Monitoring foreseeable but uncertain climate change outcomes

Using expert, practitioner and community elicitation

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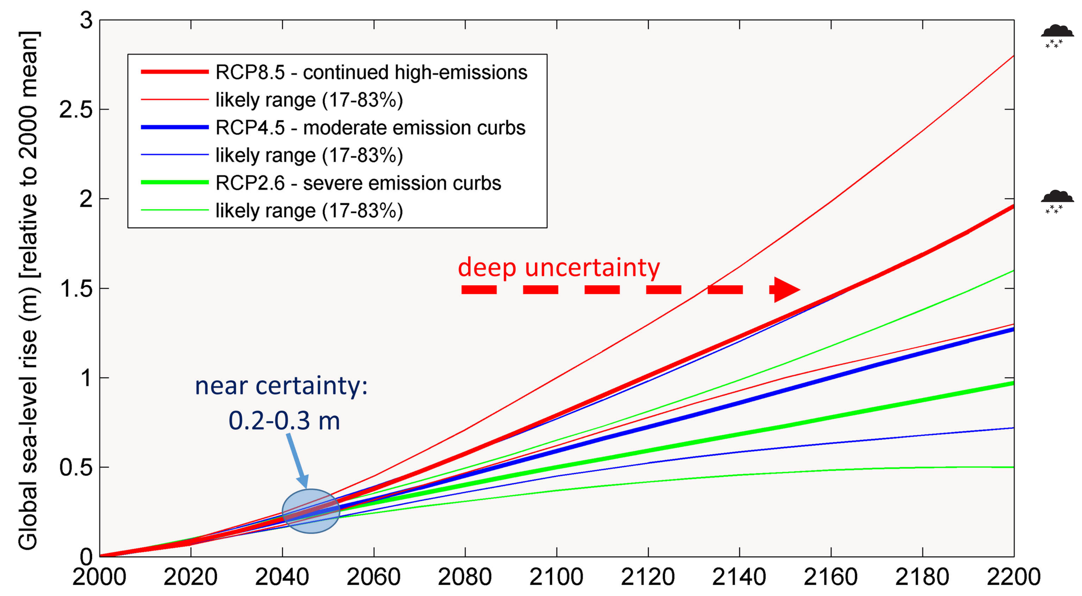
THE CHALLENGE

- Making decisions under uncertainty as frequency of heavy rainfall and sea level rise increase and affect our substantial social and economic exposure.
- Developing, implementing and monitoring climate-resilient pathways in conditions of temporal and spatial uncertainty and change.
- Changing decision and traditional technical behaviours to fit the 'decision space'.

Haumoana coastal erosion, NZ. Photo: Alan Blacklock, NIWA.

Global sea-level rise uncertainty



- Near-term certainty with narrow range of SLR, e.g. up to 2040s.
- From mid-century on: increasing uncertainty as SLR projections widen considerably (+polar ice sheet instabilities).

THE RESEARCH PROJECT: SUPPORTING DECISION-MAKING IN A CHANGING CLIMATE

Objective

- To design signals and triggers for monitoring the implementation of dynamic adaptive pathways planning (DAPP).

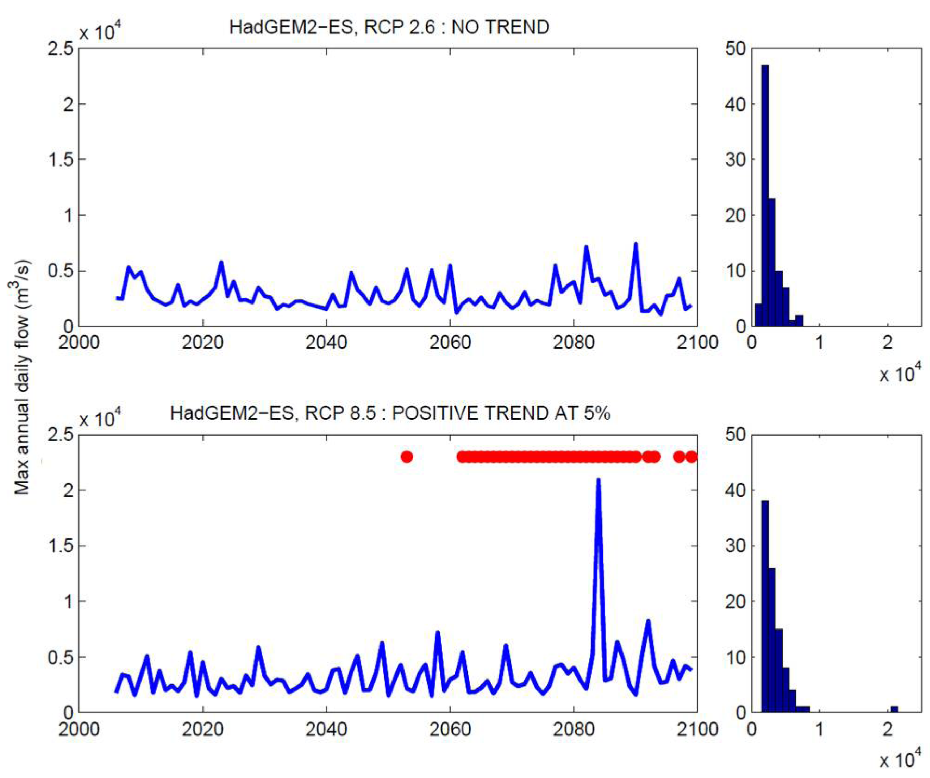
Approach

- Use ensembles of synthetic time-series of rainfall and sea level rise alongside climate scenarios to identify signals and physically derived triggers.
- Use expert elicitation with practitioners from different professional groups with multiple functions.
- Use New Zealand specific scenarios to assess the robustness of signals and triggers, and to help avoid path dependencies and lock in of irreversible, maladaptive decisions under different climatic and socio-economic futures.
- Stress test signals and triggers through coastal strategy development processes with communities for their relevance, credibility and legitimacy.
- Collaborating with Deltares and the Dutch Delta Commission using a five-step framework for a signal system based on signposts and triggers for timely implementation and reassessment of an adaptive plan.
  - Identify key decisions, adaptation tipping points and crucial assumptions.
  - Identify developments that could trigger key decisions or the tipping points or make the assumptions invalid.
  - Identify indicators that could signal such developments or render assumptions invalid.
  - Evaluate indicators for timeliness and reliability as signals using expert elicitation and statistical methods, e.g. noise to signal ratio/ trend analysis.
  - Combine promising indicators for impacts of change, e.g. damages, direct measures of change, systems change.

Emergence of frequent coastal flooding

Kohimarama Rd in Auckland, NZ, during a storm tide. Photo: Benjamin Eitelberg.

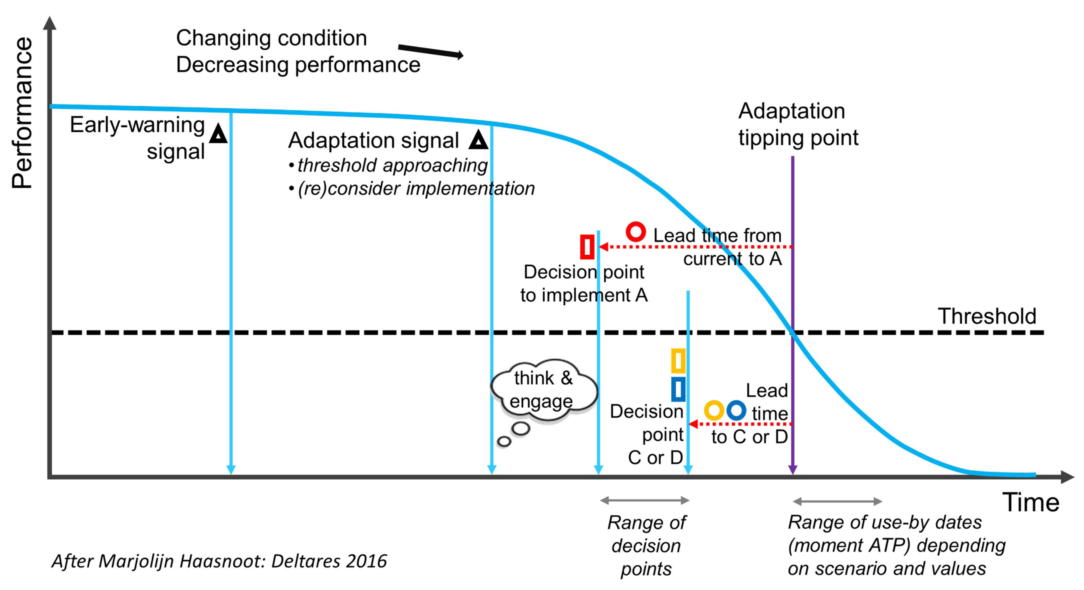
Rivers and floods



Floodwaters surround farmhouses. Photo: Alan Blacklock, NIWA.

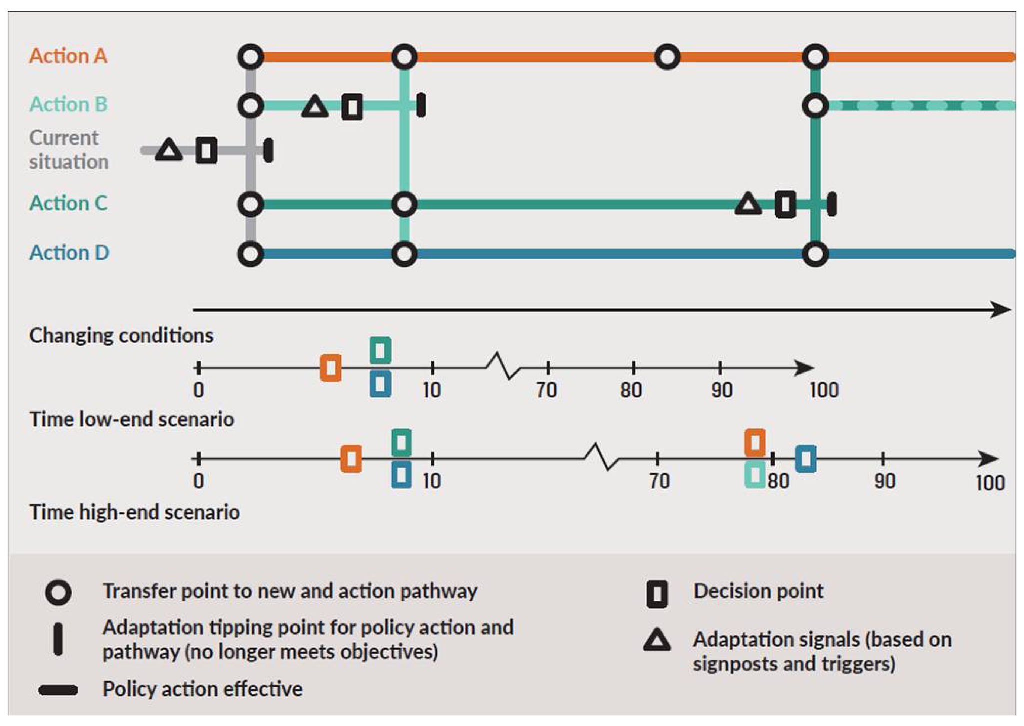
River flows simulated across New Zealand to 2100.
Annual series of flood statistics used with communities and analysed for trends and signal emergence.

Signals, triggers & thresholds



Source: After Marjolijn Haasnoot, Deltares, 2016

Dynamic adaptive policy pathways



Iteration and learning-based approaches

- Use iterative processes.
- Build shared understanding of system functions.
- Develop flexible and and adaptive solutions over time.
- Generate solutions through debate amongst decision makers that are legitimate, credible and relevant.
- Are ongoing processes that can adjust decisions as conditions change.

Possible triggers . . .

- Sea-level rise reaches Y
- No. of damaging events (time-bound or unbound)
- Erosion reaches X metres of houses
- No. of transport link disruptions
- No. of exceedances of stormwater capacity > X
- Reach a fiscal limit
- Perceptions of risk change
- Levels of Service below a critical limit
- Social capacity to adapt exceeded (many smaller events cf. an extreme event)
- Critical facility threatened

A storm on Wellington's South Coast. Photo: Dave Allen, NIWA.

Global scenario architecture

- Representative Concentration Pathway (RCP) globally
- Shared Socioeconomic Pathway (SSP) globally
- Shared Policy Assumptions (SPAs) about climate nationally

Shared socio-economic pathways

	SSP1	SSP2	SSP3	SSP4	SSP5
RCP8.5			**Unspecific Pacific** no mitigation, fragmented world, reactive NZ (8.5-3-A)		
RCP6.0					**Homo economicus** global growth with little mitigation, NZ does minimum but adapts smartly (6.0-5-D)
RCP4.5			**Kicking, screaming** fragmented world that mitigates through power blocks, NZ dragged along (4.5-3-A)		**Clean leader** global growth, significant mitigation, NZ leads, strategically exploits competitive advantage (4.5-5-F)
RCP2.6	**100% smart** global cohesive sustainability focused world with ambitious mitigation, with NZ riding front wave (2.6-1-F)				**Techno-garden** global ambitious mitigation in a cohesive rich world focused on economic gain, NZ keeps economic focus (2.6-5-B)

References

Frame, B. & Reisinger, A., (2016), Exploring Options for New Zealand under Different Global Climates. Synthesis Report RA5. *Climate Changes, Impacts and Implications (CCII) for New Zealand to 2100*. MBIE contract C01X1225. 19pp.

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