

2017 Coastal Hazards Assessment for Christchurch and Banks Peninsula

Report to Christchurch City Council

to accompany Council Report 17/469168

9 November 2017

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Introductions

From University of Canterbury

Dr Deirdre Hart (peer review panel member)

Christchurch City Council staff

Helen Beaumont

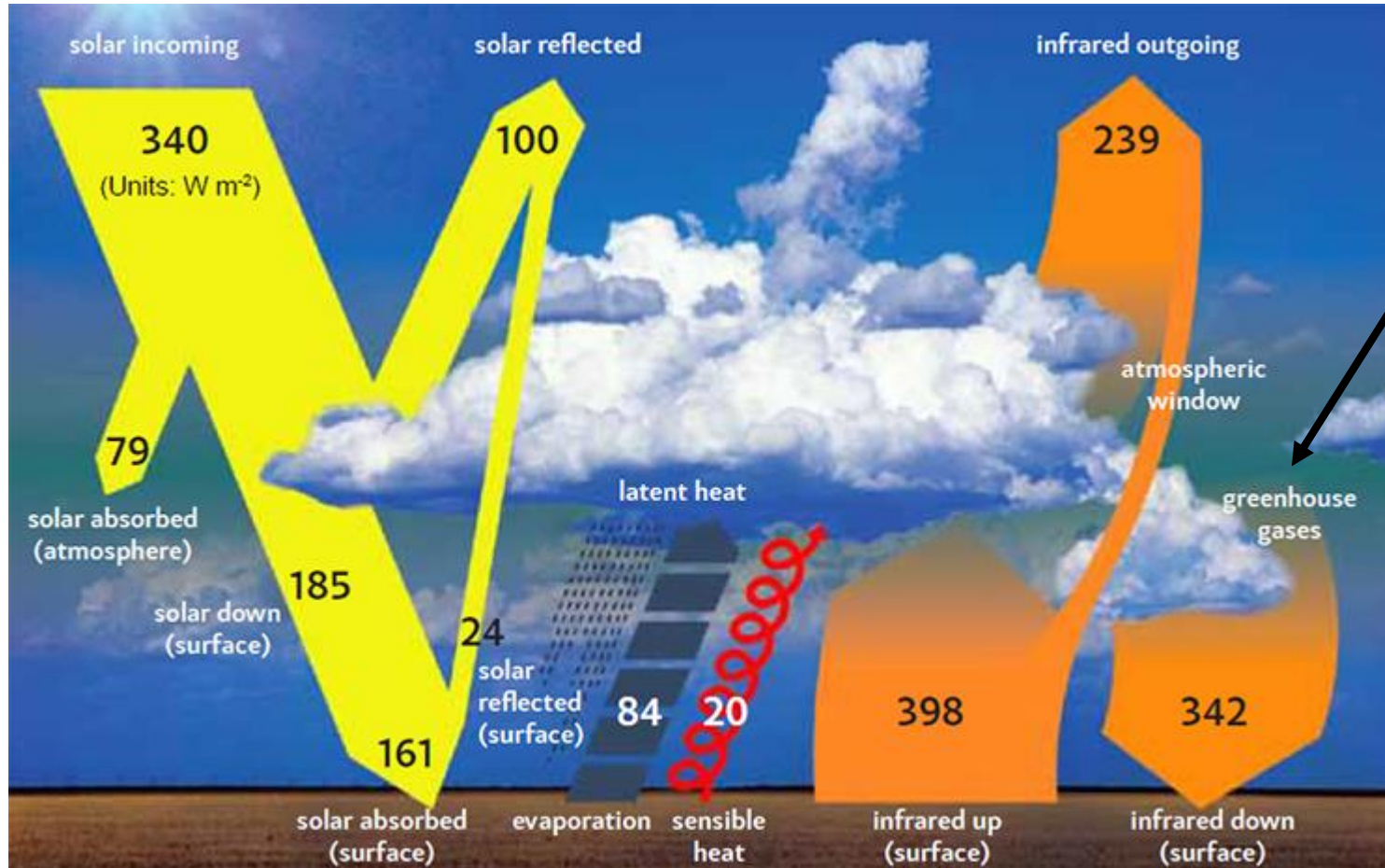
Peter Kingsbury

Tessa Zant

Why we are doing this work

- Climate change and sea level rise - global challenge
- Local Government Act – emphasis on forward thinking
- Local Government Official Information & Meeting Act - availability of information
- Building Act - consideration of natural hazards
- Resource Management Act - manage risks from natural hazards
 - Coastal Policy Statement - objective 5 on coastal hazards and addressing
 - New development
 - Existing development
 - Natural defences
- Civil Defence Emergency Management Act - improve management of risks

Greenhouse Effect: Fourier 1824, Ekholm 1901



Main atmospheric greenhouse gases (GHG) are:

- water vapour
- carbon dioxide
- methane
- nitrous oxide
- ozone.

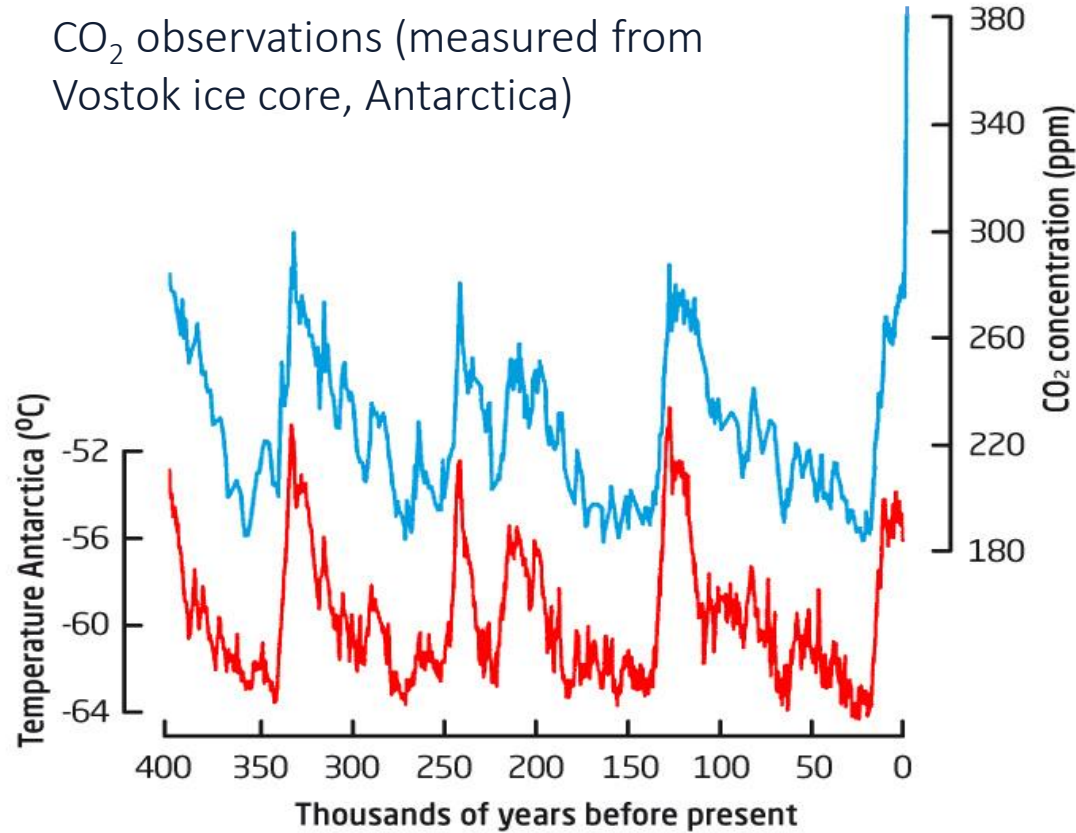


Particles like volcanic ash (when at certain elevations in the atmosphere) & the Earth's surface reflectivity (e.g. ice versus ocean) also influence this balance.

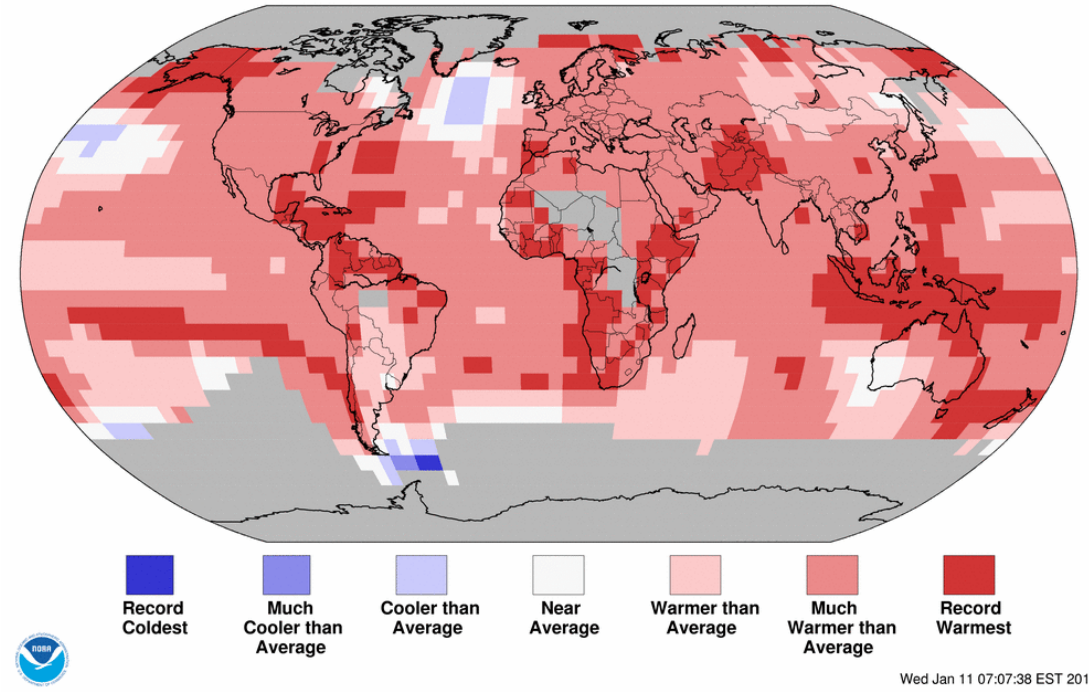
Atmospheric Carbon & Global Temperature

● Now at 404 ppm (versus pre-industrial revolution 280 ppm)

CO₂ observations (measured from Vostok ice core, Antarctica)

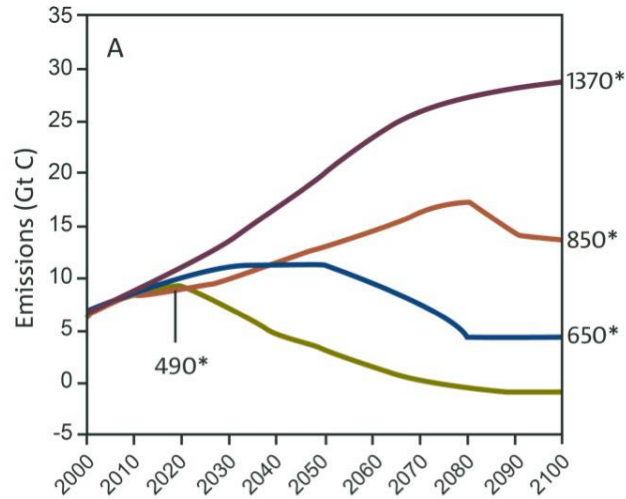


Land & Ocean Temperature Percentiles Jan–Dec 2016
NOAA's National Centers for Environmental Information
Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0

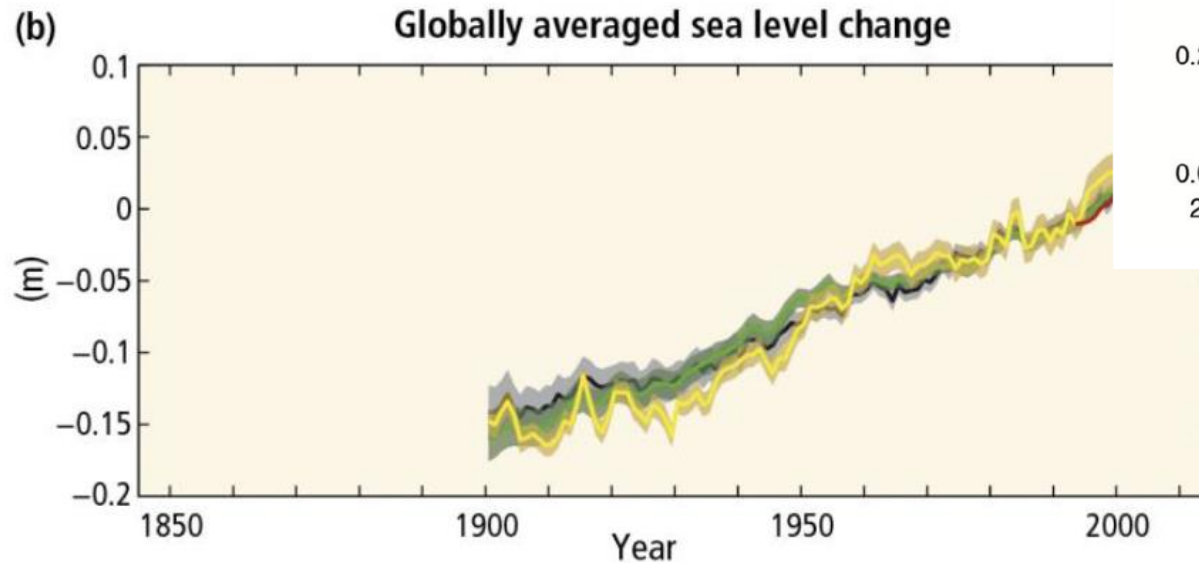
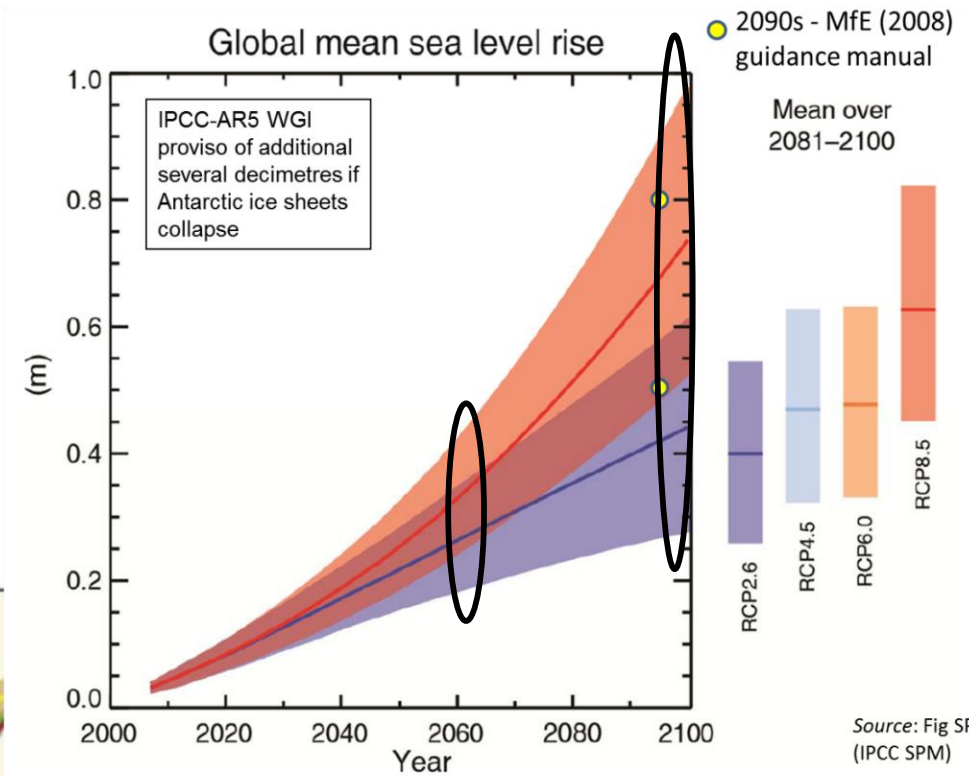


IPCC REPRESENTATIVE CONCENTRATION PATHWAYS (RCPs)	RCP2.6	RCP4.5	RCP6.0	RCP8.5 (includes report 83 rd % 8.5+)
1. CARBON concentration in the atmosphere by 2100 (ppm = parts per million carbon dioxide equivalents)	430-480 ppm peak 2010-2020 negative emissions from 2070	480-580 ppm peak 2040 then decline	580-720 ppm peak 2080 then decline	720-1000 ppm rise continues through 21 st C
2. TEMPERATURE increase by 2100 (degrees Celsius)	0.9 to 2.3 °C	1.7 to 3.2 °C	2.3 to 3.7 °C	3.2 to 5.4 °C
3. SEA LEVEL rise by 2100 (m = metres) [range]	0.40 m [0.26 to 0.55]	0.47 m [0.32 to 0.63]	0.48 m [0.33 to 0.63]	0.63 m [0.45 to 0.82]
4. ASSUMPTIONS: based on socio-economic projections, with growing populations, developing countries, & different levels of commitment to GHG reductions.	21 st C return to ~1960s carbon invent & use carbon sponge + sequester technologies halt new emissions now	Emit a lot less sponge + sequester quite a bit of carbon	Emit less sponge + sequester some, carbon	Find more & keep using more carbon

RCPs feed into sea level rise projections in the Intergovernmental Panel on Climate Change 5th Assessment Report (IPCC AR5)



Sea-level rise projections (global mean)



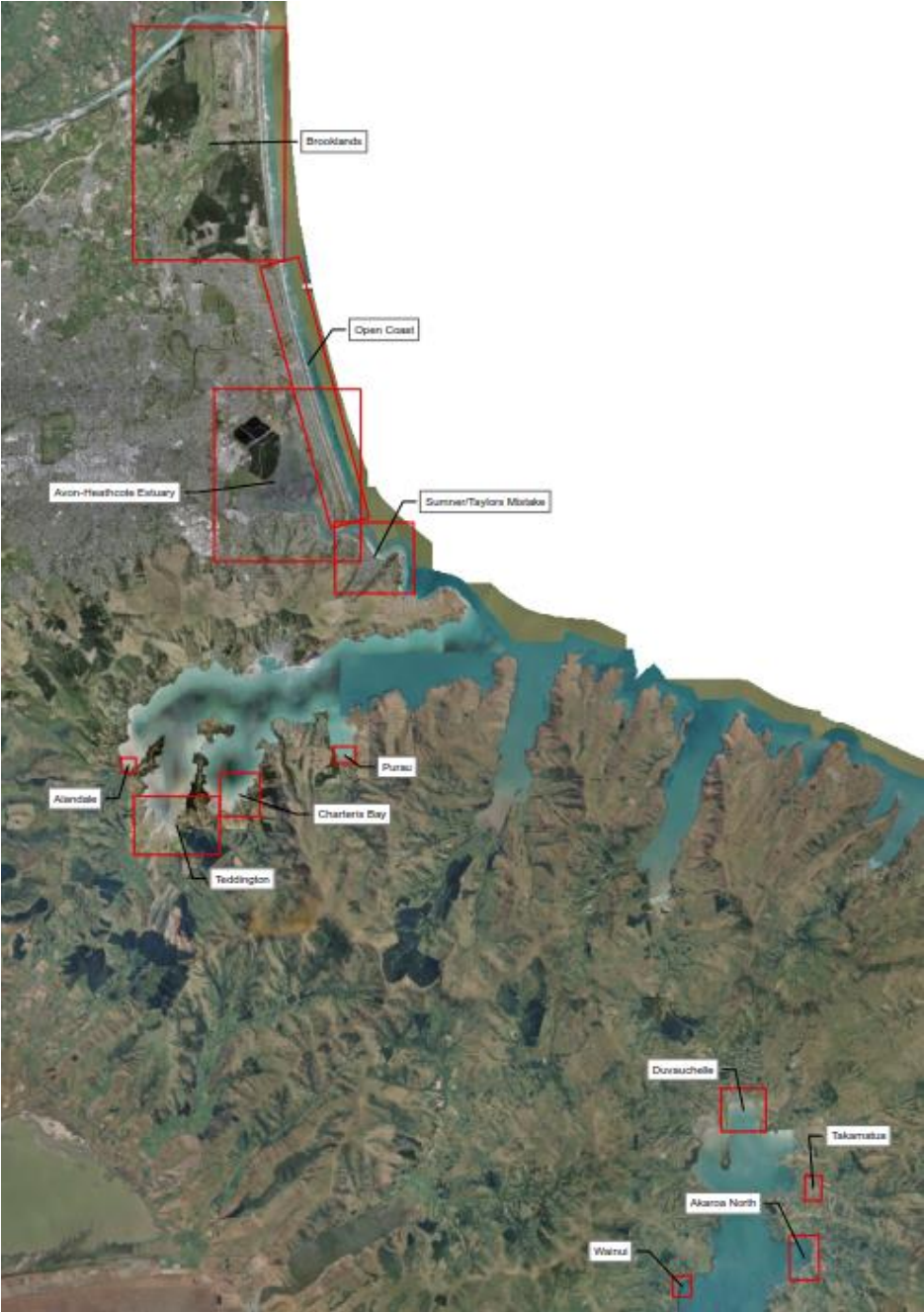
Coastal hazards reports and reviews 1999 - 2017

- 1999 - *Study of the effects of sea level rise for Christchurch (T&T)*
- 2013 - *Effects of sea level rise for Christchurch City (T&T)*
- **2015 - Coastal hazard assessment, Stage one review (T&T)**
- **2015 - Coastal hazard assessment, Stage two (T&T)**
- **2015 - 1st peer review of coastal hazard report, Stage two (Dr Terry Hume)**
- 2016 - *2nd peer review of coastal hazard report (Peer Review Panel)*
- 2017 - *Coastal hazard assessment for Christchurch & Banks Peninsula (T&T)*
- 2017 - *Peer review of revised T&T 2015 report (Dr Deirdre Hart)*

2017 Coastal Hazard Assessment Report for Christchurch and Banks Peninsula

- Replaces 2015 report and addresses recommendations of Peer Review Panel
- Main inhabited parts of coast - *open coast* and *harbour coast*
- Models used in conjunction with many other inputs
- Comprehensive technical basis for community engagement

Study areas



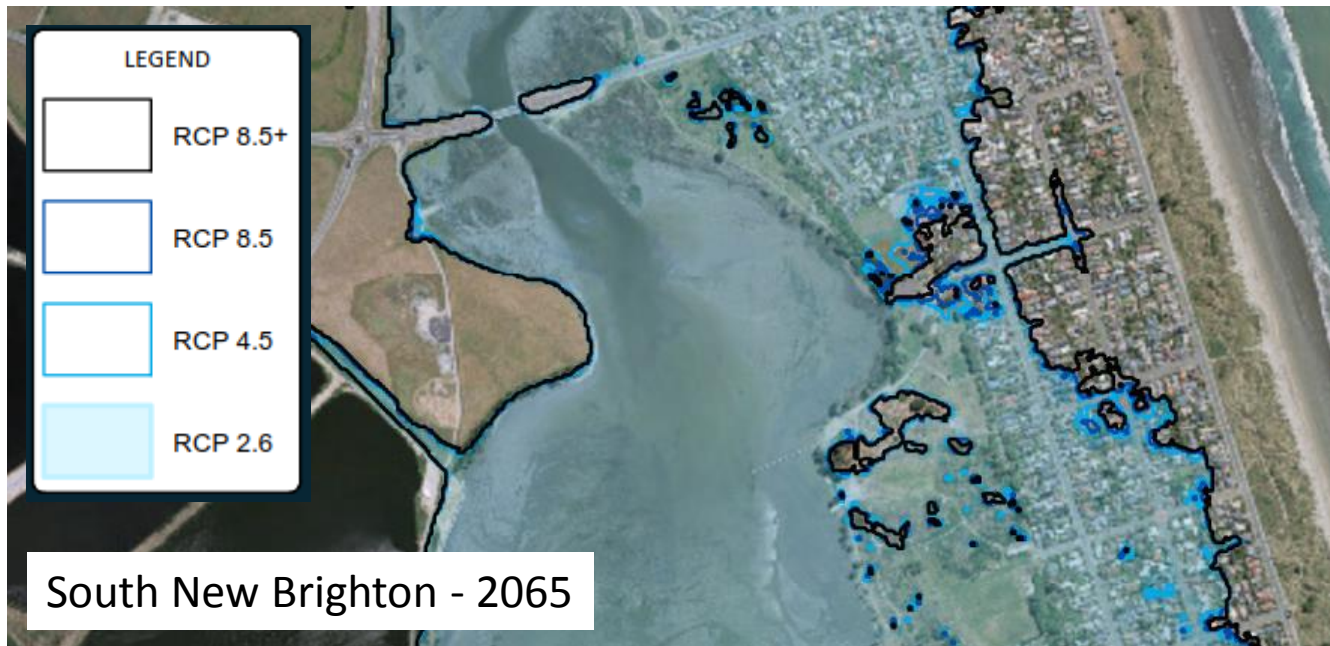
Coastal erosion and shoreline retreat

- Two time periods considered - next 50 years (2065) and next 100 years (2120)
- For open coast - two sediment budget scenarios considered for four RCP scenarios (2.6, 4.5, 8.5 & 8.5+) at two probabilities (5% 'rare' and 66% 'likely' AEP)
- For harbour coast - 50 & 100 year time period



Coastal inundation

- *1 in 100 year storm event* (1% chance in any one year)
- Two time periods considered - next 50 years (2065) and next 100 years (2120)
- Four RCP scenarios (2.6, 4.5, 8.5 & 8.5+)



Number of properties affected (2015 report)

Coastal hazard zone	Number of properties
Coastal erosion hazard zone 1	2309
Coastal erosion hazard zone 2	4634
TOTAL erosion hazard zone (1, 2 or both)	5971
Coastal inundation hazard zone 1	10039
Coastal inundation hazard zone 2	12776
TOTAL inundation hazard zone (1, 2 or both)	17819

Number of properties affected (2017 report)

Inundation

Timeframe	RCP 2.6	RCP 4.5	RCP 8.5	RCP 8.5+
2065	10,090	10,987	12,124	13,702
2120	13,682	15,308	21,481	24,894

Erosion

Timeframe	RCP 2.6	RCP 4.5	RCP 8.5	RCP 8.5+	No RCP (open coast)	TOTAL
2065	12	14	19	106	126	232
2120	57	139	484	801	157	958

What happens next

- Awareness and understanding
- Values and objectives for each community
- Options and pathways
- Strategies and implementations plans
- Ongoing monitoring and review

Community engagement

Seven drop-in sessions (23 November - 6 December)

Coastal hazard technical information, CDEM, consenting, building and future engagement

Speaker series (December 2017 - April 2018)

Climate change, coastal processes, assessing risk, insurance perspective

Community engagement (January 2018 and beyond)

Co-design with local communities

Staff workshop January 2018

Proposed engagement strategy February 2018

Further:

- Everyday sea levels: storms, ENSO, tides...
- Oceans with anthropogenic climate change (CC): hotter, more acidic
- Storms with CC: more intense &/or frequent
- Sediment budgets & CC?
- **Human responses to coastal change feedback into adjusted coastal responses:** need to consider & evaluate option consequences carefully

- Christchurch City Council **living with water**: <https://ccc.govt.nz/environment/land/livingwithwater>
- IPCC **synthesis report** : https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf
- An Australian website explaining **climate change through to coastal adaptation**: <https://coastadapt.com.au/learn-about-climate-change>
- IPCC on **impacts, adaptation, vulnerability**: <https://www.ipcc.ch/report/ar5/wg2/>
- For ideas on **how other low lying cities are responding**: see <http://www.deltacities.com/about-c40-and-cdc> & https://en.wikipedia.org/wiki/Blue-Green_Cities