NIWA
Taihoro Nukurangi

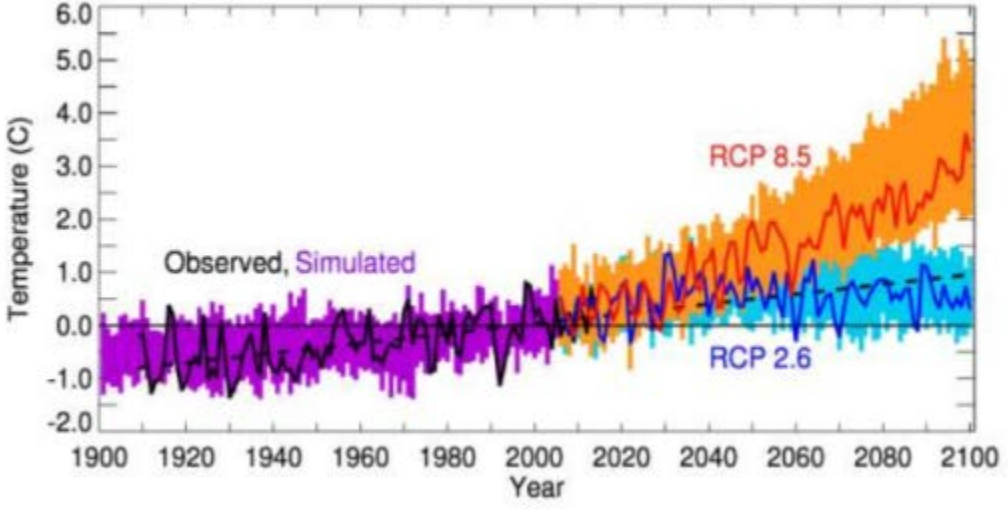
Rising challenge for local government: adapting to changing climate risks

Rob Bell (NIWA)

LGNZ: Risk Management Master Class, Dunedin, 25 July

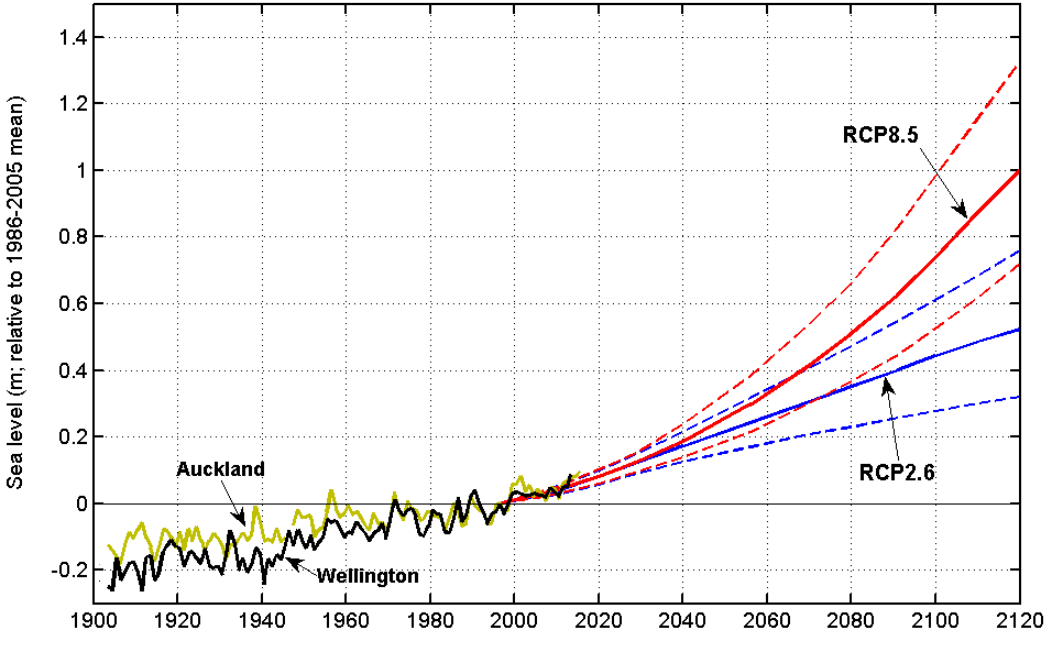
Tale of two centuries

Temperature for NZ (°C)



MfE Guidance Projections, June 2016

Sea-level rise (m)



NIWA, J. Hannah & IPCC

Key climate-change impacts & implications

NZ impacts (probable top 3 physical)

- Coastal & lowland areas - ongoing sea-level rise & erosion
- Not enough water – increased frequency of droughts (esp. east)
- Too much water – flooding, higher intensity rainfall, storms

Justin Watene

Implications for LG infrastructure/assets

- Coastal flooding, g/w + rain (drainage, roads)
- Potable water supply (drought, salinization)
- Urban flash flooding (stormwater)
- River-flood protection (rainfall, SLR)
- Rain-induced landslides (drainage, roads)

Coastal inundation has been infrequent, but ….

Dave Allen, NIWA

June 2013

Benjamin Eitelberg

Jan 2011

1-in-100 year event becomes an annual affair with modest sea-level rise: so likelihood virtually certain (by around 2050-60s)

2.9 m spring-tide range

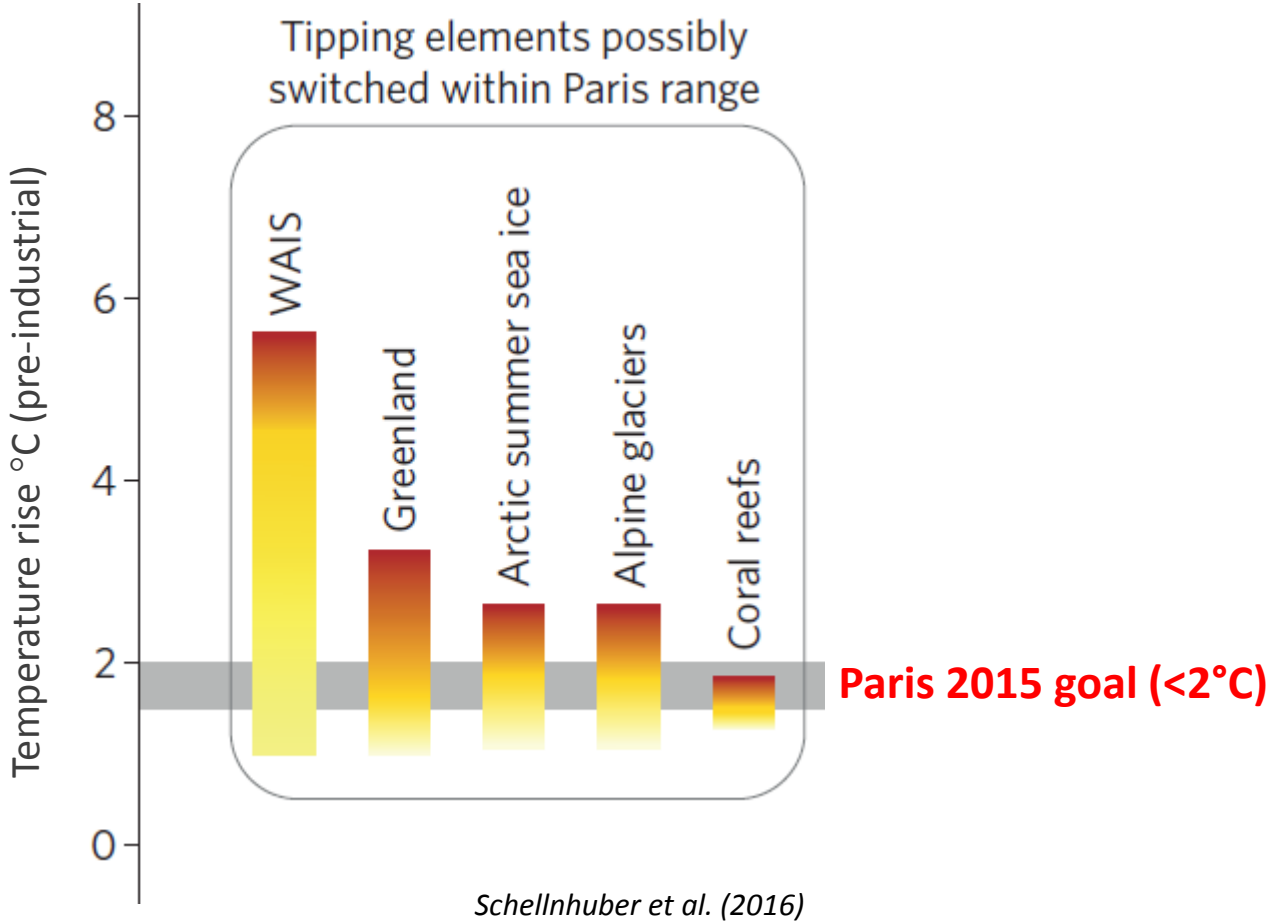
SLR	Auckland
0cm	Every 100 years
10cm	Every 35 years
20cm	Every 12 years
30cm	Every 4 years
40cm	Every 2 years
50cm	Every 6 months
60cm	Every 2 months
70cm	Every month
80cm	Every week
90cm	Twice a week
100cm	Every day

1.4 m spring-tide range

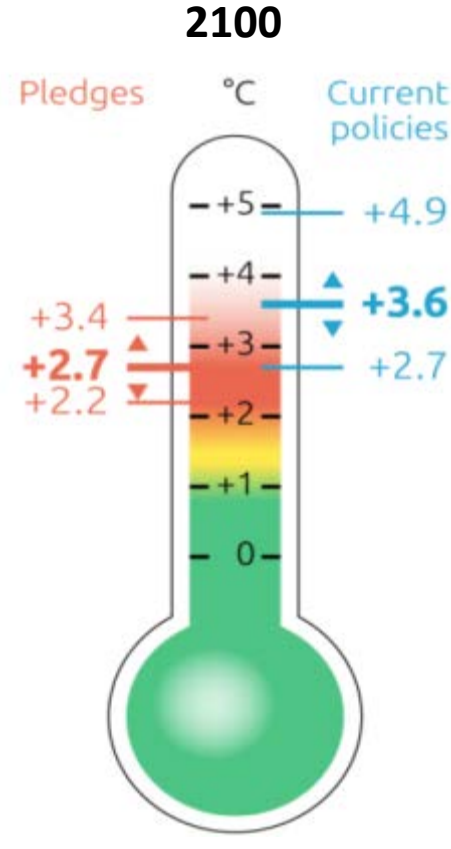
SLR	Wellington
0cm	Every 100 years
10cm	Every 20 years
20cm	Every 4 years
30cm	Once a year
40cm	Every 2 months
50cm	Twice a month
60cm	3 times a week
70cm	Every tide
80cm	Every tide
90cm	Every tide
100cm	Every tide

PCE (2015); NIWA (2015)

Emissions, targets & adaptation deficit

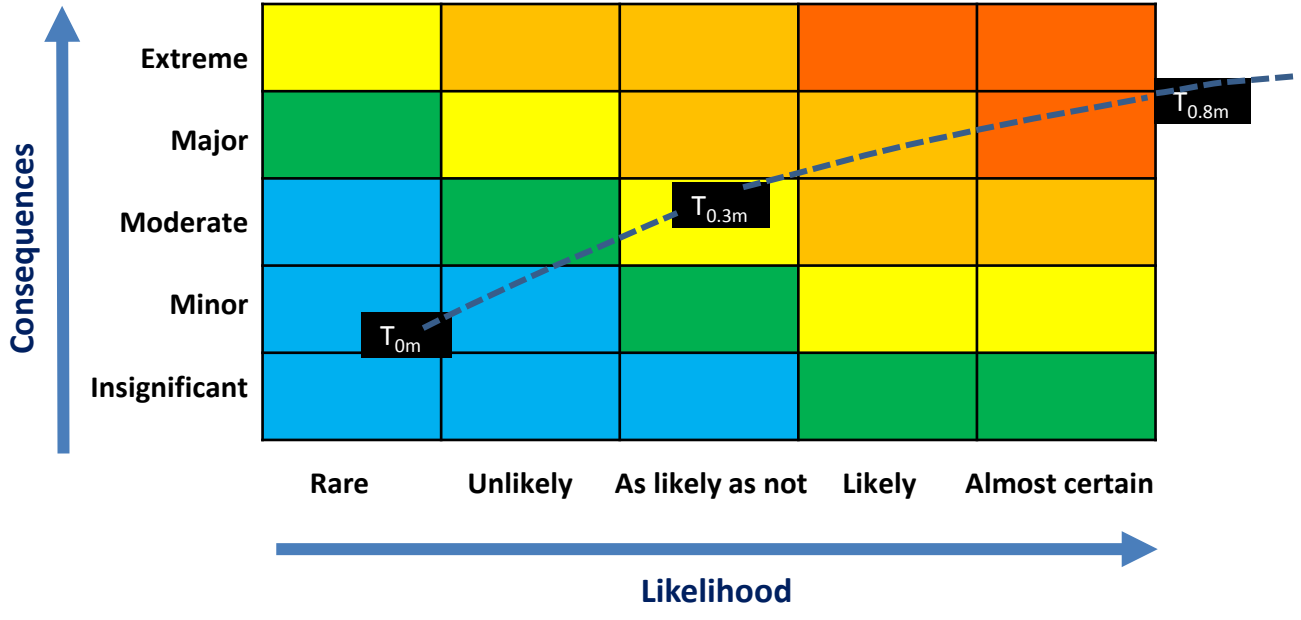


Schellnhuber et al. (2016)



COP21-Paris (Dec 2015)
Climate Action Tracker

Risk heat map: Coastal–storm inundation risk (start with 1% AEP)



Issues with conventional risk analysis:

- Saturates out quickly in "likelihood" of the hazard occurring for a given SLR or planning timeframe
- Need to consider scenarios of possible risk trajectories (for various timeframes)
- Future concurrent/cumulative risk over the **region/district** and even NZ not factored in easily
- Difficulties comparing with other hazard risks – when likelihood "almost certain"

Framing risk for evolving climate futures

- Risk is effect of uncertainty on objectives (or *likelihood* of *consequences* from an event)
- Need to get beyond hazard exposure (e.g. maps) – risk could be small
- For climate change, focus been on nailing-down “likelihood” (or pre-determining the future)
- More needed on assessing vulnerabilities and consequences for a range of possible futures.
- Uncertainty is a serious challenge – can result in wait & see without considering lead times (community engagement, council planning, consenting, implementation)
- Spatial scale of risk: future concurrent & cumulative risk across district/city/region
- Dynamic adaptive pathways planning provides a set of pre-planned alternative measures or policies, which may change “tracks” at various agreed decision-points.
- Monitoring and reviewing will be even more critical in a constantly evolving climate to support adaptive planning

RiskScape: overlays climate-related hazard & assets = risk

INPUT MODULES

Hazard Module

Vulnerability Module

Asset Module

DATA PROCESSING

Asset impact and loss calculation

MODEL OUTPUTS

Individual asset impacts and losses

Aggregated asset impacts and losses

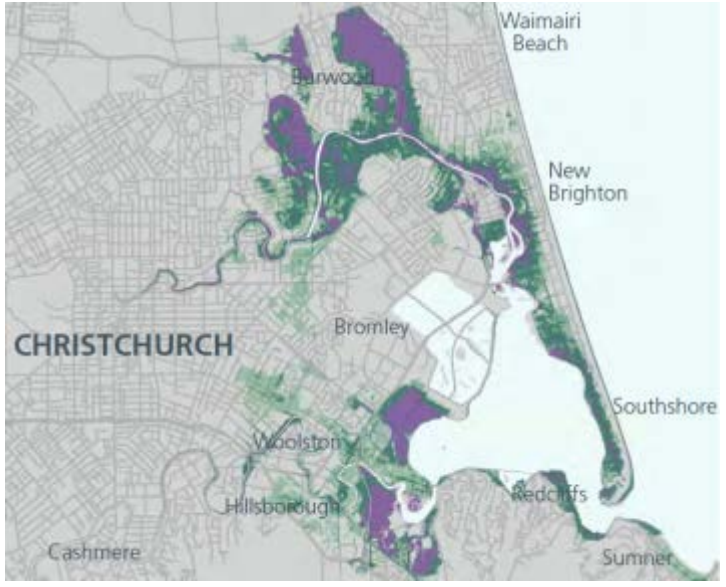
RiskScape

NZ's coastal risk exposure for ≤0.5 m above MHWS

A risk analysis based on **land elevation**: excl. stopbanks and **enumerating assets/residents**

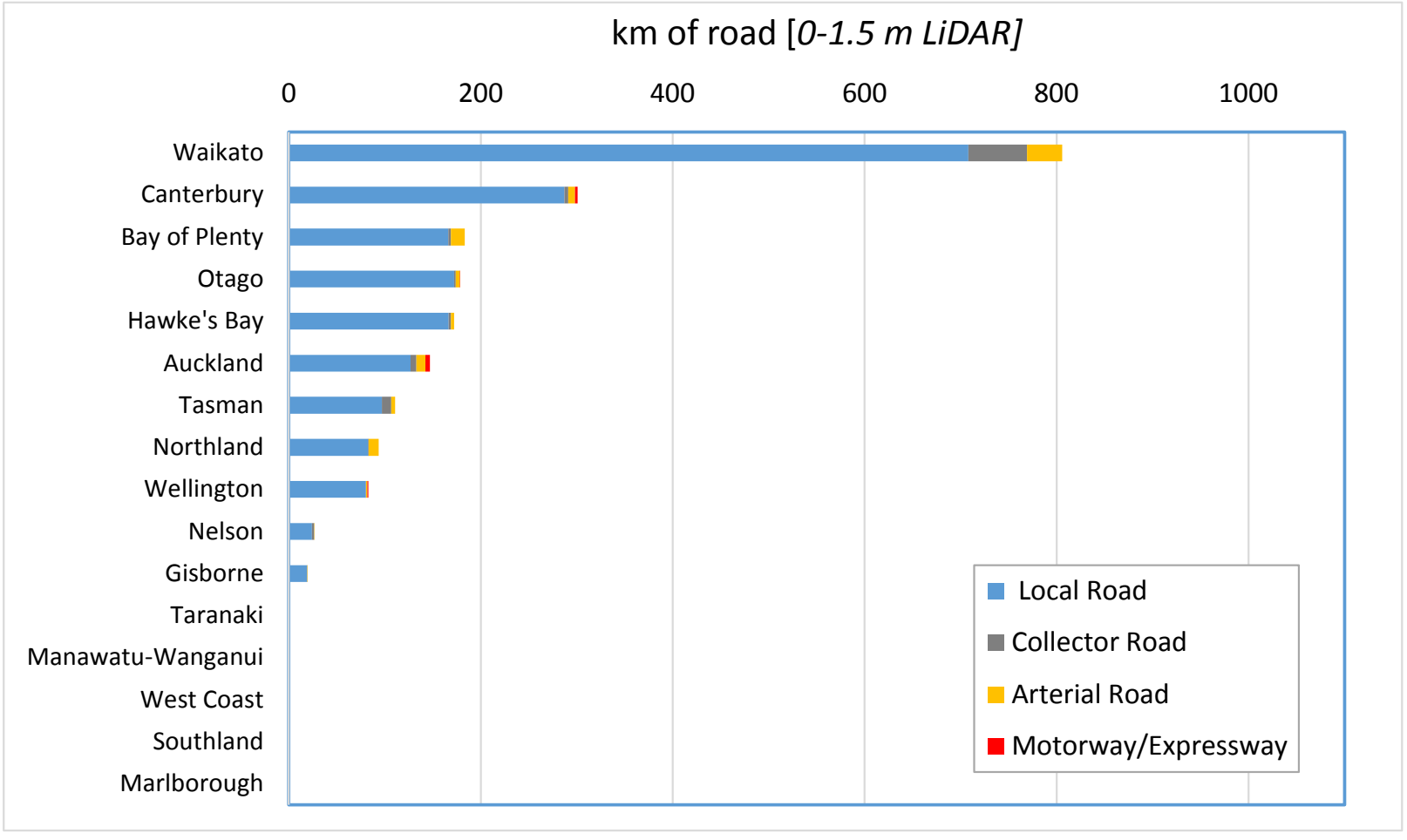
- Population (NZ Census 2013)
  - ~46,000 residents (excl. Red Zone)
- Buildings in NZ
  - Residential: ~9,000
  - All types: ~13,000
  - Replacement cost (2011): NZ$3B
- Jetties & wharves
  - ~1,500 structures (total 100 km)

Purple: ≤ 0.5 m



PCE (2015); NIWA (2015)

NZ's risk exposure for 0–1.5 m zone: roads



PCE (2015); NIWA (2015)

Resilience of infrastructure: challenges ahead

- Managing the **rising** risk (SLR, rainfall and development/asset values ⬆)
- Key future drivers for assets:
  - SLR - uncertainty at the upper end (esp. ice sheets) tied to emissions – but will be ongoing rise for centuries
  - Rainfall intensity – increases as temperature rises e.g. Dunedin 24% for 3°C
  - Forecasting drought duration – reservoirs & potable water demand
  - Combination & cumulative risks – rainfall + coastal, multiple hotspots
- Statutory framework issues:
  - Short local government timeframes *vs* 30 year AMPs or 100+ yrs (NZCPS)
  - Planning across a changing MHWS boundary (regions & TLAs)
  - Building Act (50-yr horizon & silent on climate-change) *vs* NZCPS/RMA
- How do we do managed retreat from coastal areas or floodplains in A-NZ?
  - who pays, who decides, equity issues, when?, public assets, insurance/bank roles
- Provision of "fit-for-purpose" geospatial resources for risk assessments: accurate LiDAR topography, NZ-wide datum, national asset/building databases

Key message for next few decades:
expect more of this, engage & plan for the longer haul

Buffalo Beach Rd, Whitianga, Aug 1989

South Dunedin, 3 June 2015

Sally Boult