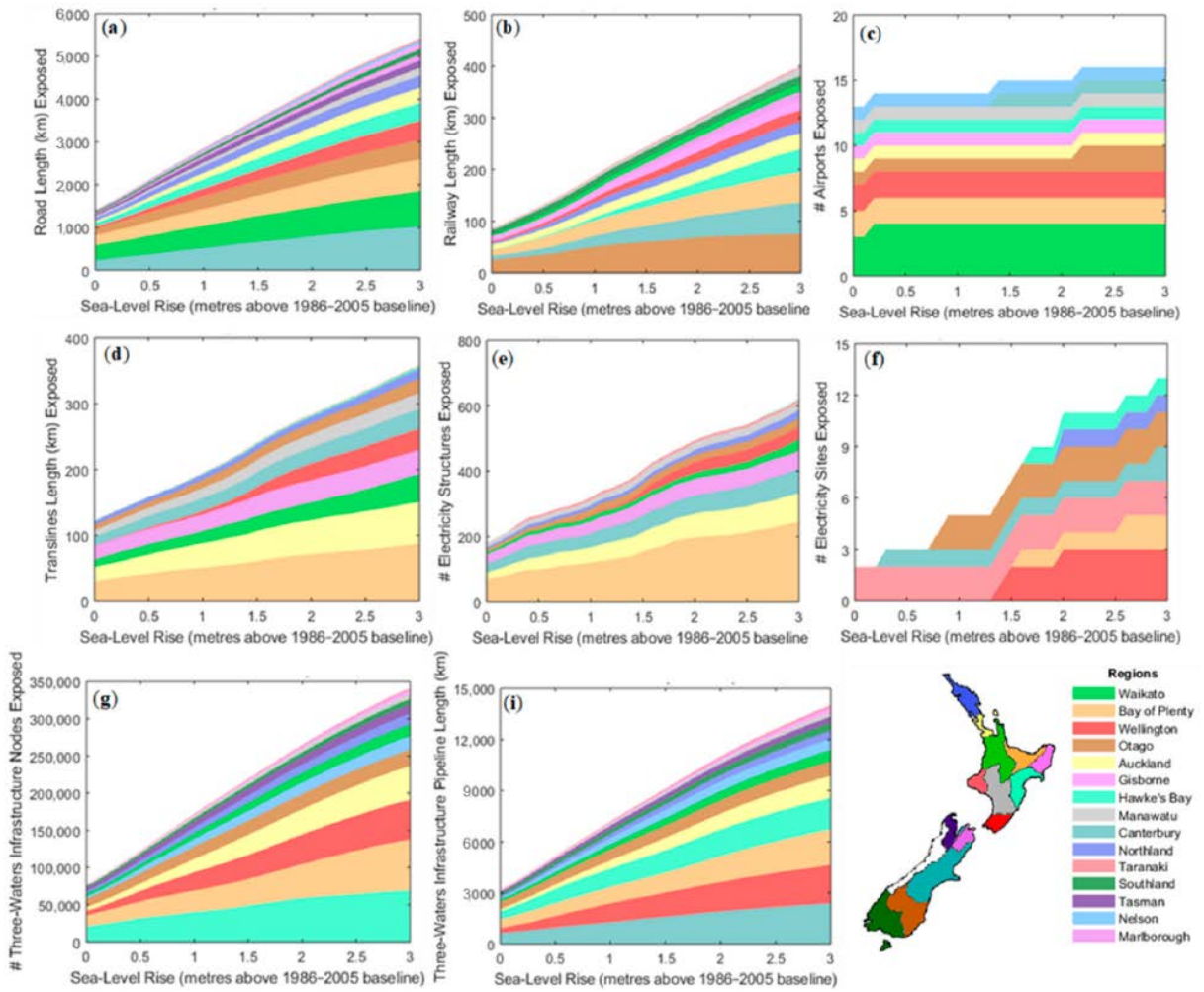

National SCIENCE Challenges THE DEEP SOUTH

NIWA

Coastal Flooding Exposure Under Future Sea-level Rise for New Zealand

Prepared for The Deep South Challenge

NIWA – enhancing the benefits of New Zealand's natural resources www.niwa.co.nz



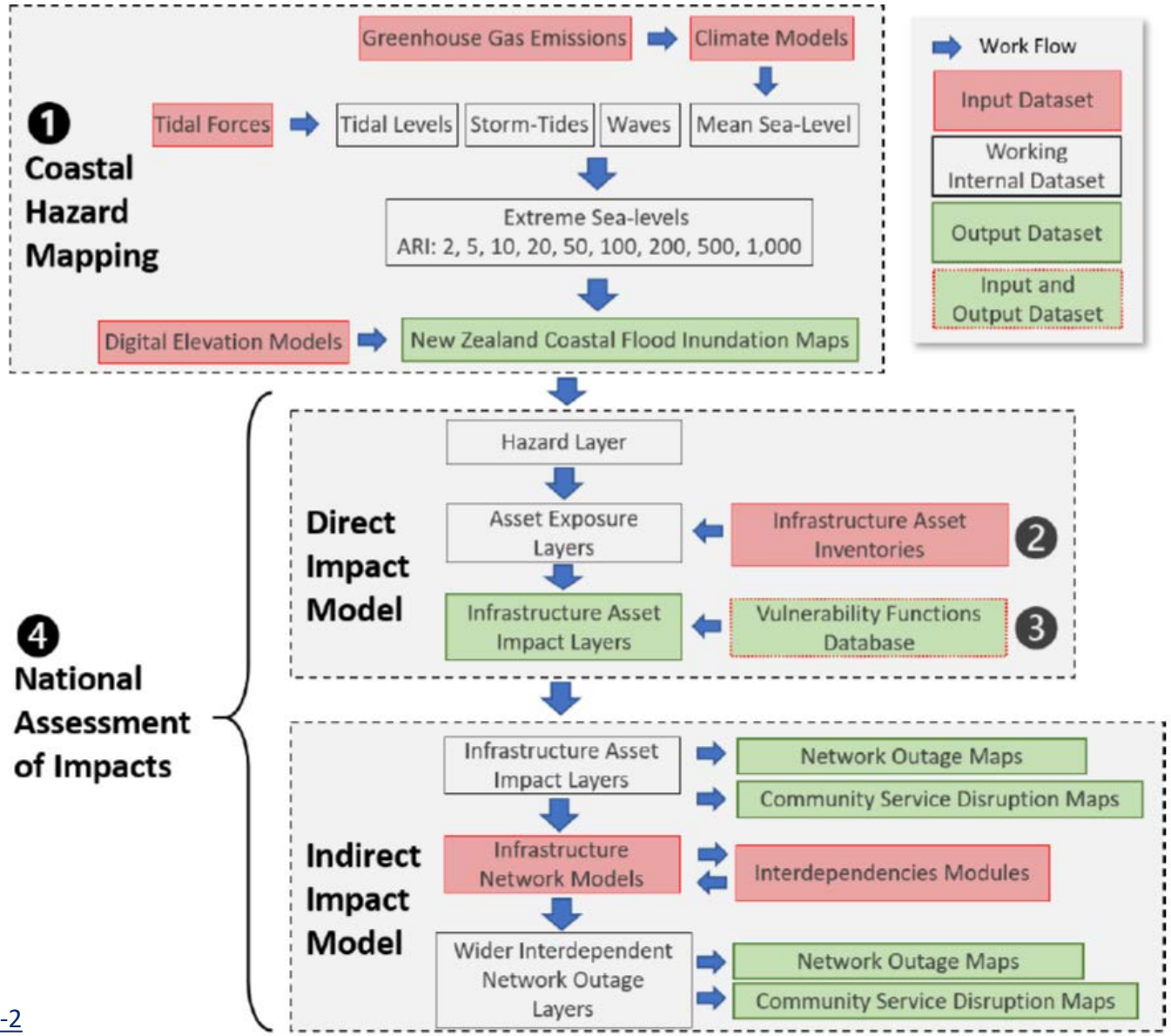
deepsouthchallenge.co.nz/projects/national-flood-risks-climate-change

National Assessment of Critical Infrastructure Network Service Disruption from Future Coastal Flooding

October 2020 - October 2023

New Project:

- Extend to a wider range of return periods (2, 5, 10, 20, 50, 100, 200, 500, 1000)
- New LiDAR in regions replacing low-res DEM
- Quantify direct and indirect impacts to infrastructure via interdependencies
- Mapping spatial extent of outages due to coastal hazards
- Range of sector specific metrics: population, freight, lost-load, etc.
- Online data portal

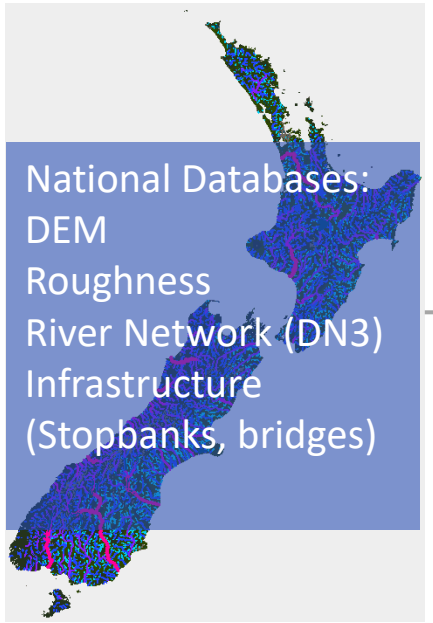


deepsouthchallenge.co.nz/projects/infrastructure-disruption-coastal-flooding-phase-2

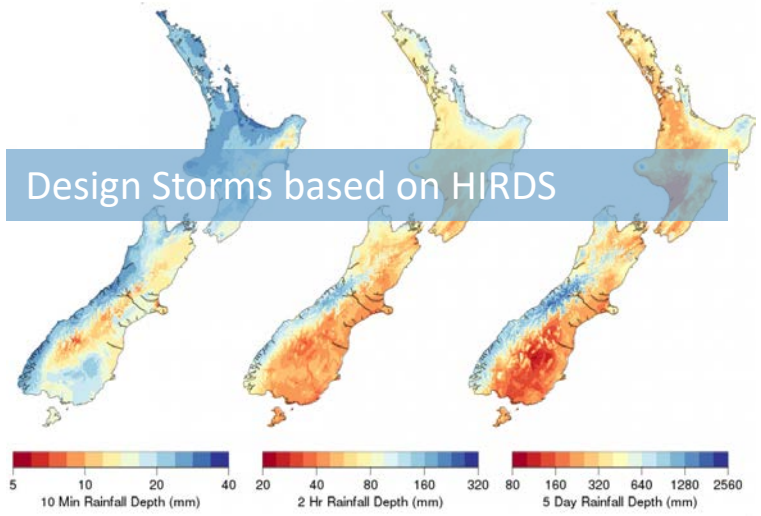
Reducing flood inundation hazard and risk across Aotearoa-NZ

October 2020 - October 2025

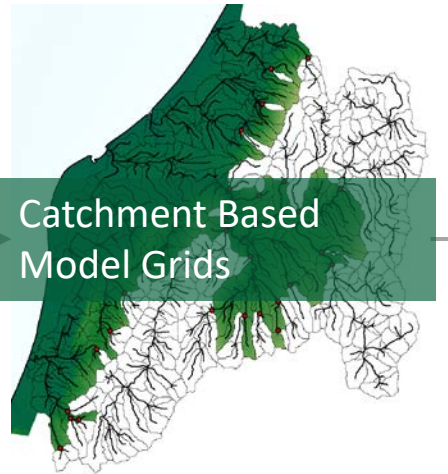
Nationally consistent flood inundation hazard and risk assessment for current conditions and future scenarios under climate change.



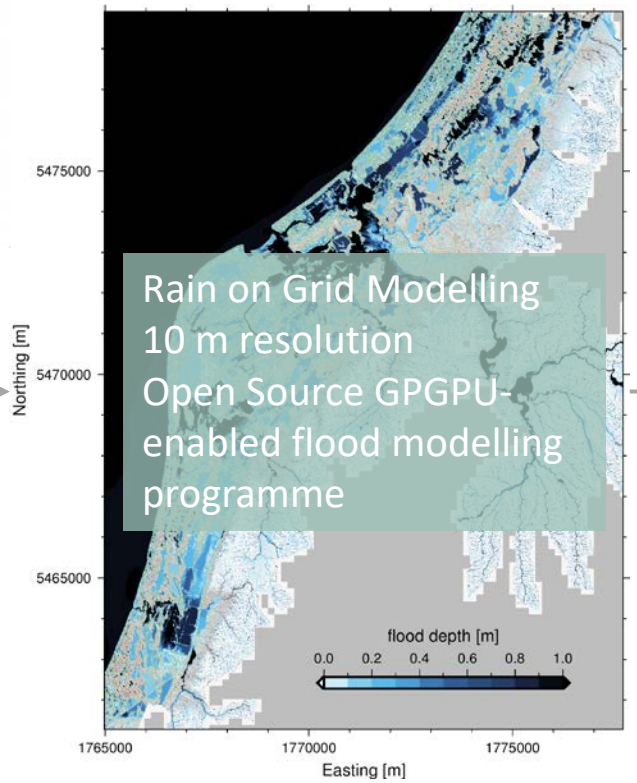
National Databases:
DEM
Roughness
River Network (DN3)
Infrastructure
(Stopbanks, bridges)



Design Storms based on HIRDS



Catchment Based
Model Grids



Rain on Grid Modelling
10 m resolution
Open Source GPGPU-enabled flood modelling programme

Stitch together into national grid

Reducing flood inundation hazard and risk across Aotearoa-NZ

October 2020 - October 2025

Key Contacts:

- **Flood Mapping** – Emily Lane
- **Risk to Infrastructure** – Ryan Paulik
- **Societal Vulnerability** – Paula Blackett
- **Adaptation & Reducing Risk** – Iain White & Silvia Serrao-Neumann