Moving from shoreline management to coastal adaptation

Webinar 01 Feb 2024

sniffer knowledge brokers for a resilient Scotland

What we'll cover

13.00 Welcome

13:05 Strategic context

13:10 The latest thinking on sea level rise & climate projections

13:35 The shift from shoreline management to coastal change adaptation planning

13:45 Q&A

13:55 Coastal change adaptation in Scotland – examples of impacts and innovative approaches

14:35 Q&A

15:00 Close

- Presentations are recorded
- Q&A is not
- Please mute your microphone and keep cameras off if not presenting
- Raise hand or type question in chat

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The strategic context

Tracy McKen & Kay White
Scottish Government

Tracy McKen

Senior Policy Advisor

Water Environment and Resilience Team

Scottish Government
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gov.scot

Coastal Adaptation and Wider Policies

- Scottish National Adaptation Plan
- National Planning Framework 4
- Flood Resilience Strategy

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What is the purpose of the Flood Resilience Strategy?

To change our approach from “fixing flooding problems” to creating flood resilient places

Lay-out the principles we must follow to improve flood resilience in the period ahead

To set out the strategic level changes that we need to make

Scalable to available resources

…reducing flood exposure by all available means

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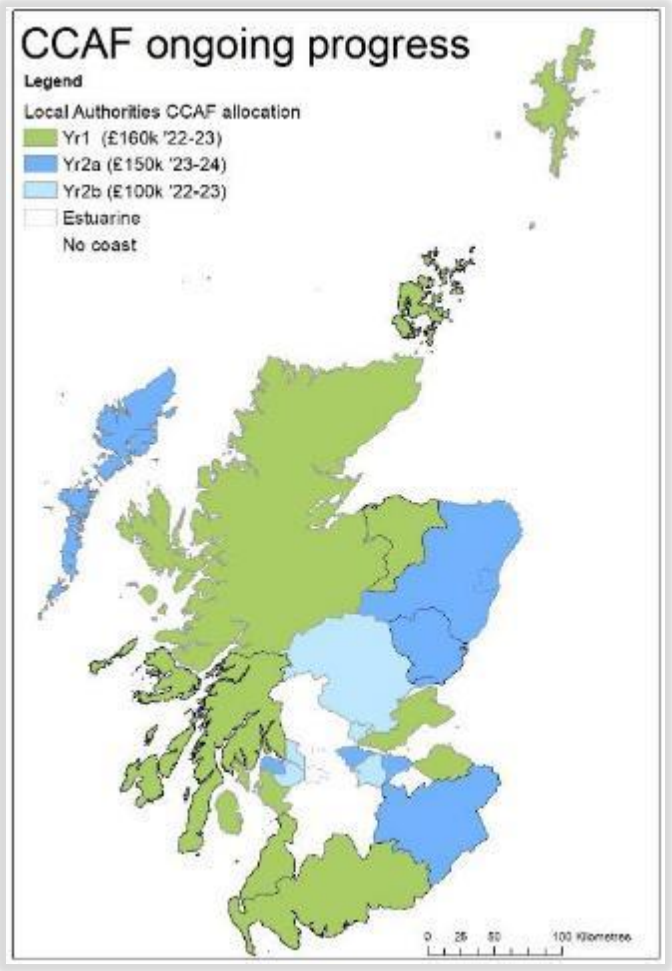
Coastal Change Adaptation Planning

Funding

- 2022-23 - £1.6 million – direct to 10 LAs
- 2023-24 - £2.4 million
  - £1.85m direct to 14 LAs
  - £0.55m distributed to LAs for case studies
- 2024-25 - £2.7 million
  - £1.65m direct to 19 LAs
  - £1.05m available for case studies
- 2025-26 - £5.0 million
  - Distribution still to be agreed



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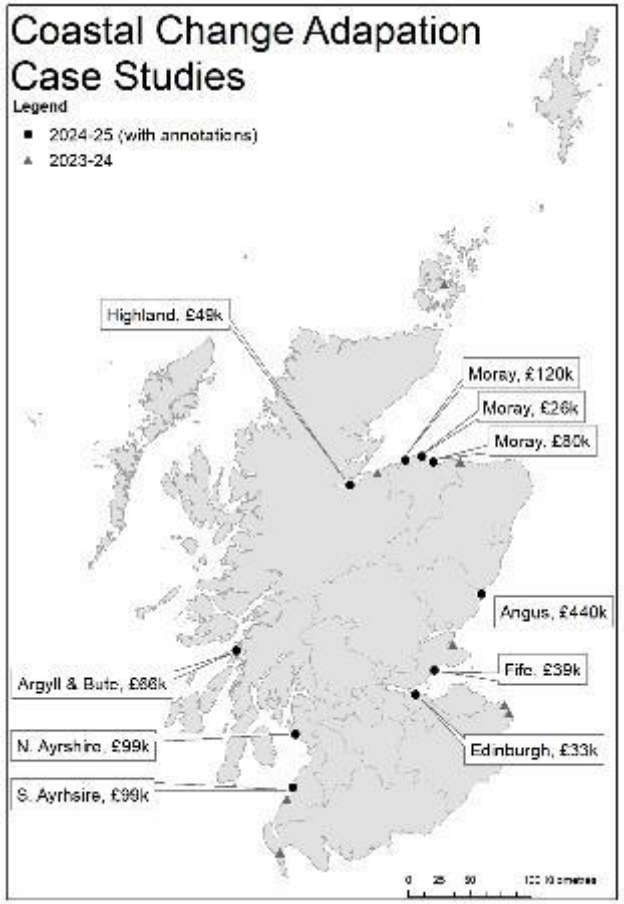
Coastal Change Adaptation Planning

2024-25 case studies:

- These ten case studies give a good geographic spread with eight councils areas receiving funding.
- Three projects will include enhancing the natural defences at locations to help reduce the rate of erosion and protect from flooding. These are at Kingston in Moray, Montrose in Angus and Cullipool in Argyll and Bute.
- Other projects focus on engagement with local people, business and infrastructure owners on the process for developing a coastal change adaptation plan.
- There are also projects which focus on improving the monitoring of the coastline to inform trigger points and guide adaptation actions.



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Consultation on draft Adaptation Plan 2024-2029

1 February 2024

Kay White
Senior Policy Adviser
Climate Adaptation Team

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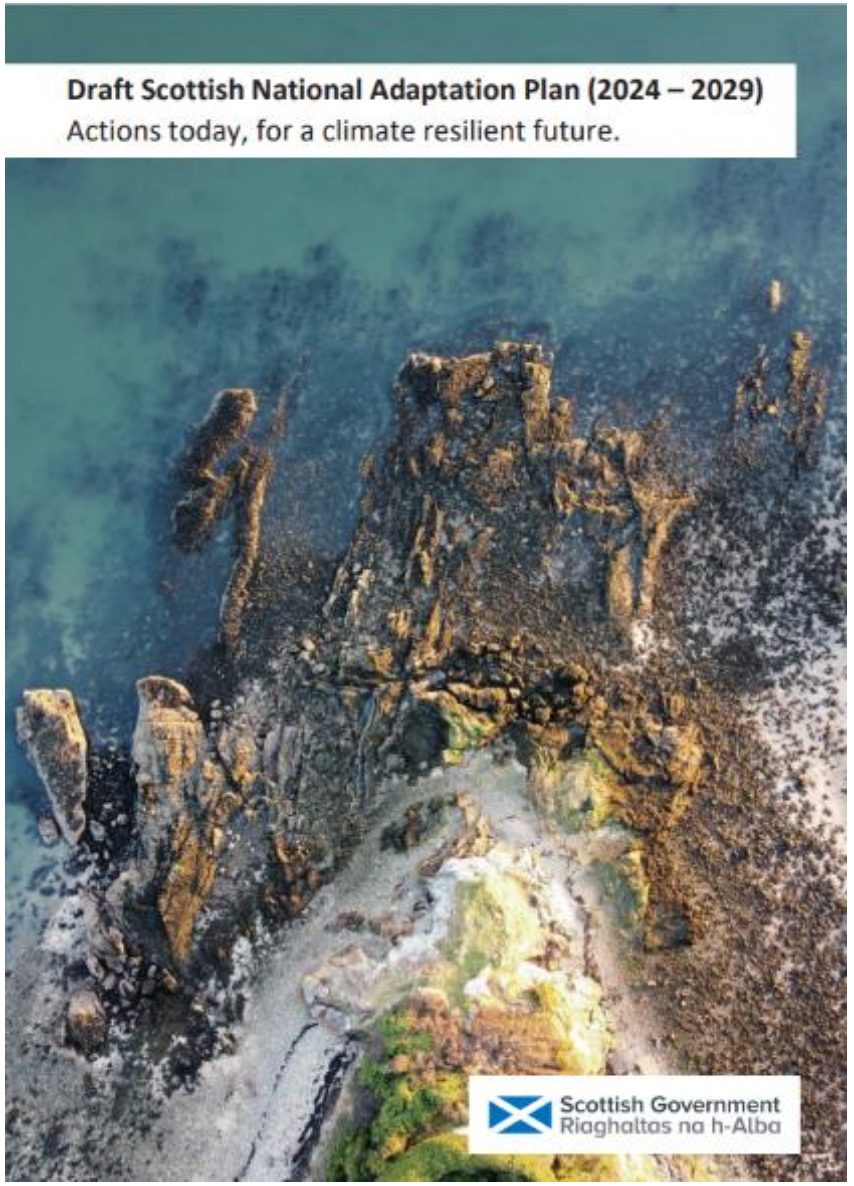
Slide Deck Overview

Part One: Orientation and timeline

Part Two: Outcomes and objectives

Part Three: Coastal action



What we've done and where we're going

June – Dec 2022
CCRA risks assigned to each SG Directorate. Policy development on priority risk areas

Mar 2023
Monitoring Framework project started

August 2023
Interim policy response to CCC on 8 priority risk areas

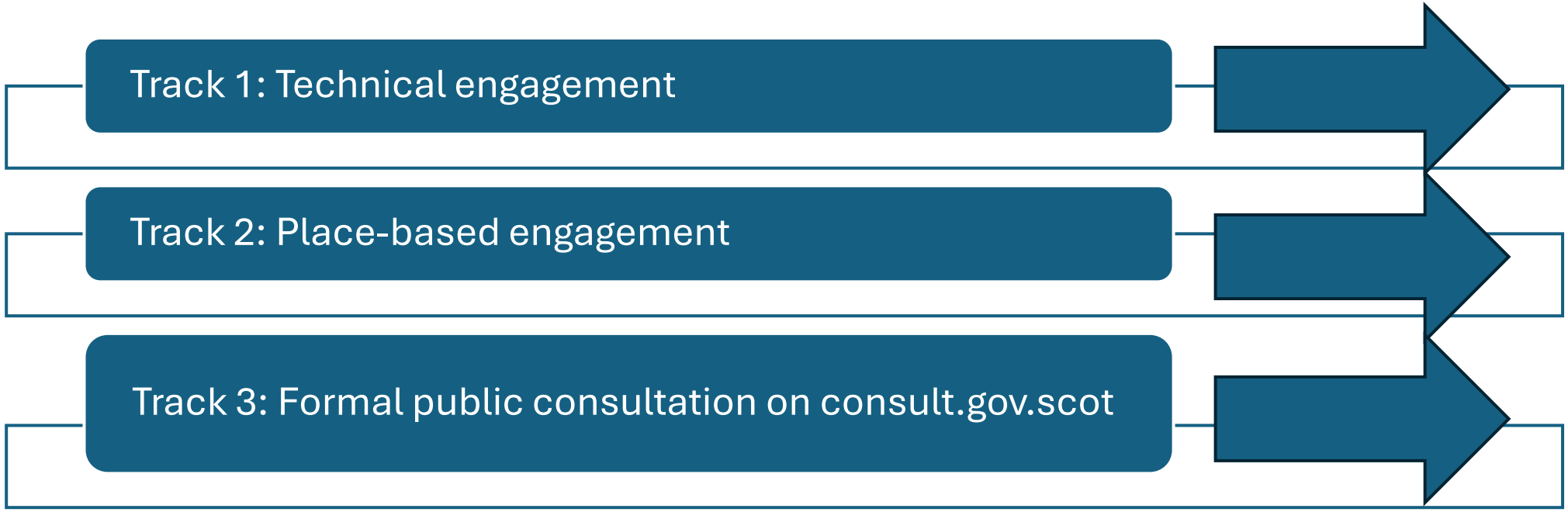
November 2023
2nd CCC report published

December
Final preparations for consultation

Jan - April 2024
Public consultation

Autumn 2024
Final plan laid in parliament

Public consultation and engagement



Outcomes and objectives

Nature connects	across our land, settlements, coasts and seas
Communities	are shaping places and co-creating climate resilience solutions
Public Services and Critical Infrastructure	are person-centred, prepared and building resilience with leadership and collaboration
Economy, Business and Industry	are adapting, realising opportunities and securing supply of food, goods and vital services.
International Action	supports climate justice and enhanced global action on adaptation

Outcomes and objectives

- Nature-based solutions
- Development planning
- Nature Networks
- Marine, coastal and the blue economy
- Natural carbon stores and sinks
- Place-based collaboration
- Community support
- Preparedness for extreme events
- Built environment
- Culture and historic environment

- Public service providers
- Access to public services
- Resilience of power systems
- Resilience of transport system
- Water, sewage and drainage services
- Business awareness of climate risk
- Innovation
- Economic development opportunities
- Supporting vulnerable communities globally
- International advocacy
- Knowledge exchange

Coastal Action

- **Coastal Change Adaptation Plans** promote naturally functioning coastal landforms to reduce the risk of coastal erosion and so reduce the risk of coastal flooding.
- **Flooding and Coastal Erosion Maps** - The Scottish Environment Protection Agency (SEPA) will review the Natural Flood Management and Natural Susceptibility to Coastal Erosion Maps available on its website to better understand what information may be required to improve implementation of nature-based solutions.
- **Business engagement in CCAPs - encourages businesses** as well as local communities, to be involved in the process of producing local authority wide CCAPs, to engage with the relevant local authority for further information. A landowner can also draft their adaptation plan, based on the information provided by Dynamic Coast to assess the coastal erosion risk, to consider coastal erosion risks when moving or extending business premise
- **Historic Environment –** CVI at all world heritage sites, working with SCAPE

We want to hear your views on the draft plan!

Citizens Space consultation

Email the team:
AdaptationConsultation@gov.scot

Consultation closes on 24 April

The latest thinking on sea level rise & climate change projections

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Cat Payne
Sniffer
cat@sniffer.org.uk

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Climate impacts happening faster than expected

Worst-case global warming predictions are the most accurate, say climate experts

'Doomsday' seed vault in the Arctic has FLOODED after soaring global temperatures caused permafrost to melt

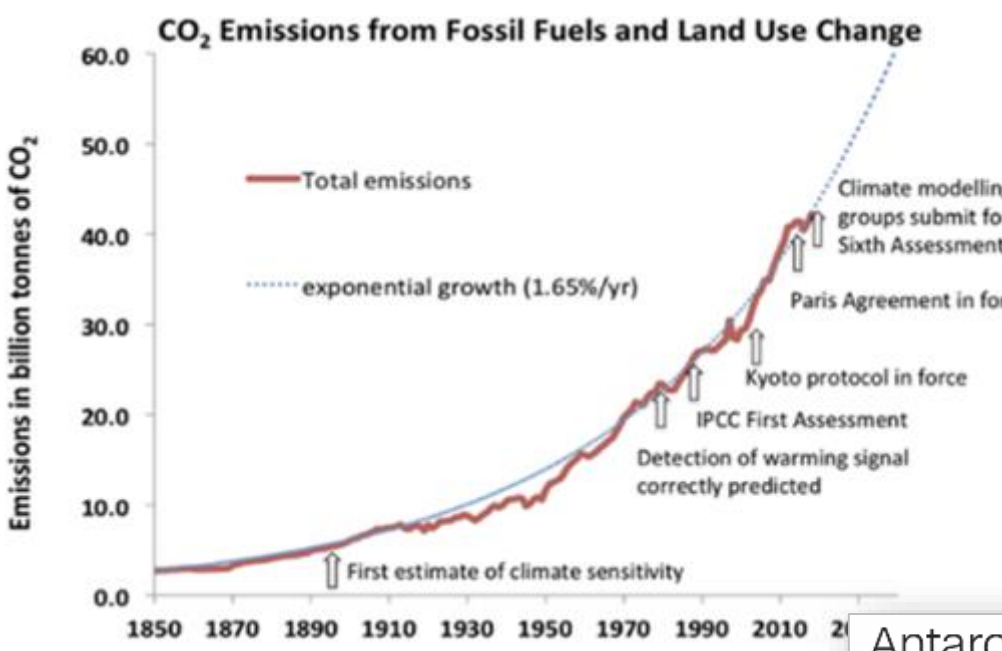
'We're f***': Climate change will be catastrophic for mankind after study reveals methane leaking from the Arctic Ocean, scientist warns**

"**Nowhere is safe** … who would have predicted a temperature of 48/49C in British Columbia?"
Sir David King

The North Pole is an insane 20C warmer than normal … winter descends

Scientists deliver 'final warning' on climate crisis: act now or it's too late

We are perilously close to dramatic climate change that could run out of our control



says only swift and drastic action can avert irrevoca… orld

GLOBAL WARMING DOOMSDAY ALERT

The Ocean Is Warming at a Rate of 5 Atom Bombs Per Second, Scientists Warn

IMF chief 'couldn't sleep' after reading climate report: 'What have we done?'

Canadian inferno: northern heat exceeds worst-case climate models

Amazon rainforest 'close to irreversible tipping point'

Forecast suggests rainforest could stop prod… sustain itself by 2021

Keep global warming under 1.5C or 'quarter of planet could become arid'

Antarctica ice melt has accelerated by 280% in the last 4 decades

Responding to climate change

Actions for net zero

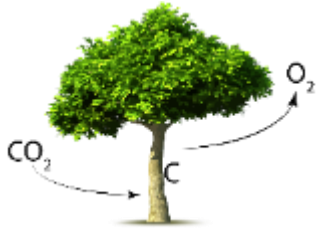
Mitigation

Preventing the causes of climate change

CUT

Sequestration

Getting GHG out of the atmosphere



CAPTURE

Adaptation

Dealing with the consequences

COPE

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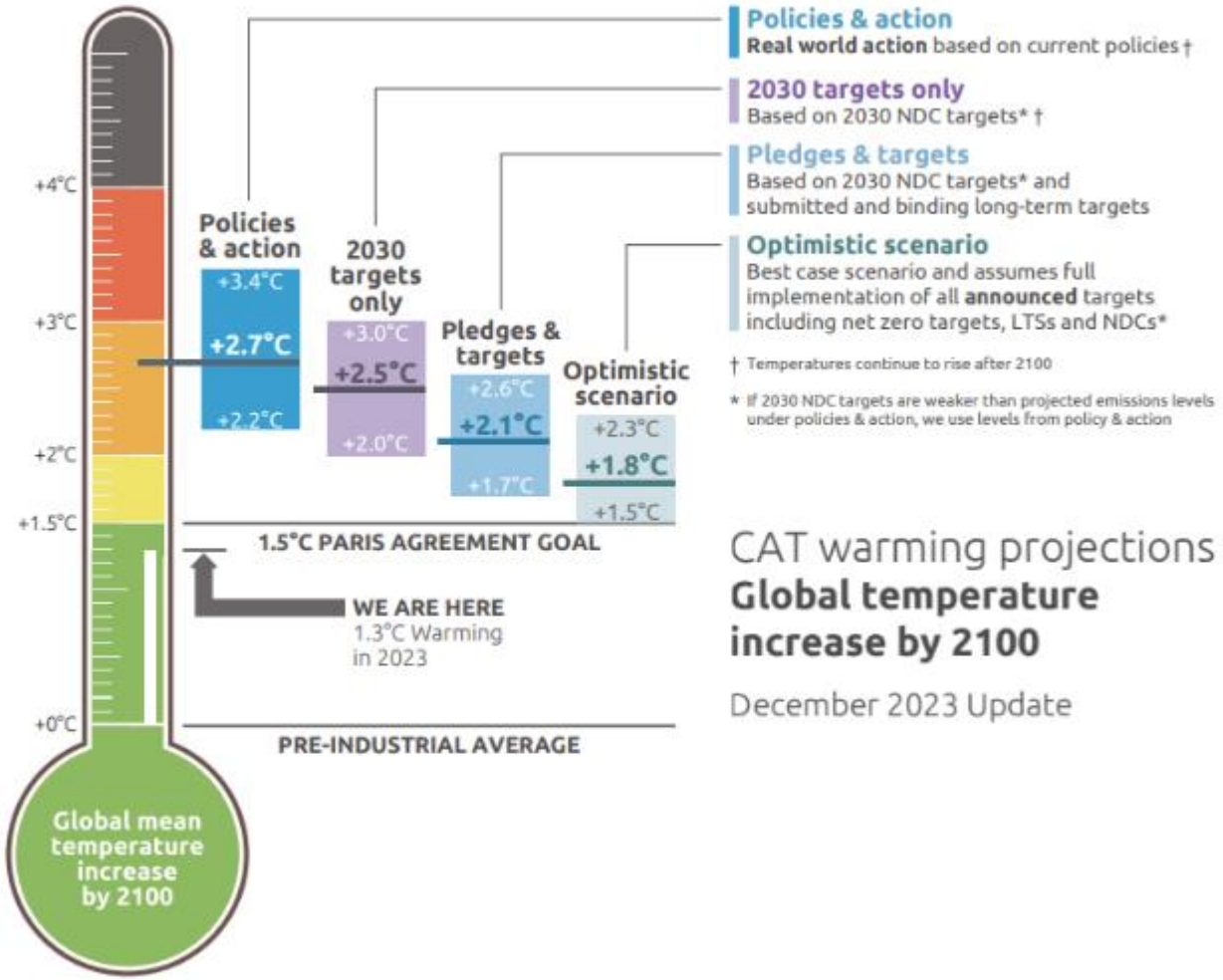
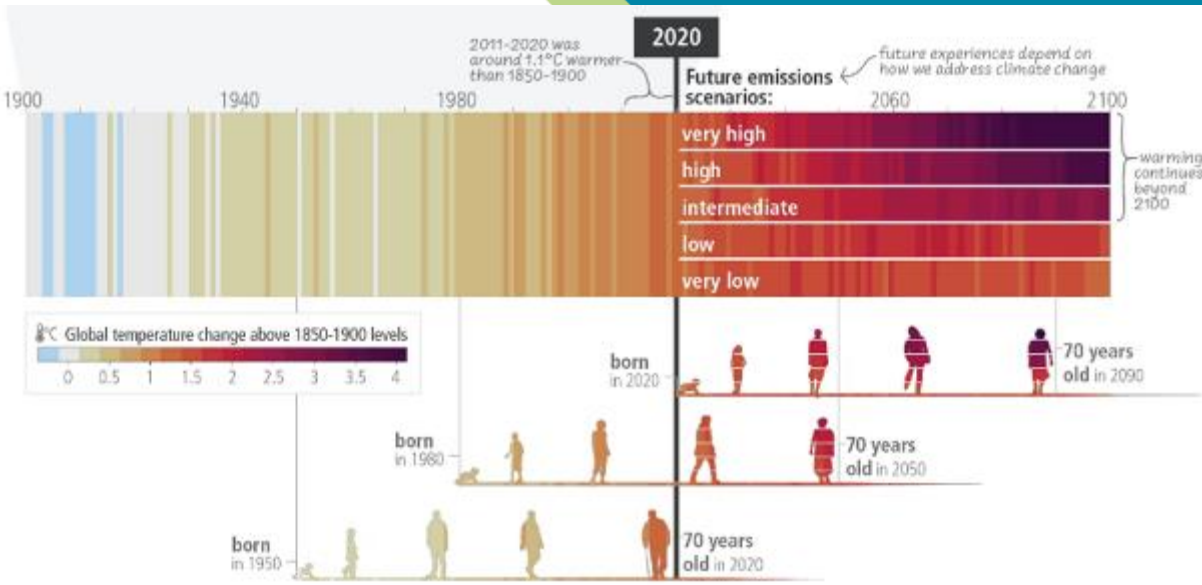
Global projections



Future climate outcomes will be determined by the action taken (or not taken) to cut emissions now and in the years ahead.



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Meeting current legislation ≠ safety

Change observed, funding found, research undertaken, peer review **2-5+ years**

Incorporate projections into regulation – local plans, Building Standards dictated by their review cycles **5+ years**

IPCC cut off for including research in AR (assessment reports) **2 years**

Downscaling and remodelling of national projections **3-8+ years**

Line by line review of IPCC AR by national governments **1+ years**

Changing guidance for climate change allowance for precipitation extremes

- 2003 +12%
- 2009 +20%
- 2016 +30% (CEC guidance for new dev)
- 2019 +40% (peak flow, Forth region)
- 2019 +55% (precipitation anomaly)
- **2020 +85% (UKCP18 uplift)**

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Dr Alistair Rennie
Nature Scot / Dynamic Coast

Update on sea level rise & climate projections

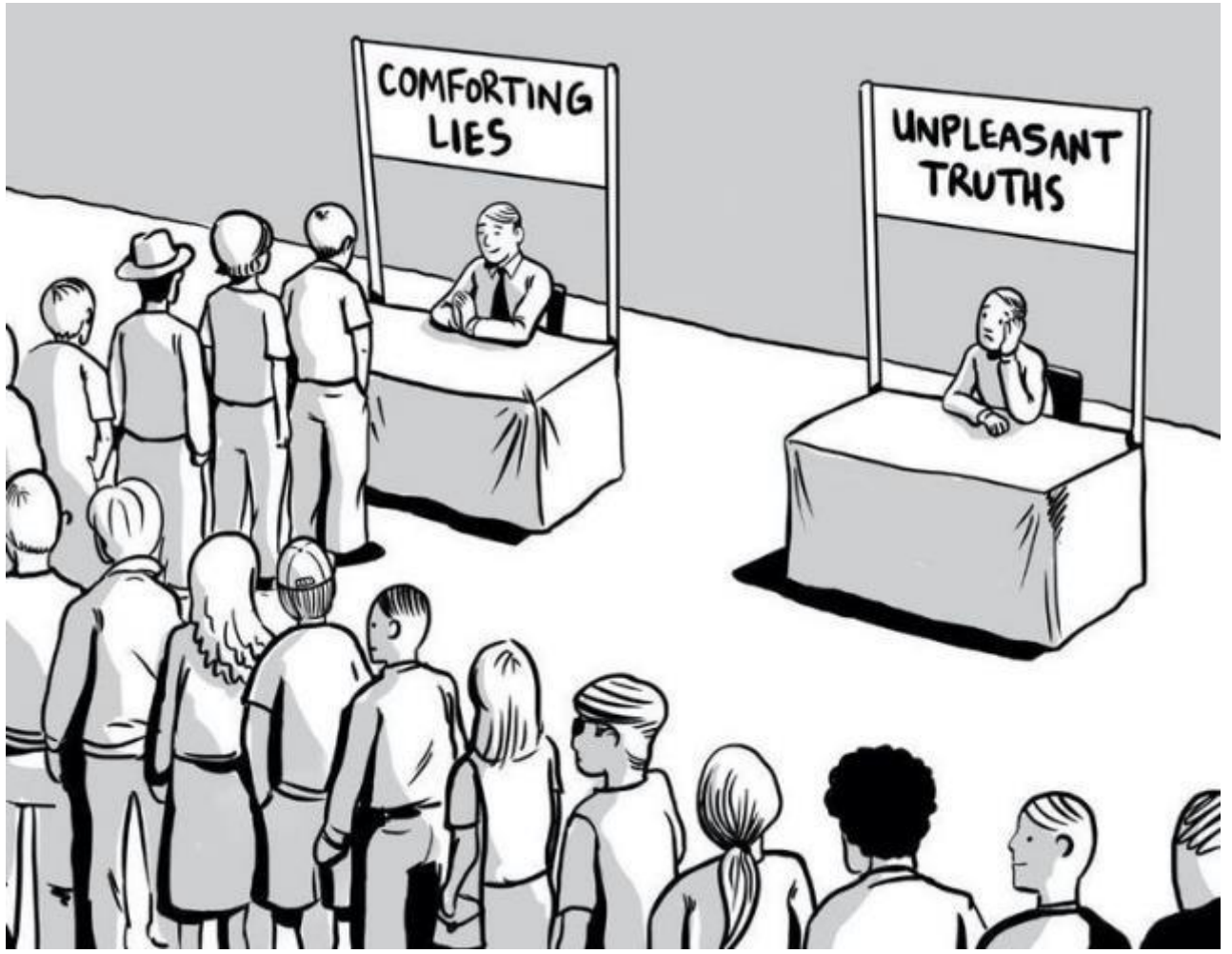
Coastal Change Adaptation Workshop

Thursday 1st February 2024

Dr Alistair Rennie
DynamicCoast.com
DynamicCoast@nature.scot
@DynamicCoasts

Why is this important?

- People don’t like change, uncertainty and bad news
- Our climate metrics are not improving & this matters to us all.
- We need to act now.



Climate observations

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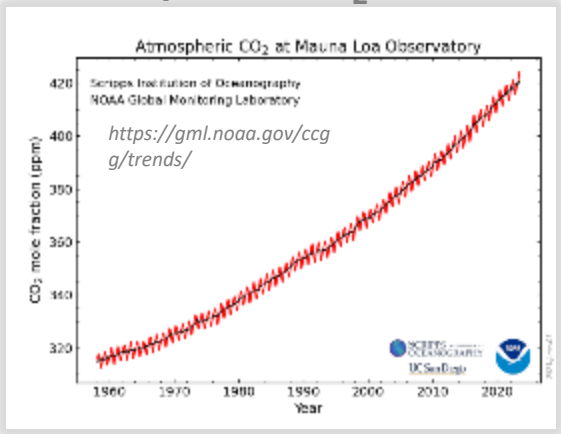
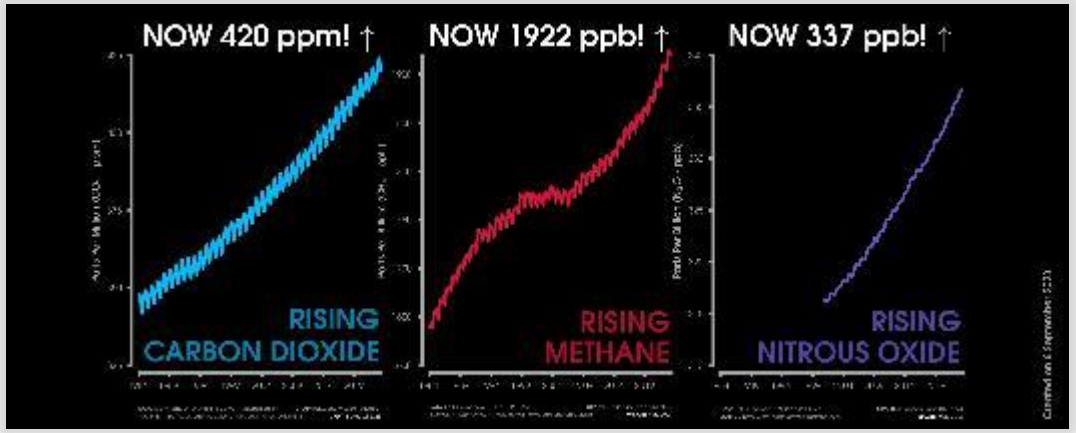
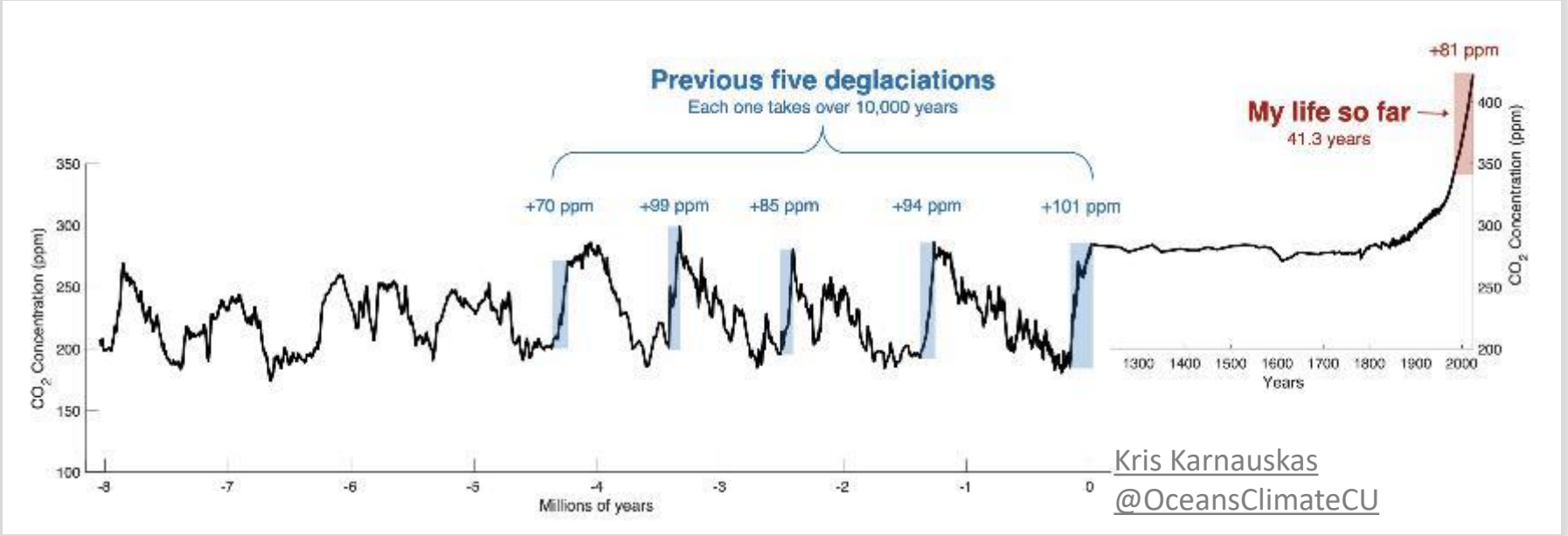
Anthropogenic climate change is:

↑ Global GHG,

Atmospheric CO_2







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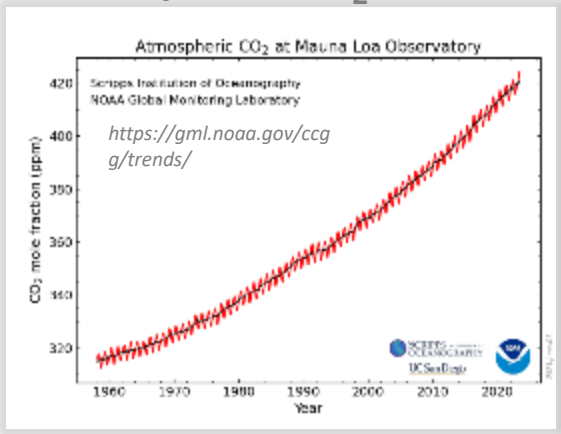
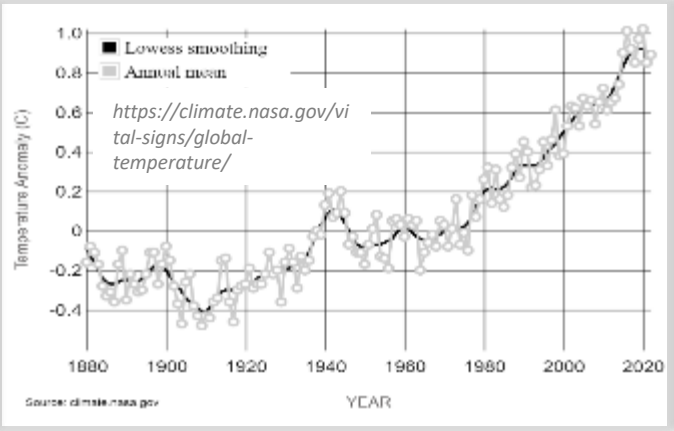
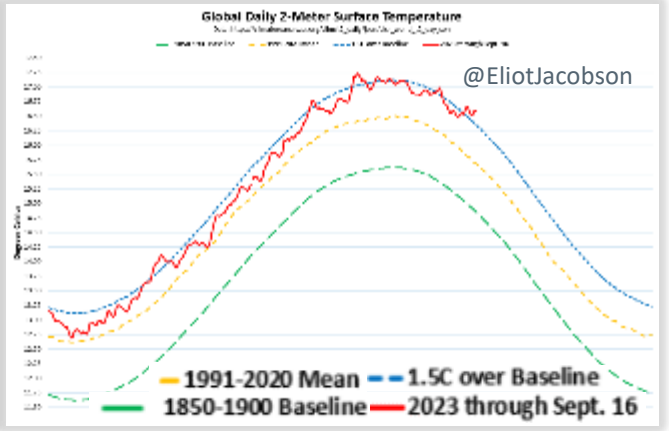
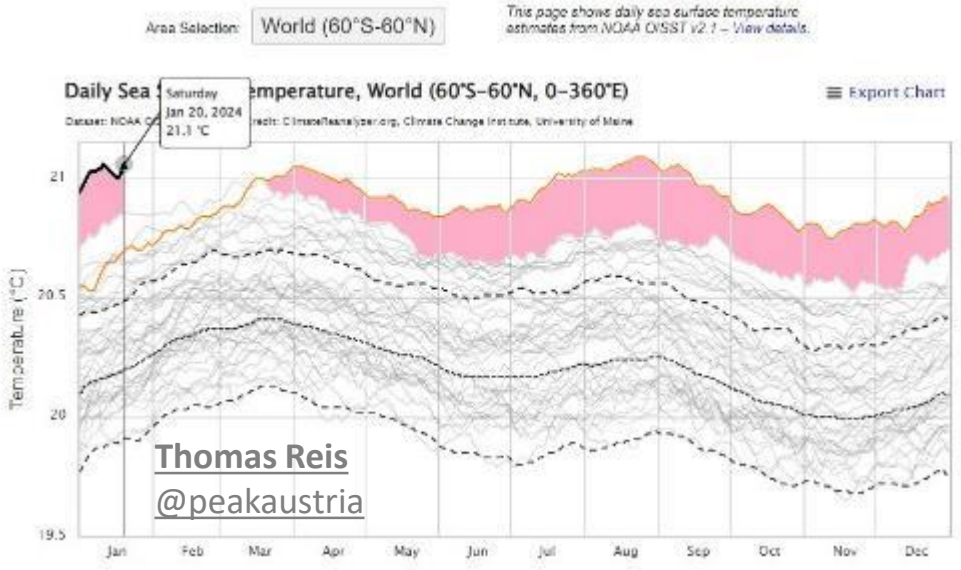


Global atmospheric temperature







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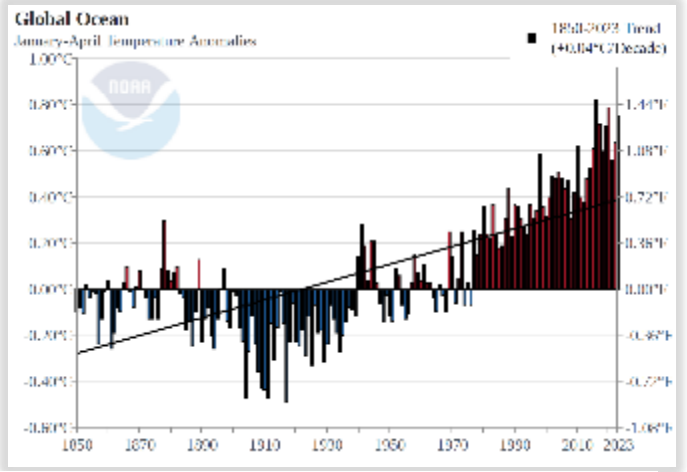

www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/globe/ocean/ytd/4/1850-2023

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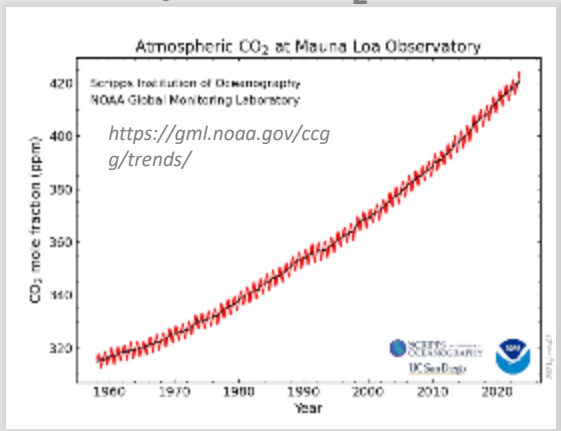

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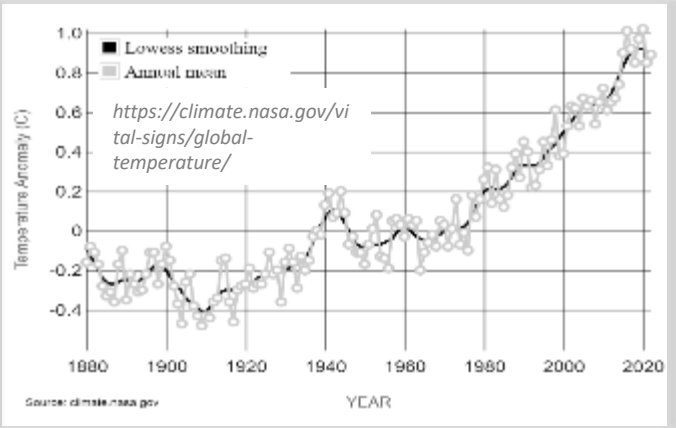

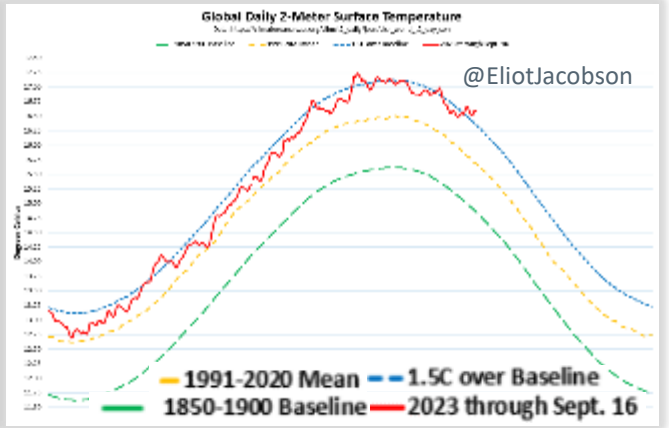

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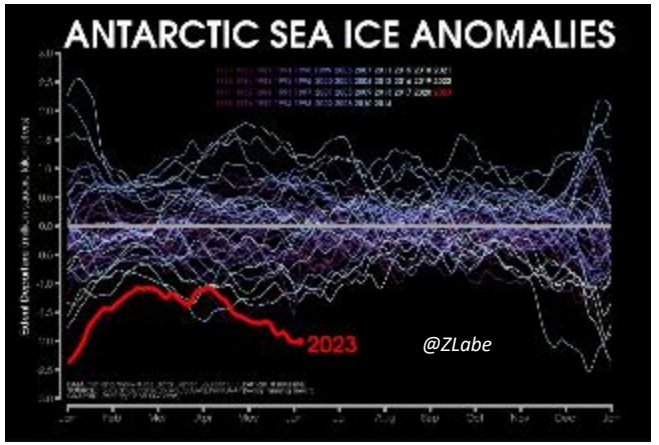

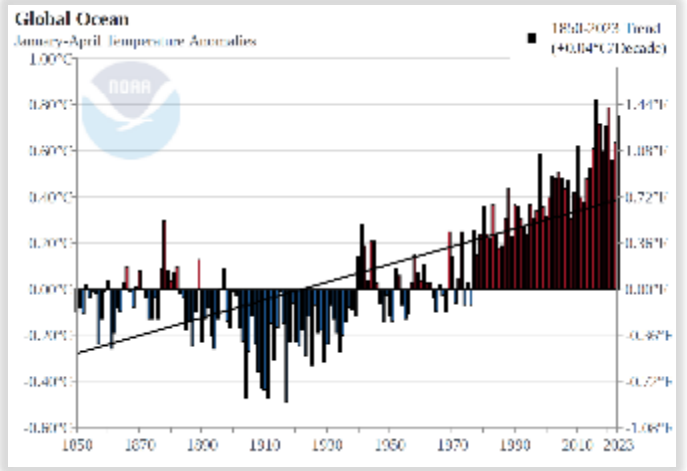

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Climate observations

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Anthropogenic climate change is:

↑ Global GHG,

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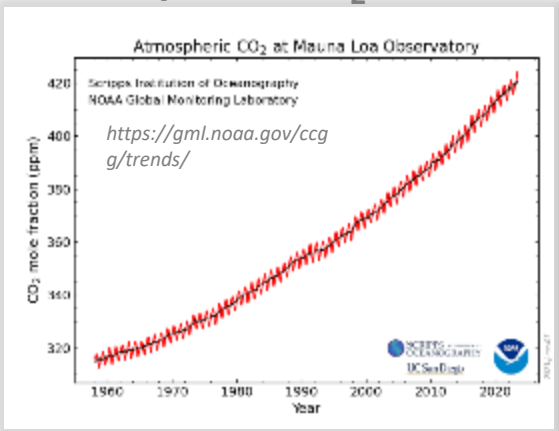
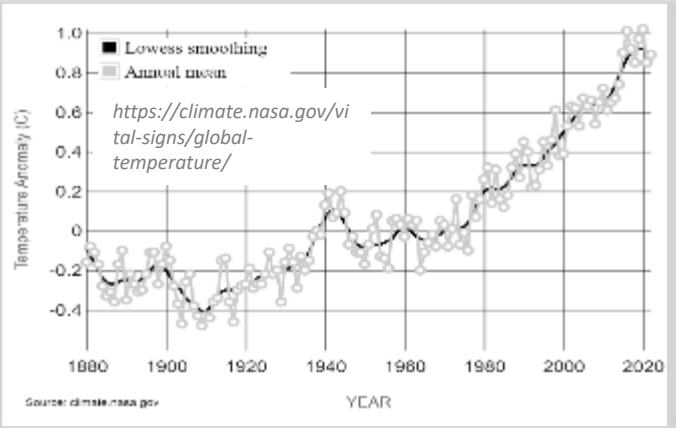
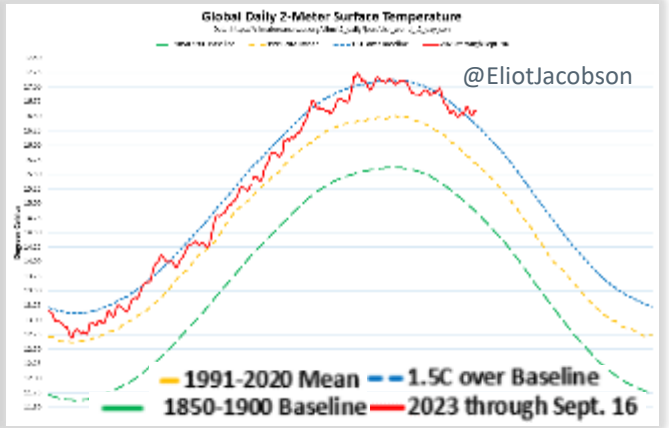
↑ relative **sea level rise**:

Atmospheric CO_2



Global atmospheric temperature





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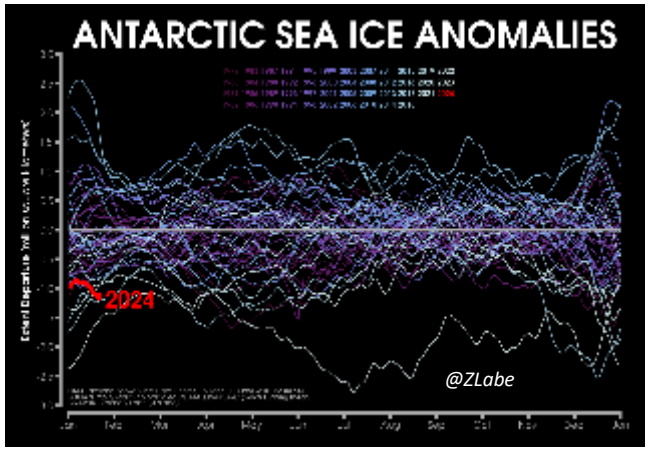

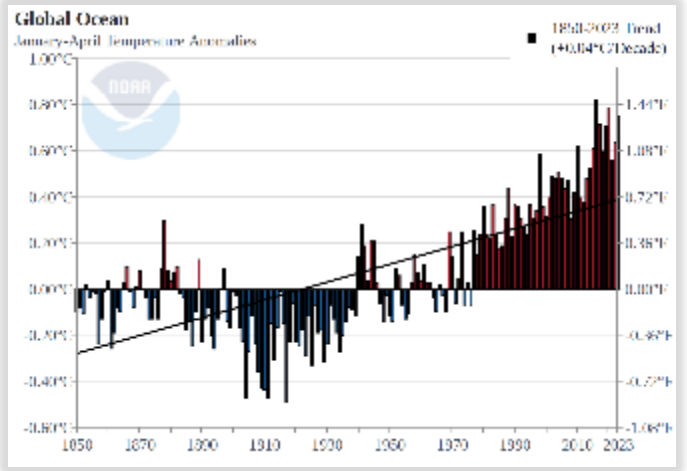

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Climate observations

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Anthropogenic climate change is:

↑ Global GHG,

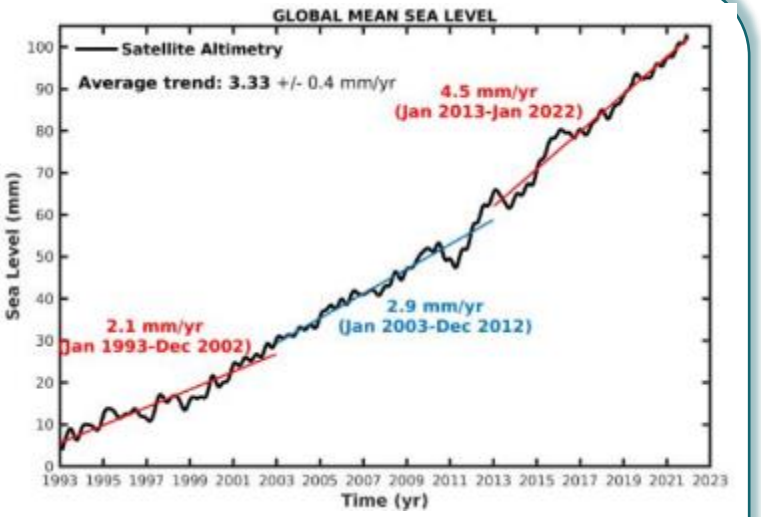
↑ Global air and sea surface temperatures

↑ Relative sea level rise:

Now faster than UKCP18 expectations.

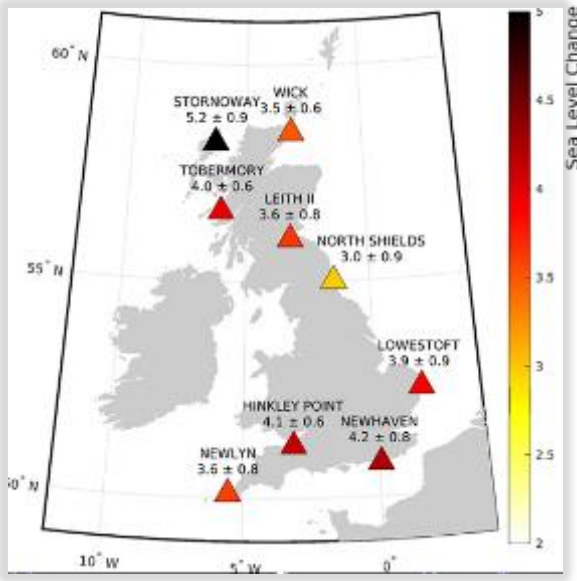
RCP8.5 95% isn't the worst case,
We may already be on track with it!
This is why CCA Guidance says use a range of #.

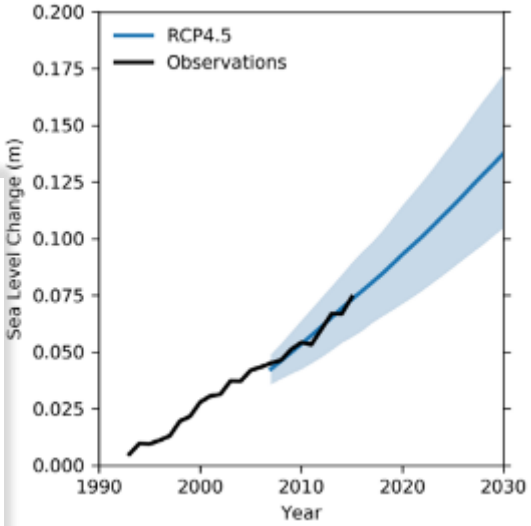
In 2018 UKCP18 demonstrated that Global MSLR was occurring at 3mm/yr in line with RCP4.5 central estimate.

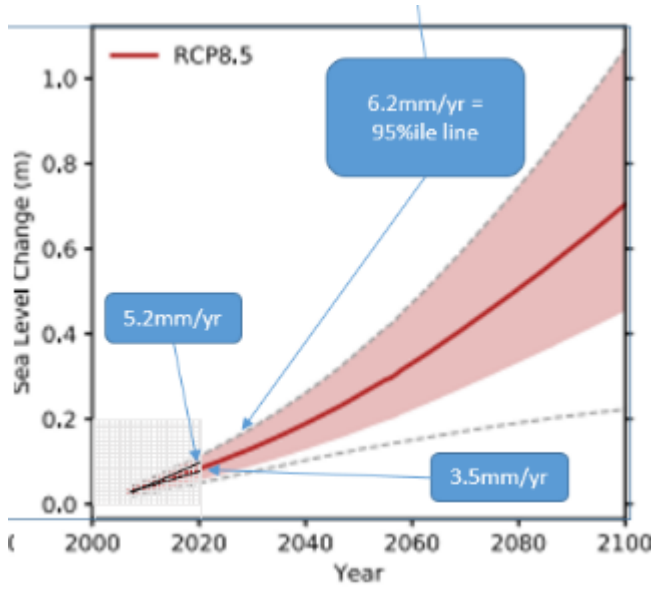


Relative sea level rise

3.6-5.2mm/yr in Scotland







MetOffice (2022) https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.7787

Climate observations

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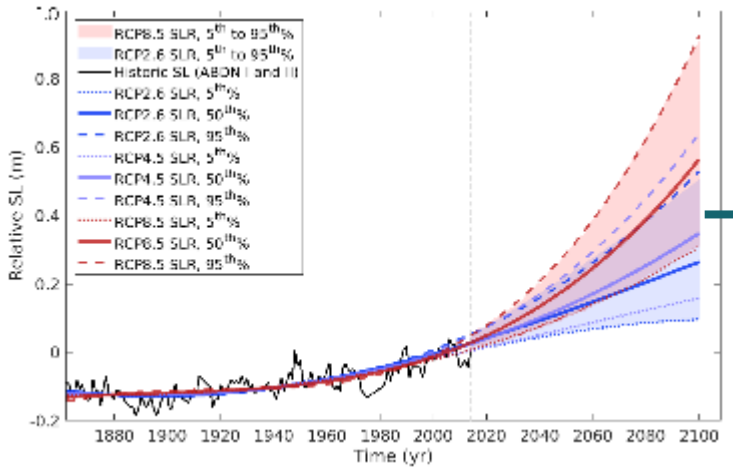
Sea level (Aberdeen)



Flooding (surge heights) increasing, Aberdeen (Sniffer 2008)

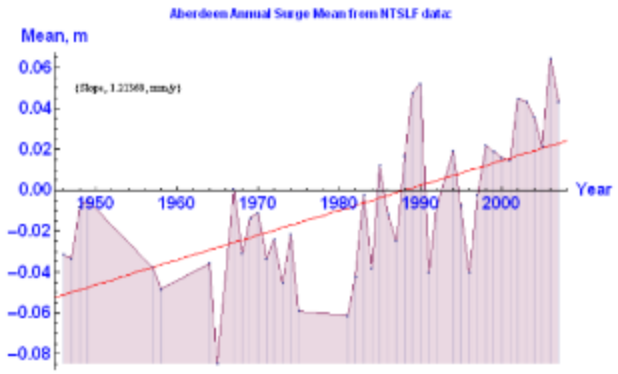


Figure 23 Mean surge level at Aberdeen

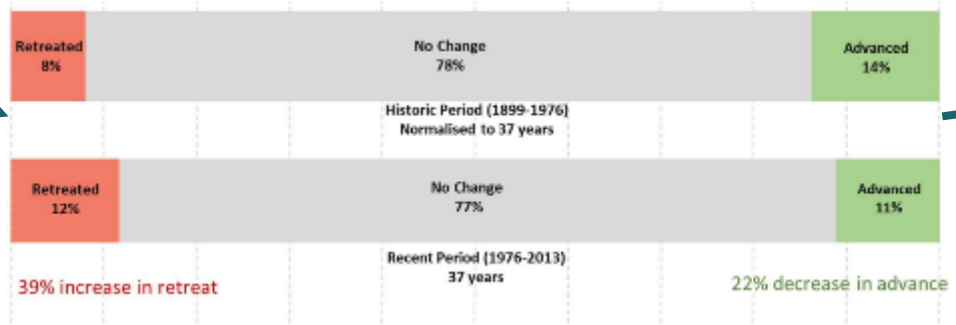
Phasing with spring tides & surges

Coastal erosion & flooding, one of Scotland's most severe climate risks. (CCC 2021)

Phasing with spring tides & surges

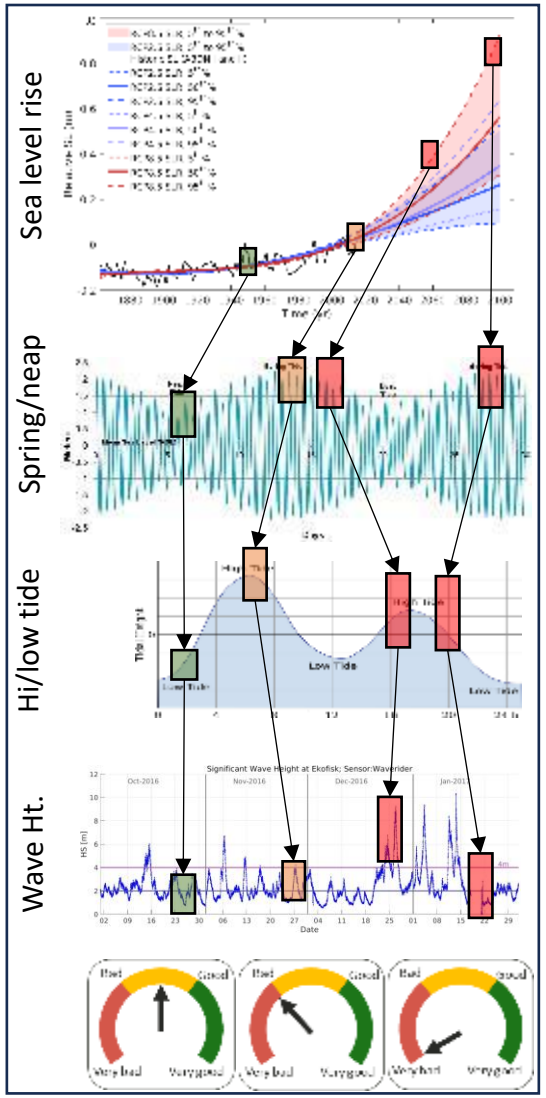
Increasing extent of erosion in Scotland

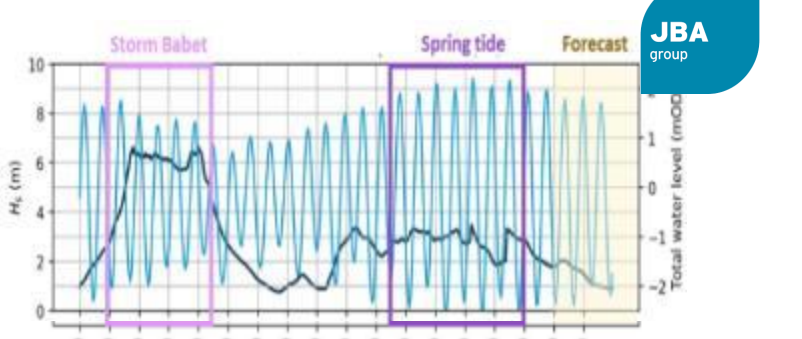
(Dynamic Coast 2017)



What does this look like?

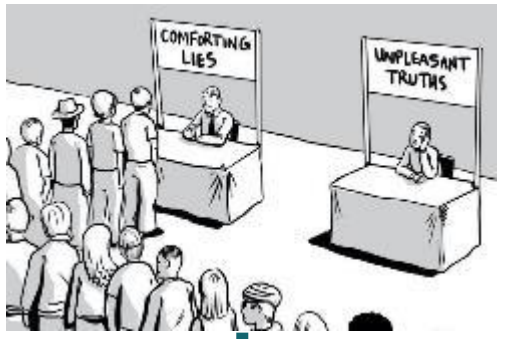
- Our coast is a 4D complex space, where phasing and antecedent conditions are critical.
- RSLR underlies, tides, surges and waves.
- We are rolling the dice every day, without even knowing it.





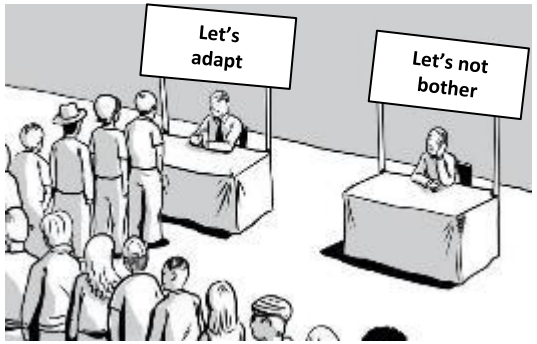
What we do now is important

- Which of these ‘futures’ do we want versus what we plan for? Incl. precautionary principle.
- As a community we need to inform public & decision makers to support sensible & sustainable options.
- CCAP (& FRMS) are the mechanisms to do this. Let’s explore and set the policies and trigger points, adapt as events unfold and keep on incorporating the latest science.
- Whilst we’re just about to hear more on the science, I hope you will also appreciate the practical adaptation steps our peers are also undertaking.
- Visit **DynamicCoast.com** and click ‘**Adapt’** to see the progress!



Coastal Change Adaptation Fund & Guidance, is helping authorities to adapt.

£11.7m



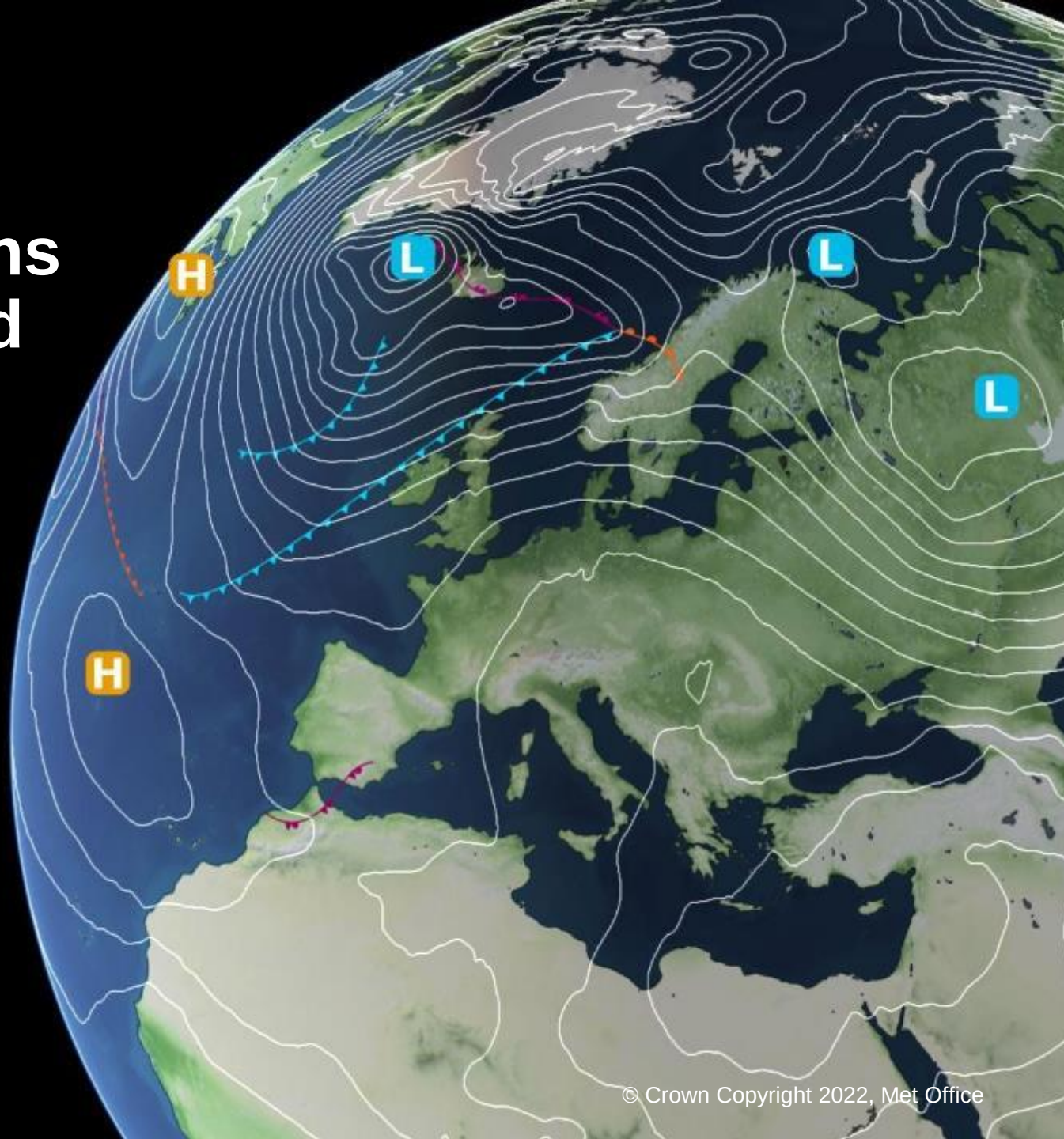
Dr Matthew Palmer
Met Office

Observations and projections of sea level rise for Scotland

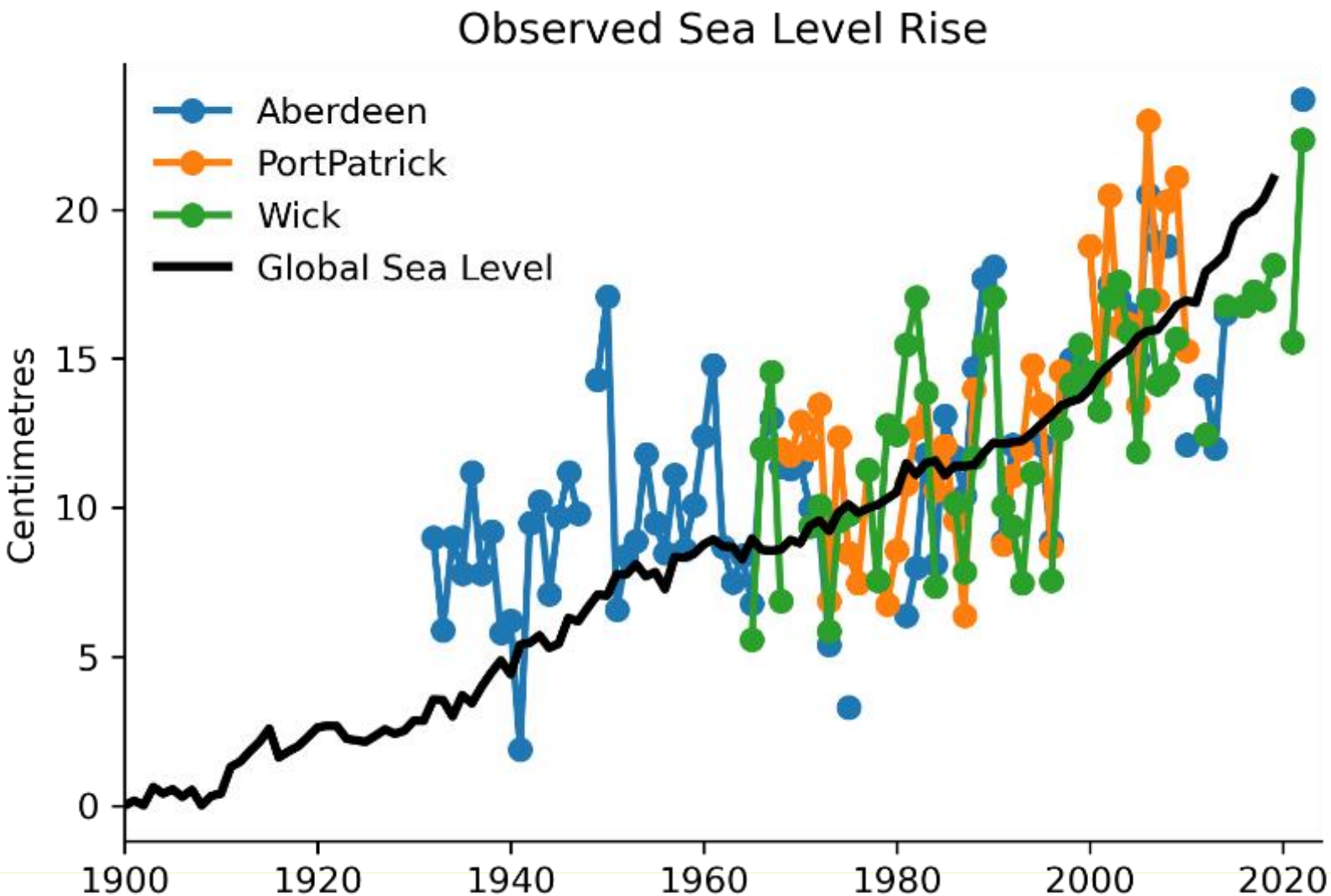
Dr Matt Palmer
Met Office Hadley Centre, Exeter, United Kingdom
University of Bristol, Bristol, United Kingdom

Coastal Change Adaptation Workshop

1st February 2024

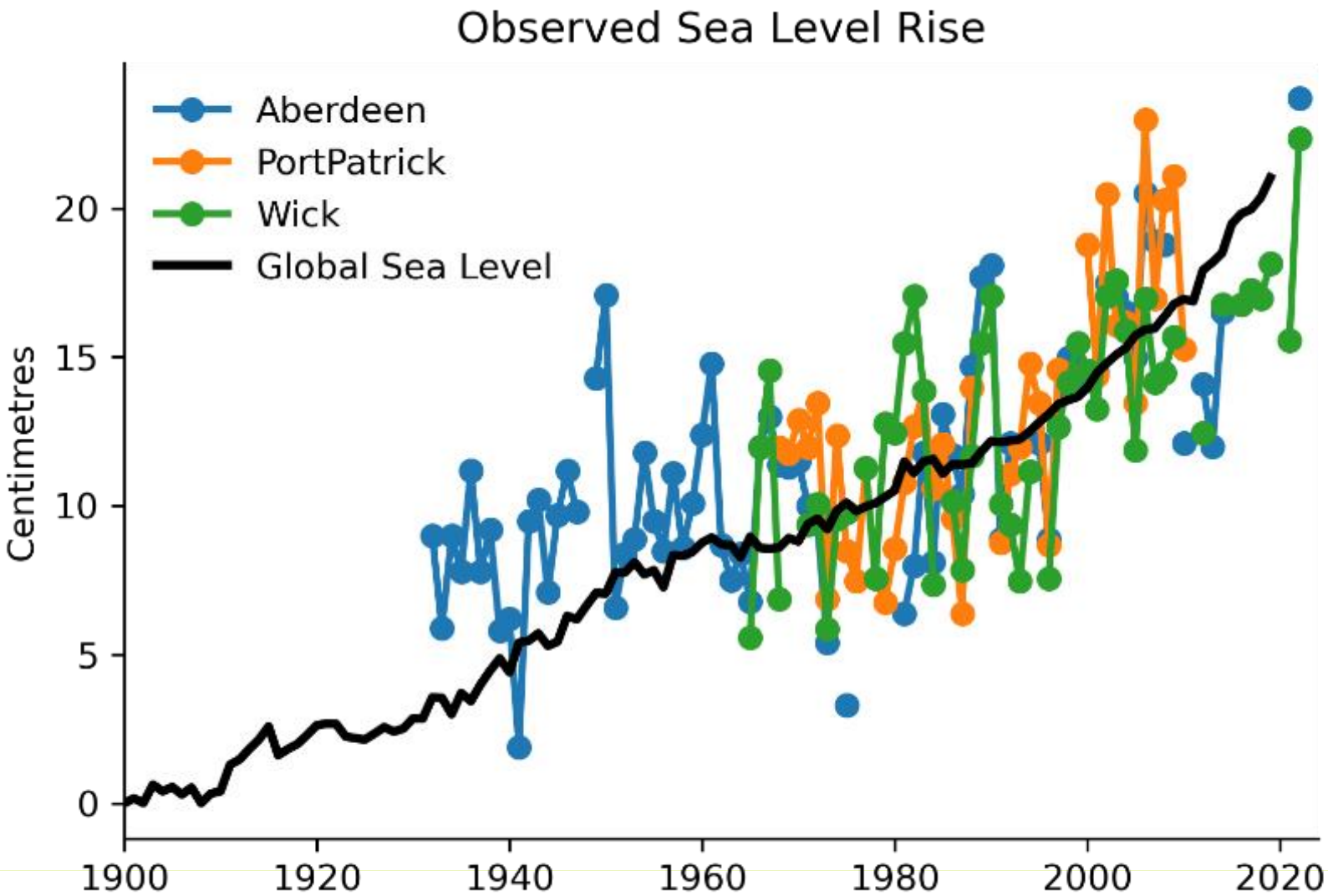


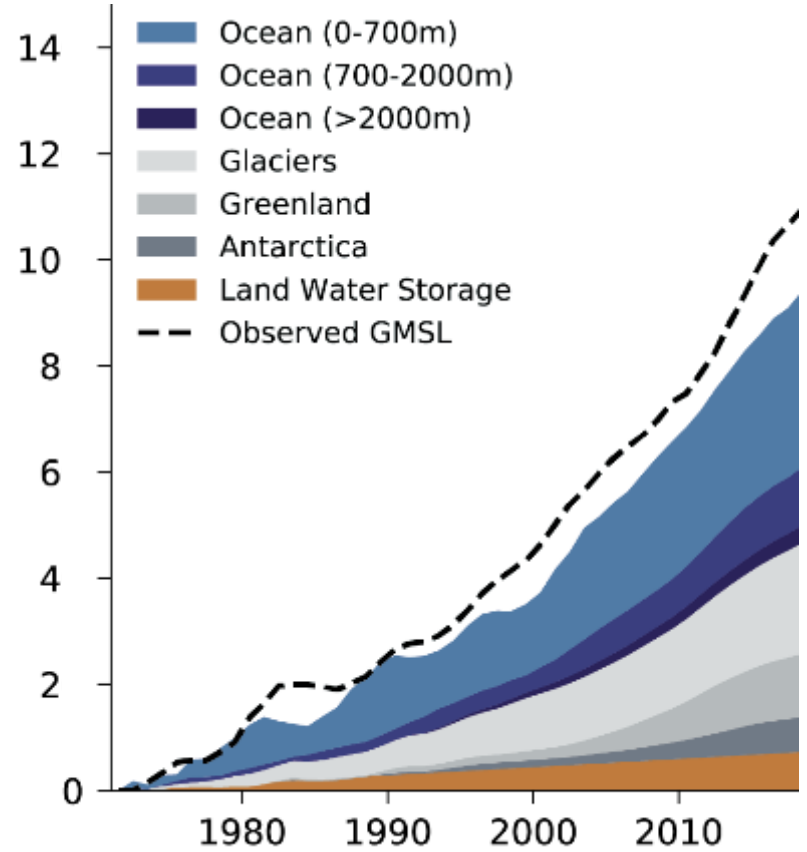
Met Office



Data sources: IPCC AR6; psmsl.org

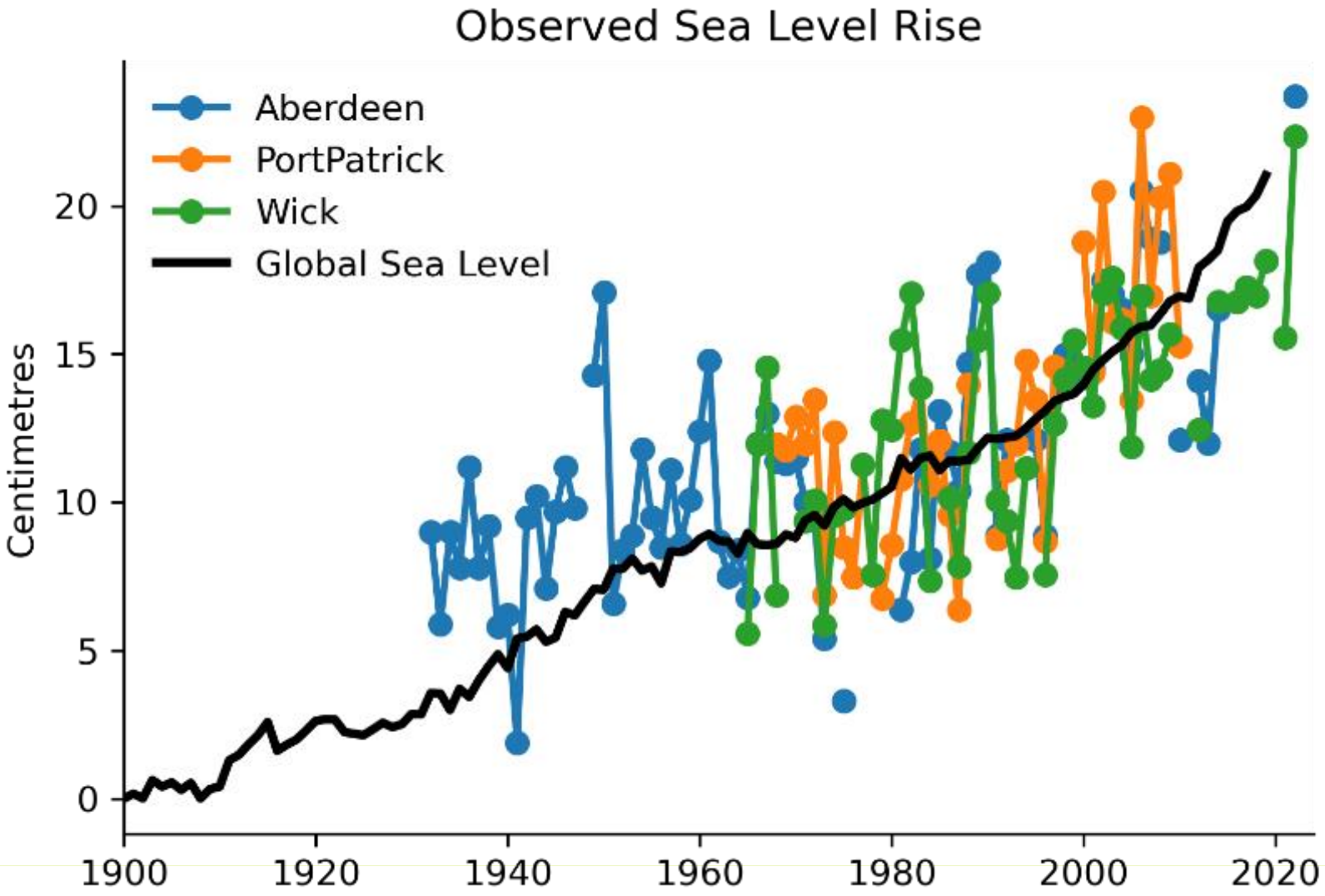
Met Office

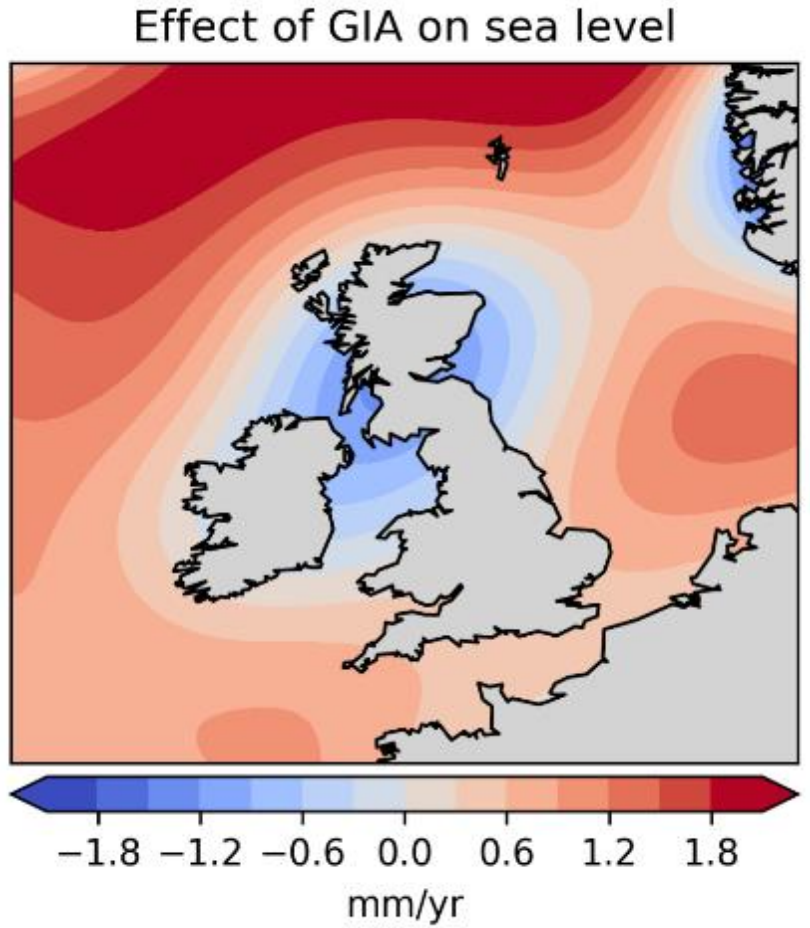




Data sources: IPCC AR6; psmsl.org

Met Office



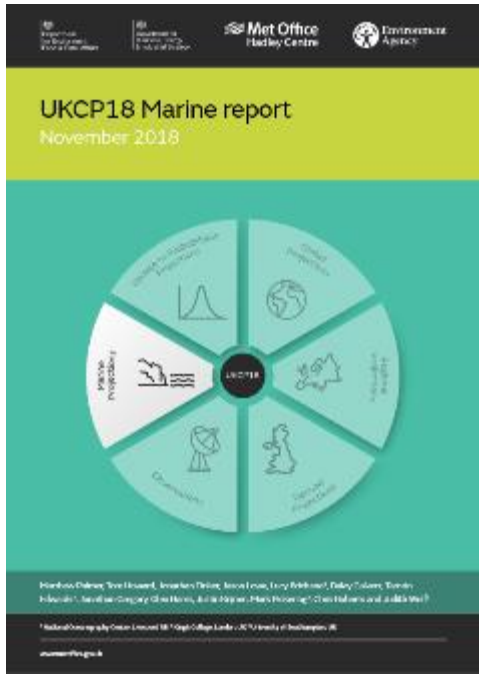


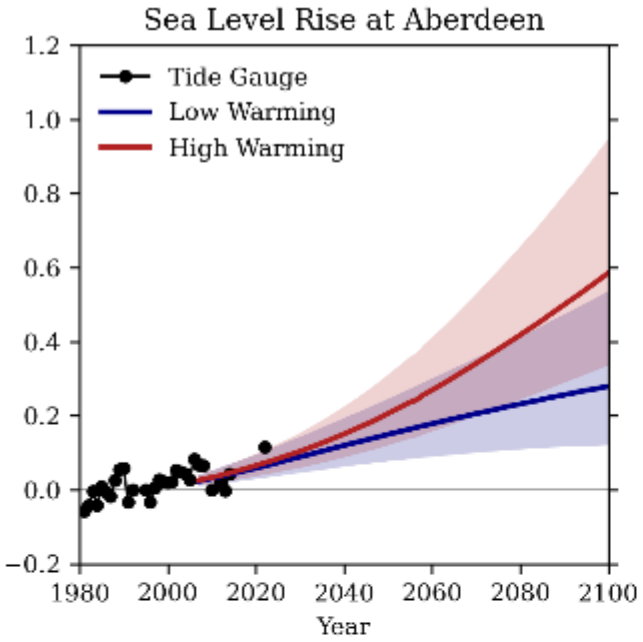
Glacial **I**sostatic **A**djustment

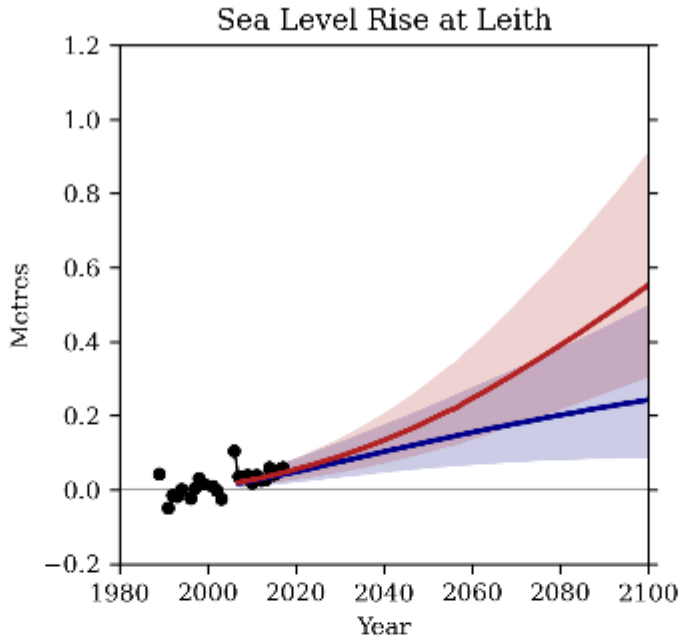
a.k.a. “post-glacial rebound”

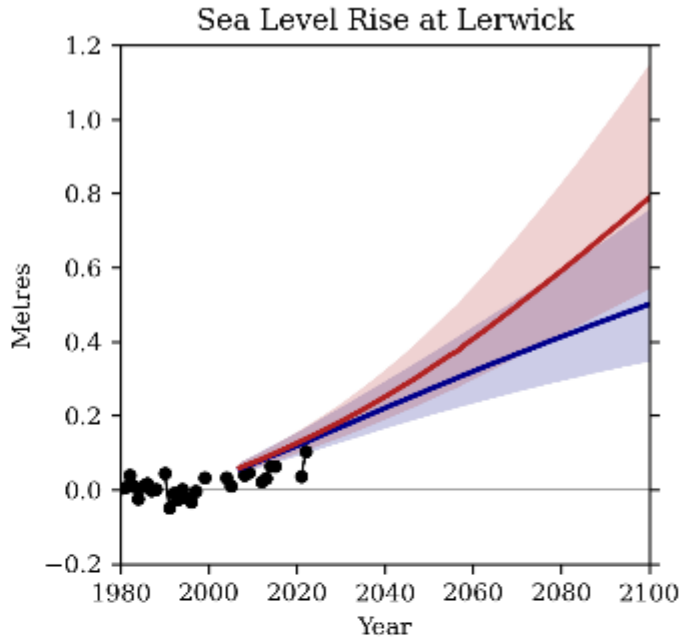
Data sources: IPCC AR6; psmsl.org; UKCP18

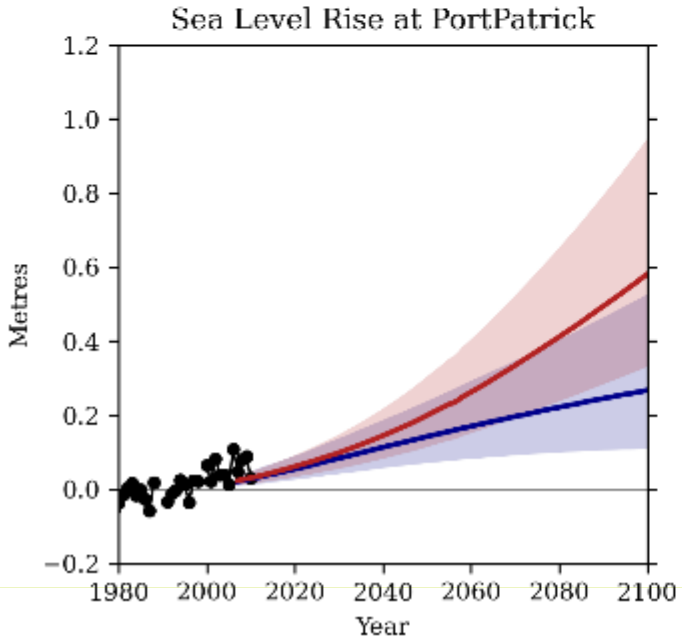
UKCP18 sea level projections for coastal locations to 2100

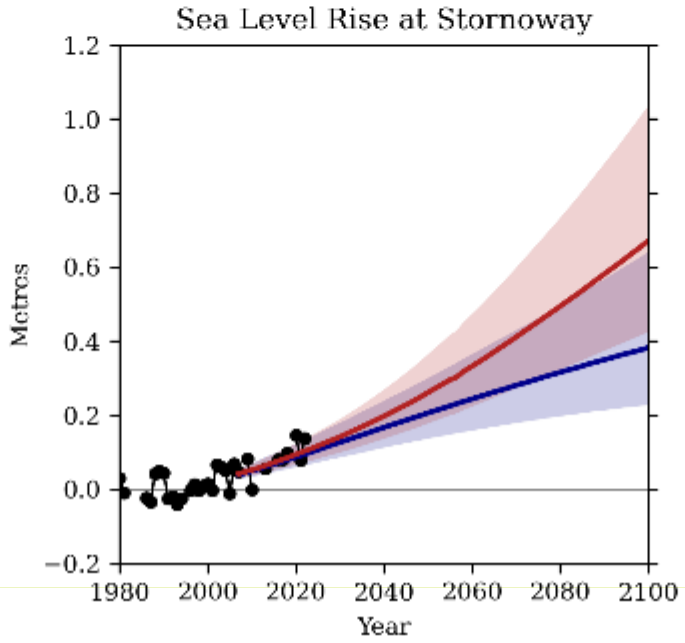


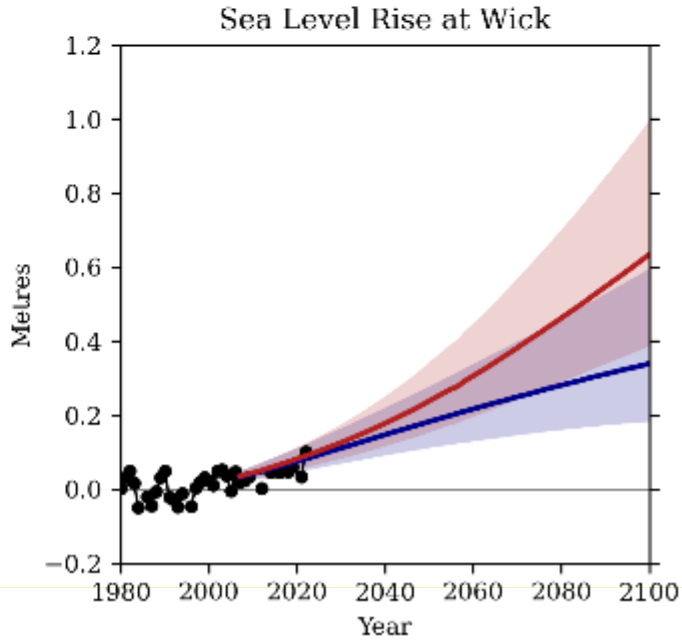






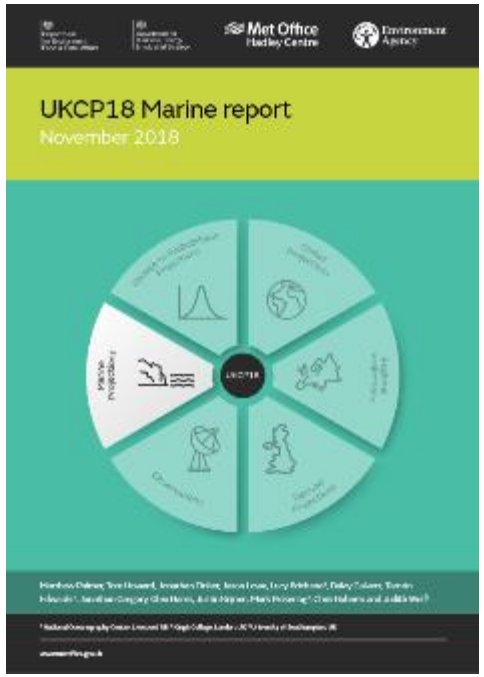


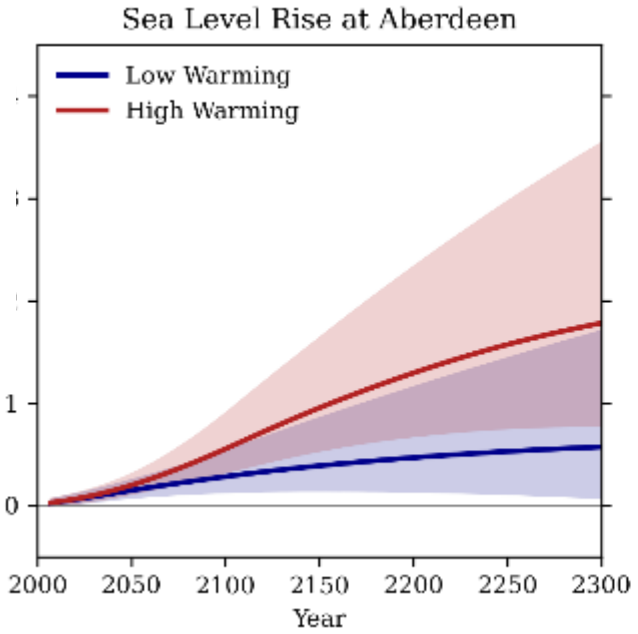


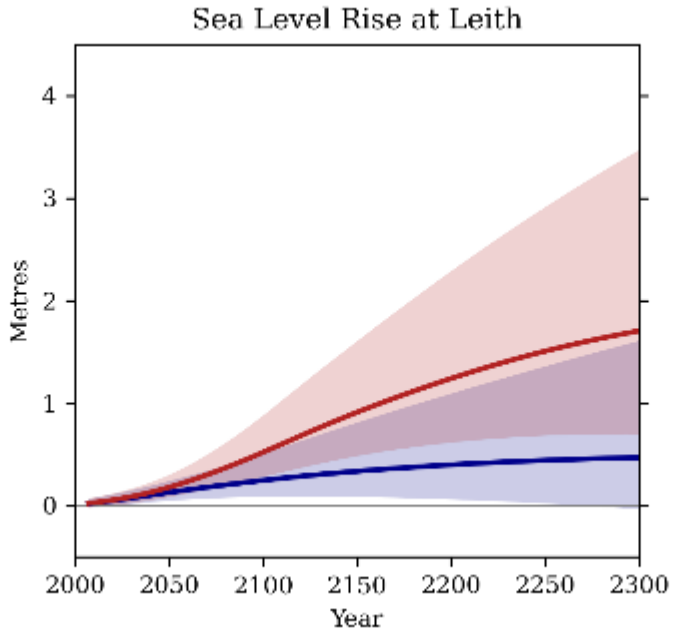


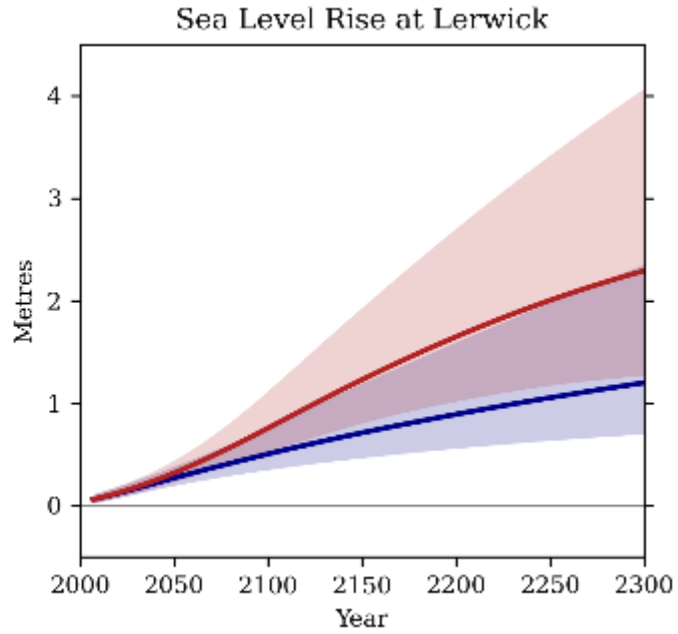
Data source: UKCP18

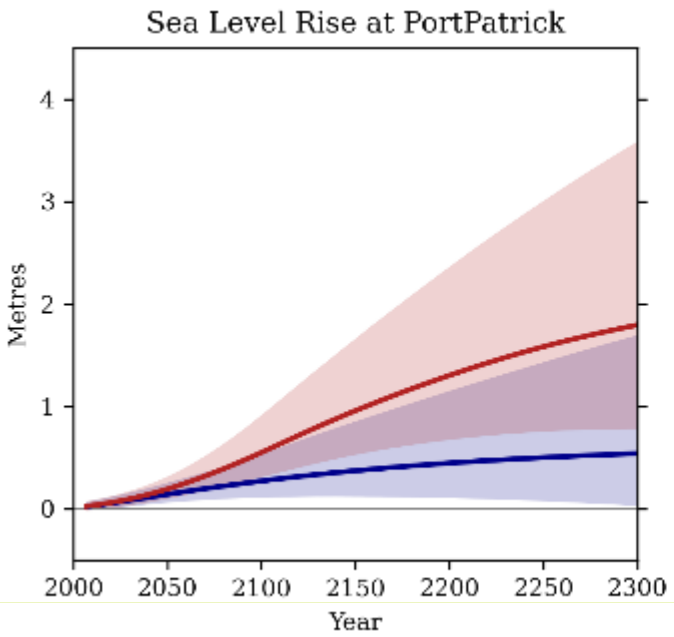
UKCP18 sea level projections for coastal locations to 2300

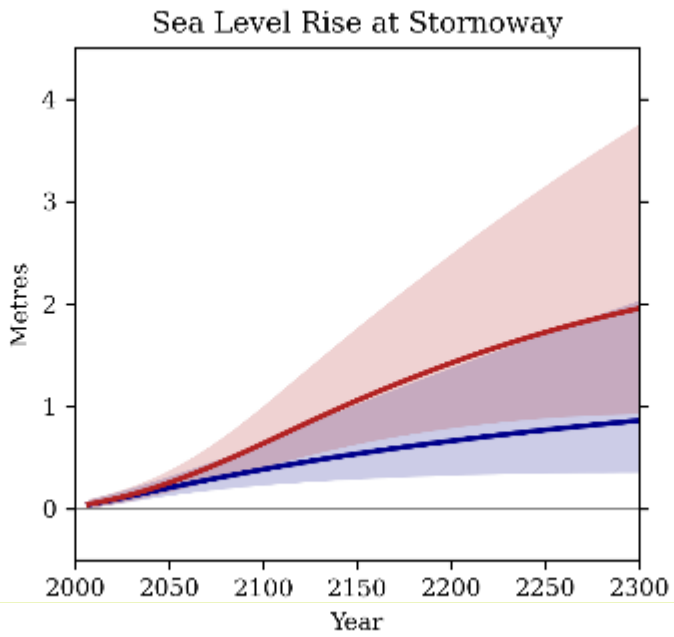


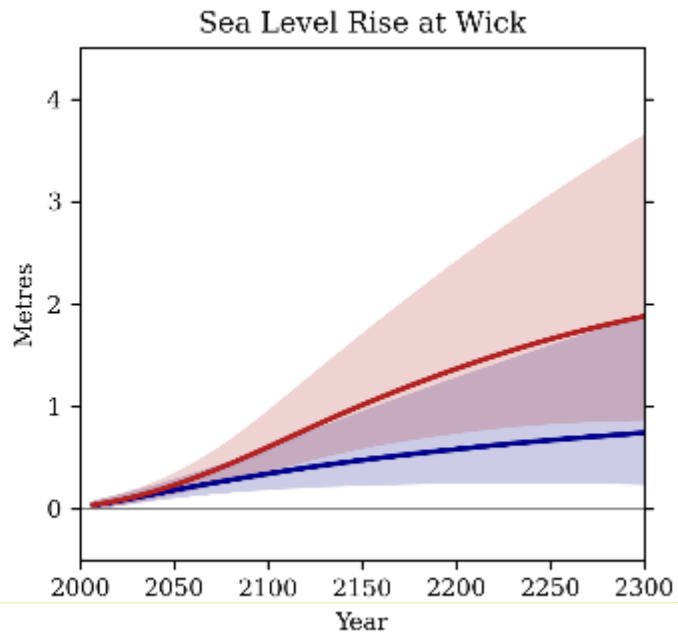








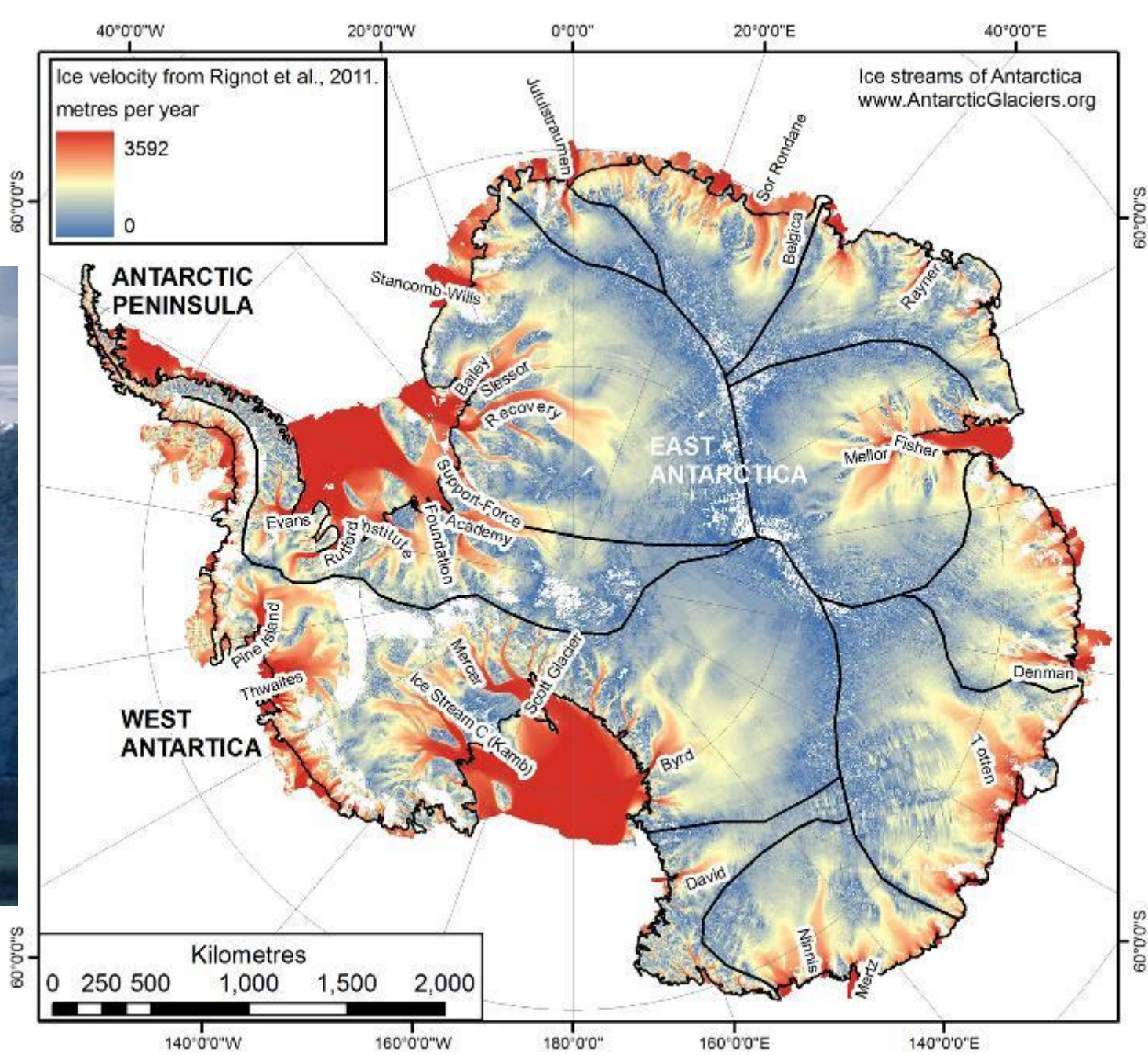




Data source: UKCP18

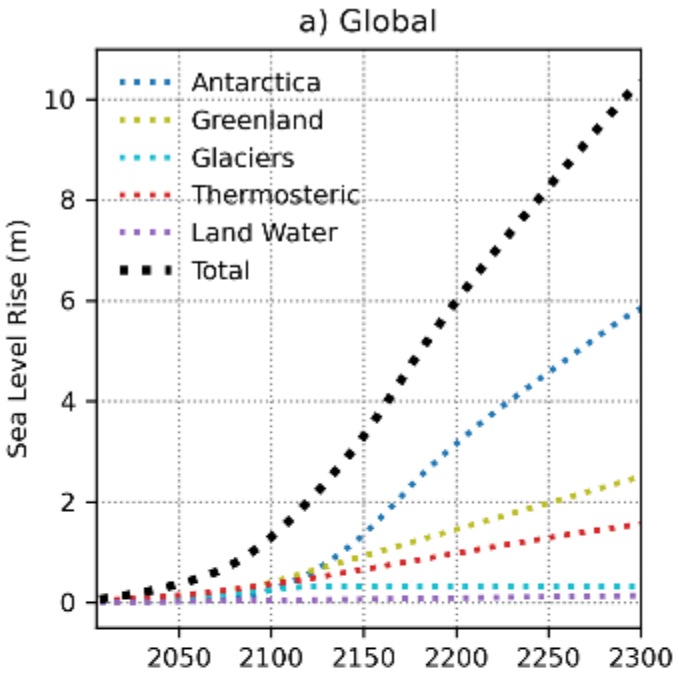
Met Office

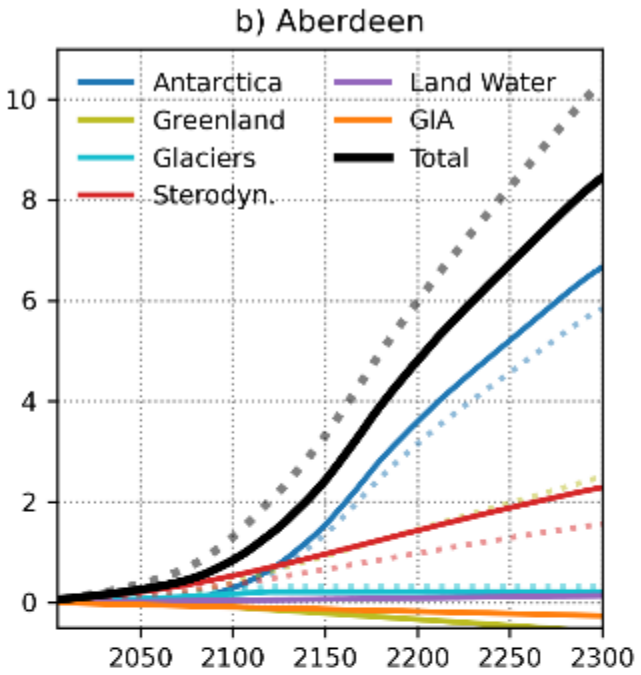
Key uncertainty: Antarctica

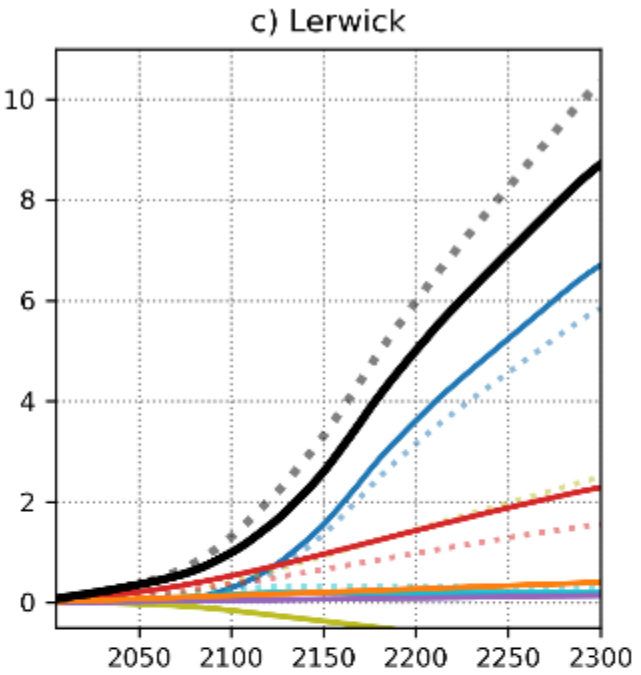


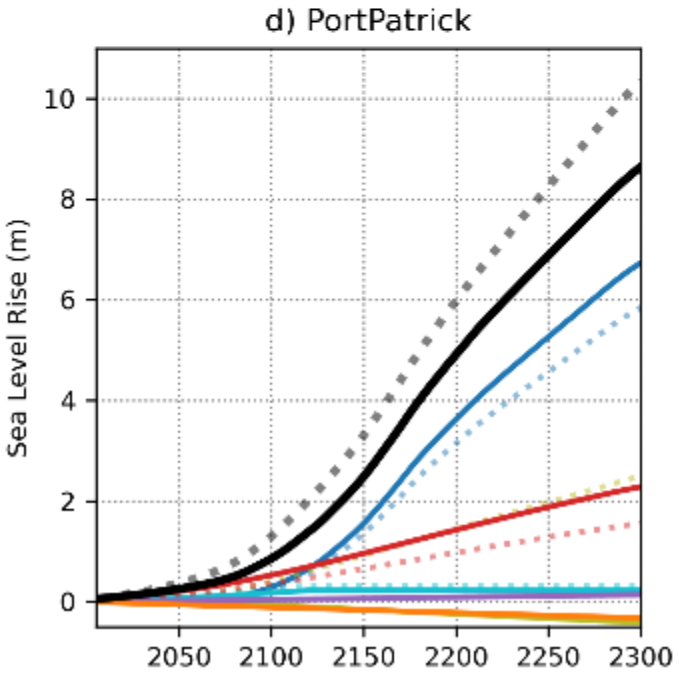
Data source: www.antarcticglaciers.org

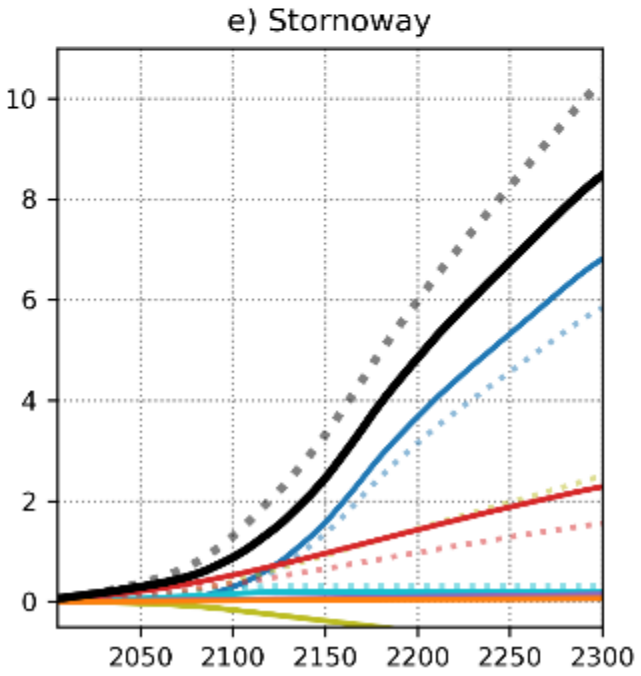
High-end storyline of sea-level rise (H1)

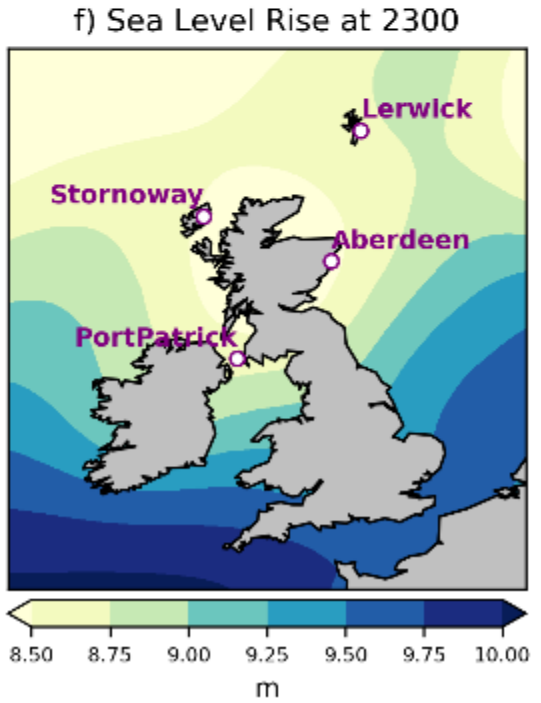






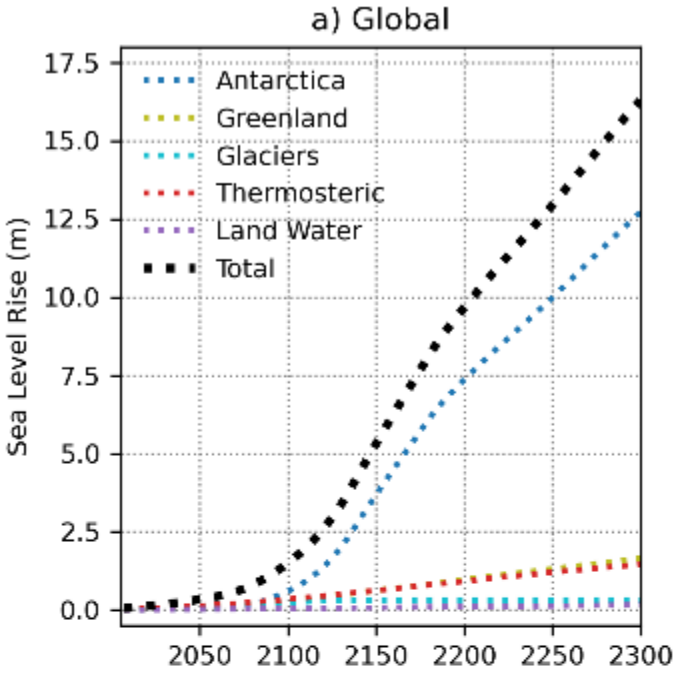


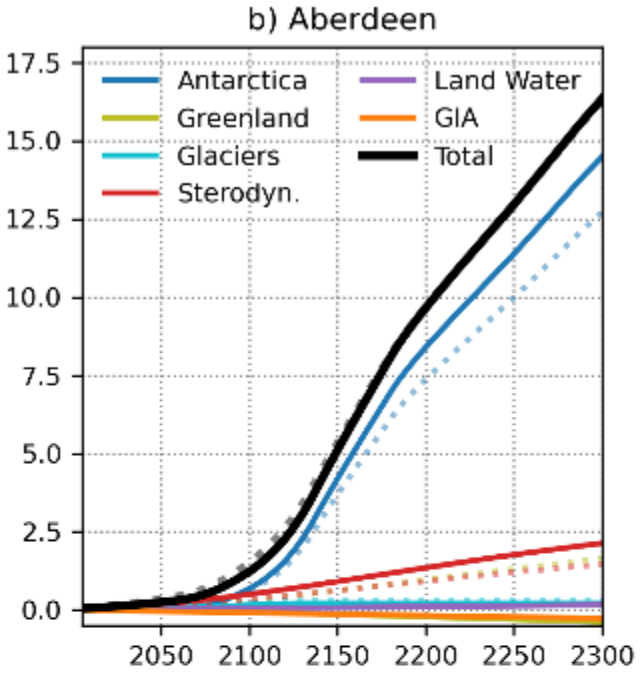


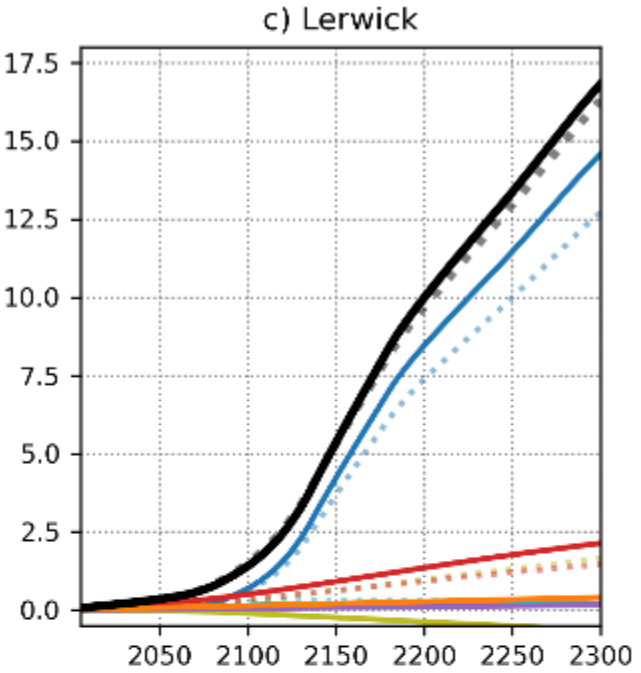


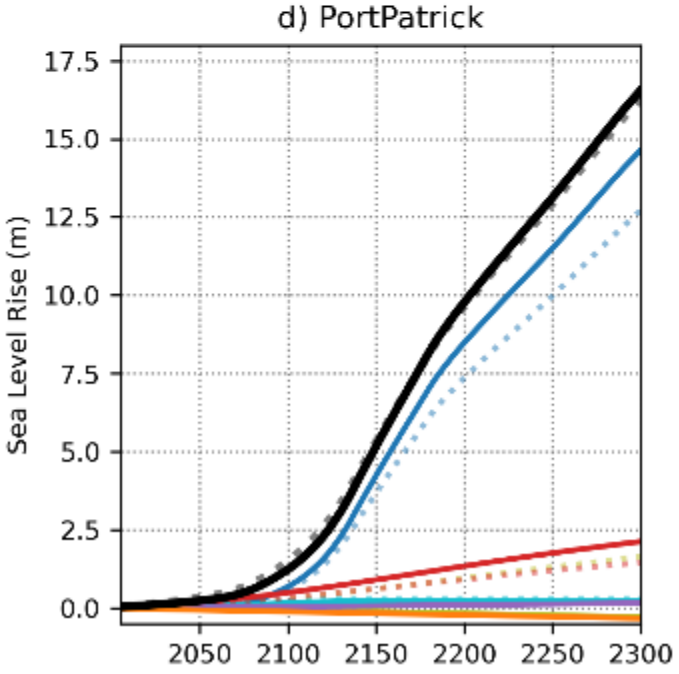
Data sources:
Palmer et al (in revision);
van de Wal et al (2022)

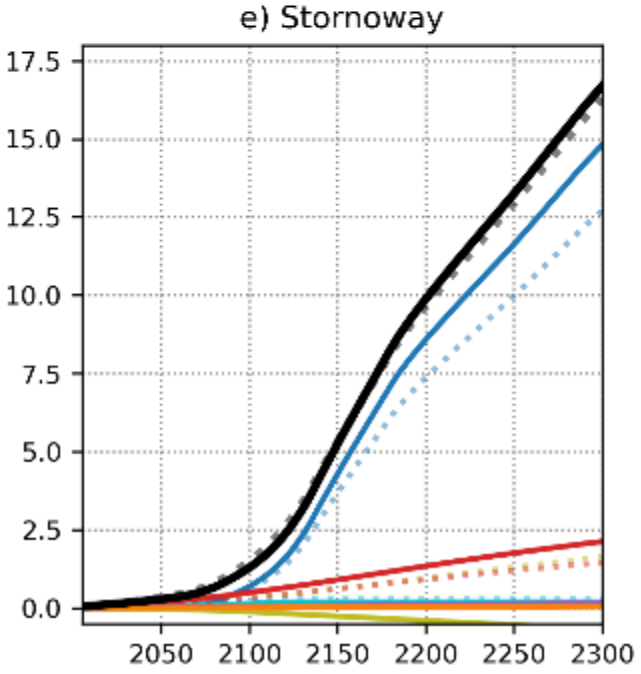
High-end storyline of sea-level rise (H2)

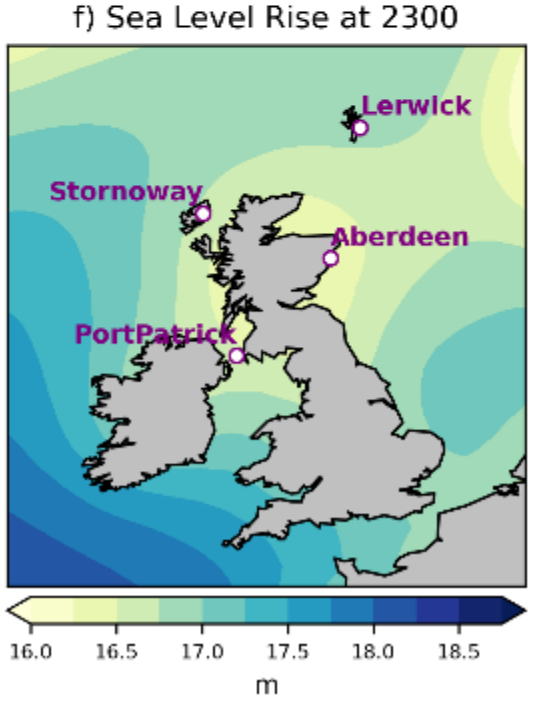












Data sources:
Palmer et al (in revision);
IPCC AR6

Summary:

- Global sea level has risen by about 20 cm since 1900
- SLR in Scotland is reduced due to GIA and the associated vertical land motion
- UKCP18 sea level projections show local SLR beyond 2100 => adaptation planning must consider multi-century time-horizons
- The UKCP18 low warming scenario shows 0-2 m of local SLR by 2300
- The UKCP18 high warming scenario shows 1-4 m of local SLR by 2300
- Due to uncertainties in ice sheet processes, we cannot rule out much larger local SLR by 2300

Kathryn Calisaya
SEPA

Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

For the future of our environment

Coastal Change Adaptation Planning

Kathryn Calisaya, SEPA, Flood Risk Management Planning Policy

01 February 2024

What is Coastal Change Adaptation Planning?

Stage 1: Strategic goal

Understanding the place

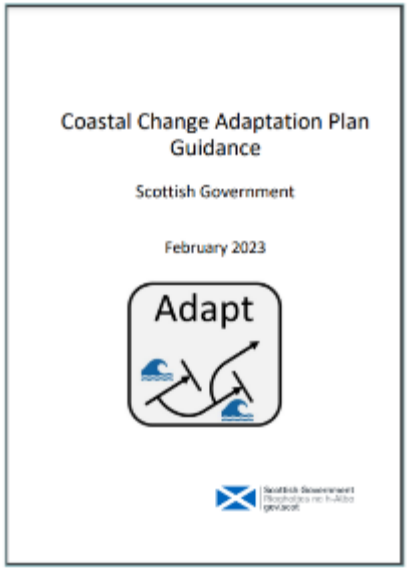
Stage 2: Planning Actions

- Triggers
- Thresholds
- Pathways

Stage 3: Operational Plan

Planning delivery of actions

- Cost
- Timescales



Stage 1: Understanding the Place

1. Agree on the place

- Geographical area
- Assets
- Community / stakeholders

2. What is important for that place?

Now: 2025 **Future: 2125**

- What actions are being taken now or have been taken in the past?
- What is the history of that place?
- What are the long-term flood and erosion risks (next 100 years)
- What else might change?
- What important for the future of that place?
- Why do people want to live there?

North Berwick, East Lothian.

Stage 1: Understanding the Place

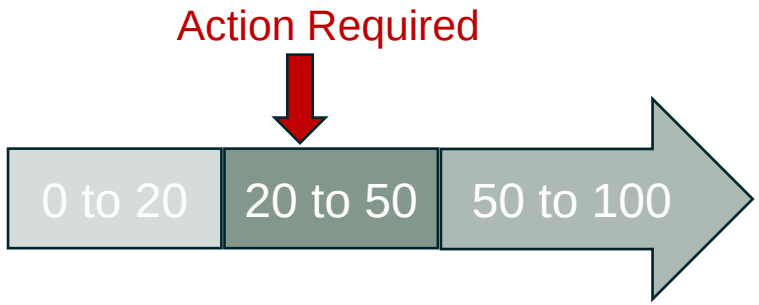
Accept that places change

Differences with SMPs

- Identify Coastal Change Management Areas
- Adopt CCMAs into Local Development Plans
- Do NOT put timescales against polices
- Do NOT include a ‘medium term’ policy
- Be Mindful of language

Agree Policies

- No active intervention
- Hold the line
- Managed realignment



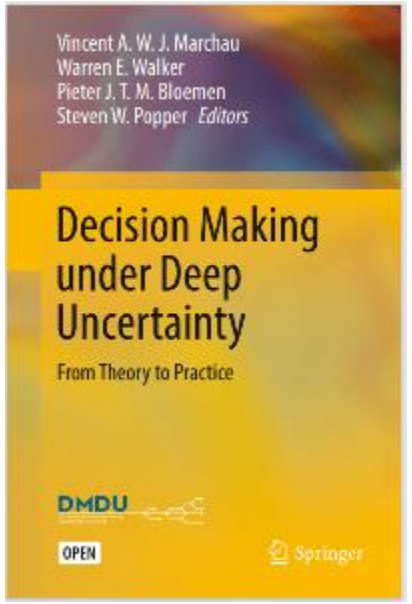
Old color photographs of Scotland, 1890s - Rare Historical Photos

Stage 2: Planning actions

Dynamic Adaptive Policy Pathways (DAPP)

Proactive and Dynamic Planning in Response to how the future unfolds

- Join Knowledge Hub Welcome - Knowledge Hub (khub.net)
- Joins PEERS: Practitioner Exchange for Effective Response to Sea Level Rise (PEERS) Interest Form (google.com)
- Read Chapter 4.2 Decision Making under Deep Uncertainty: From Theory to Practice | SpringerLink



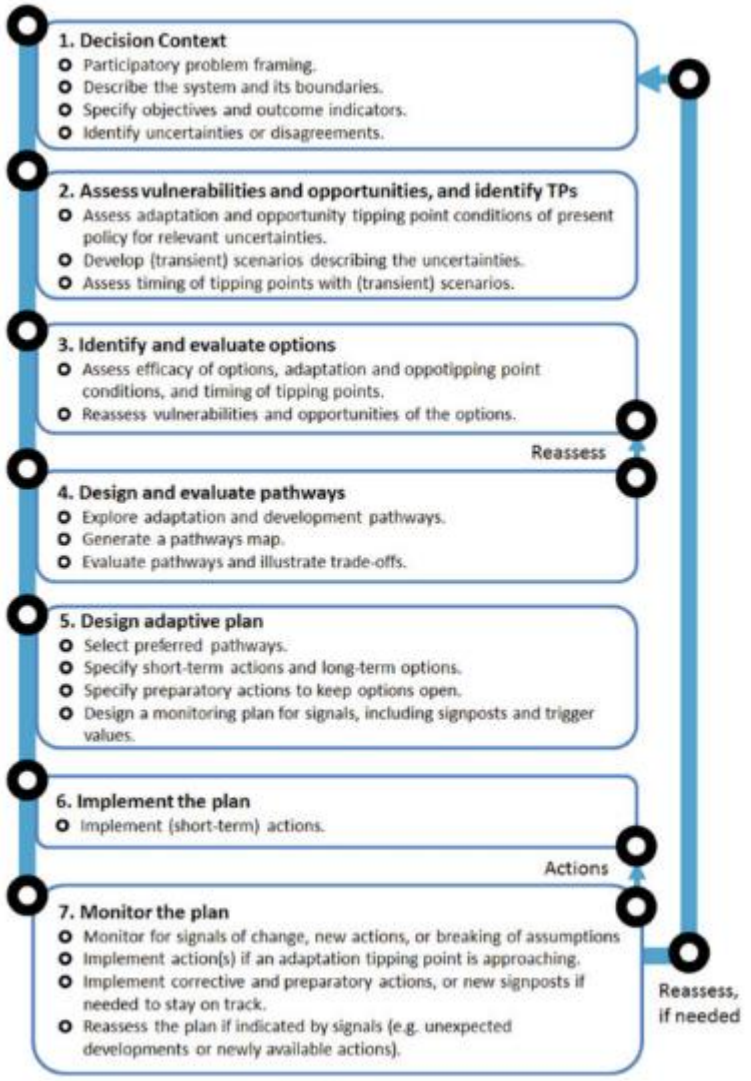


Fig. 4.1 DAPP approach. Adapted from Haasnoot et al. (2013)

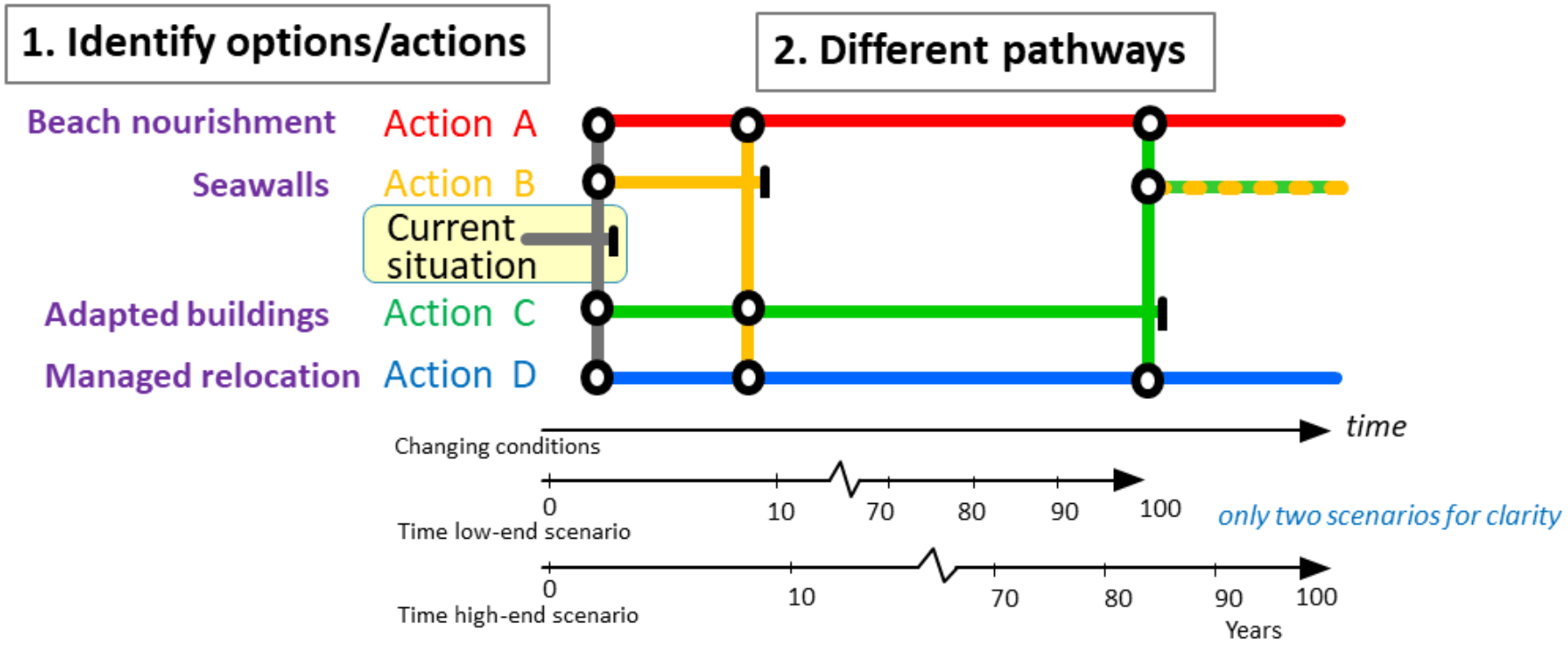
Stage 2: DAPP Triggers and Thresholds

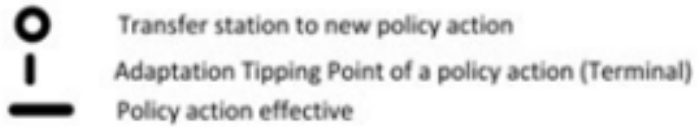
- **Threshold:** a place you don't want to get to / unacceptable consequences
- **Trigger:** new action must be taken to avoid reaching that threshold
- Monitoring is key
- How to identify and monitor social / economic triggers is more difficult than physical triggers.

Houses left perilously close to the cliff collapse in Mundesley. Photograph: Joe Giddens/PA

CoastSnap
community beach monitoring

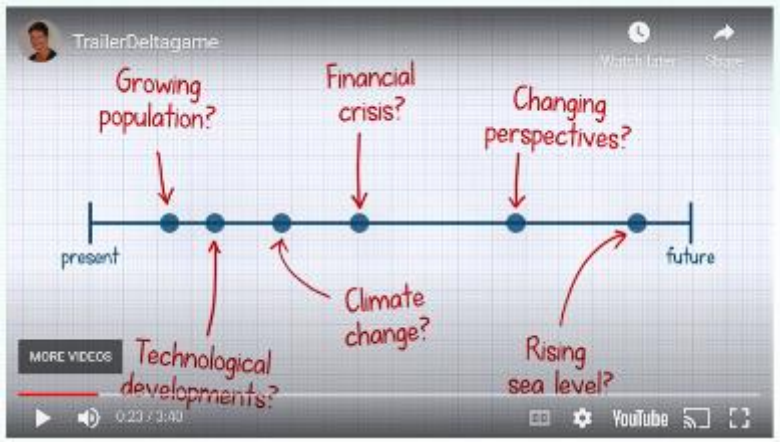
Stage 2: Dynamic Adaptive Pathways

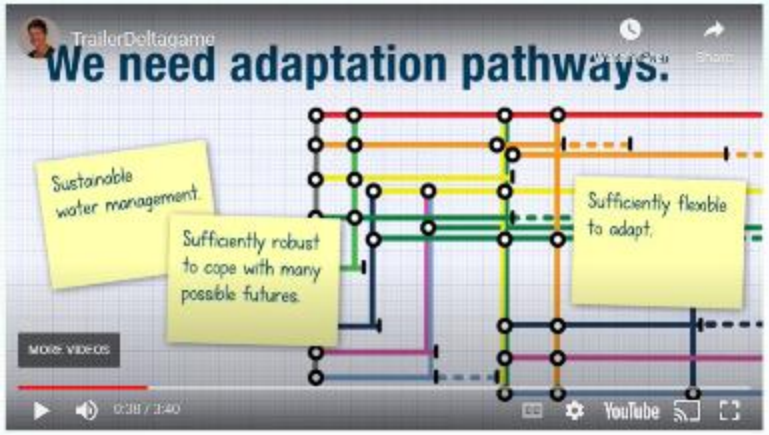




[The New and Adaptive Paradigm Needed to Manage Rising Coastal Risks - NZAIA]

Stage 2: Actively Involve Communities





Deltares

[Sustainable Delta Game | Deltares]

Stage 2: Planning Actions

You are not alone!

What we do

Within the H2020-CoCliCo Project, we are developing a climate service for coastal adaptation on a pan European scale, informing broad scale flood risks and providing boundary conditions for users concerned with local adaptation in cities and ports.
https://coclicoservices.eu/

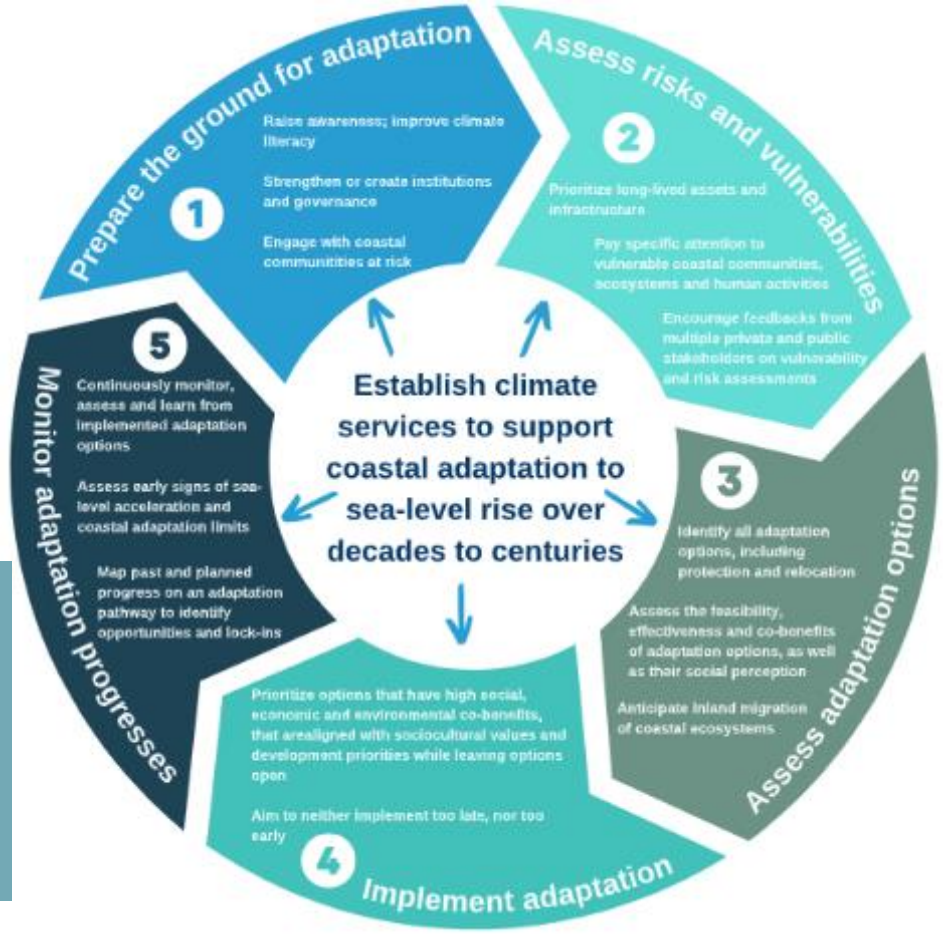
CoCliCo
coastal climate core services

score

Within the H2020-SCORE project, different stakeholders are co-creating adaptation solutions with stakeholders in 10 coastal cities and regions in Europe. This allows for mutual exchange of knowledge and sharing expertise and success stories.
https://score-eu-project.eu/

The H2020-PROTECT project is currently preparing projections to 2500 based on existing literature, and will make new projections using new ice-sheet melting simulations by the end of the project.
https://protect-slr.eu/

Protect
CRYOSPHERE & SEA LEVEL



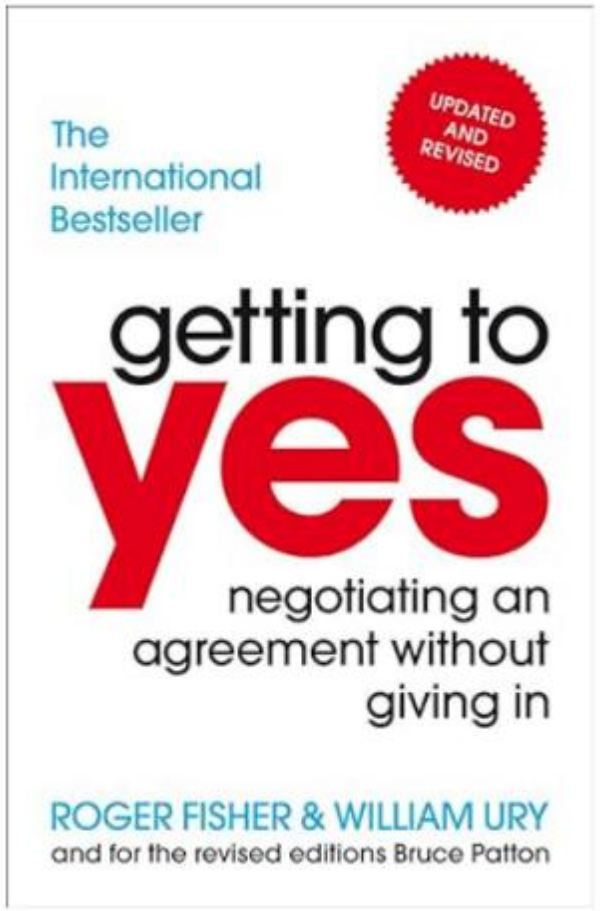
When will a 2-metre rise in sea level occur?

Global mean sea-level rise will exceed 2 metres after 2100 and within less than 2 millenia.

Cloud UGA (univ-grenoble-alpes.fr)

Stage 2: Benefits of Dynamic Adaptive Pathways

- **Flexible**
- **Cost Effective**
- **Transparent decision making**
    - Provides confidence to take actions NOW
    - Provides confidence to wait or delay actions
    - Enables you to change planning actions according to how quickly trigger points or thresholds are reached.
    - Avoids over-investment too early
    - Avoids ‘loosing face’ by changing your position
    - Helps generate consensus



Thank you

Contact details

KATHRYN CALISAYA
Senior Policy Officer
Email: kat.calisaya@sepa.org.uk

sepa.org.uk

Q&A

13:45-13:55

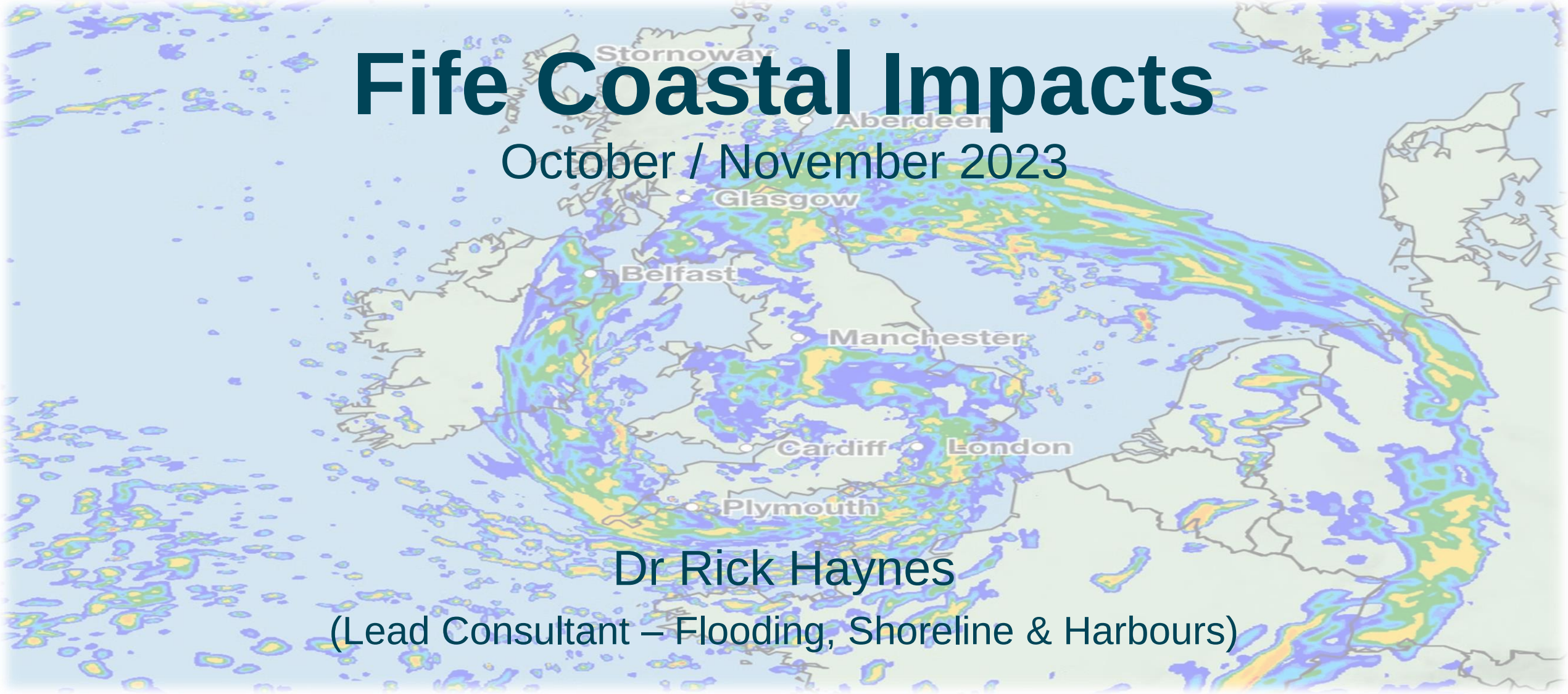
Crovie
Credit: Dynamic Coast

Dr Rick Haynes
Fife Council

sniffer
knowledge brokers
for a resilient Scotland

Fife Coastal Impacts

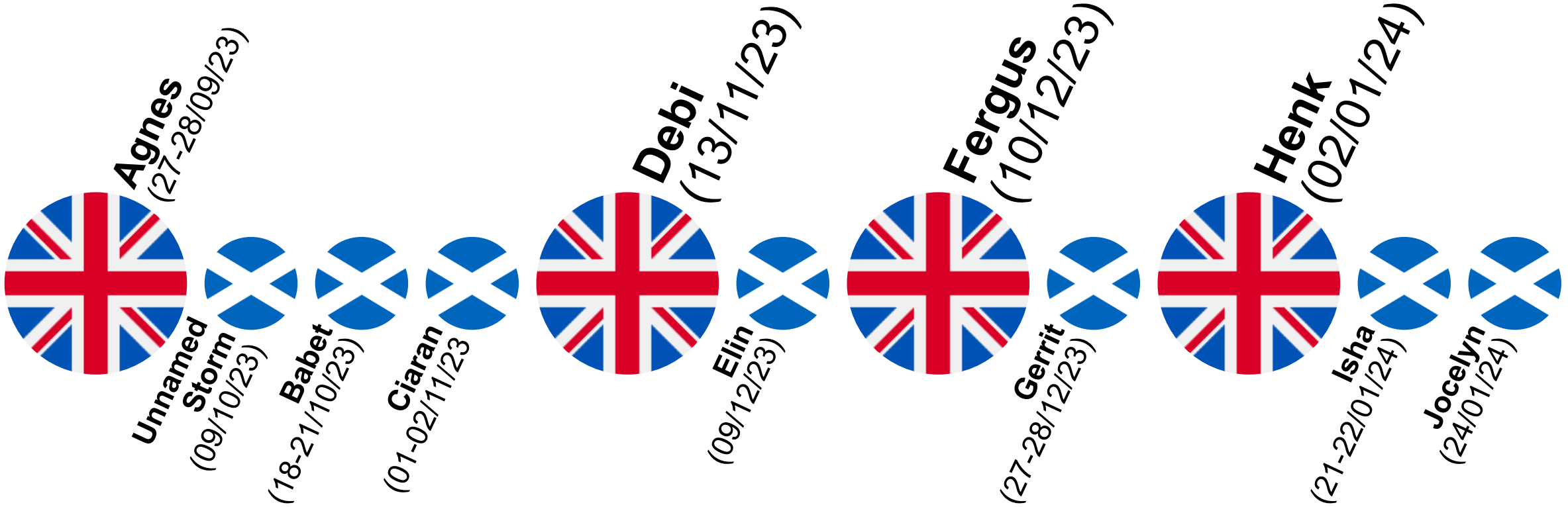
October / November 2023



Dr Rick Haynes

(Lead Consultant – Flooding, Shoreline & Harbours)

Storm Patterns 2023-24



Weather Pattern

Storm Babet

(18-21 October 2023)

- 150-200mm rainfall in eastern Scotland
- 2 MetOffice red warnings
- 58mph winds over much of Scotland
- 77mph at Inverbervie
- Gusts over 115mph on mountain tops
- MetOffice summary: HERE

Storm Ciarán

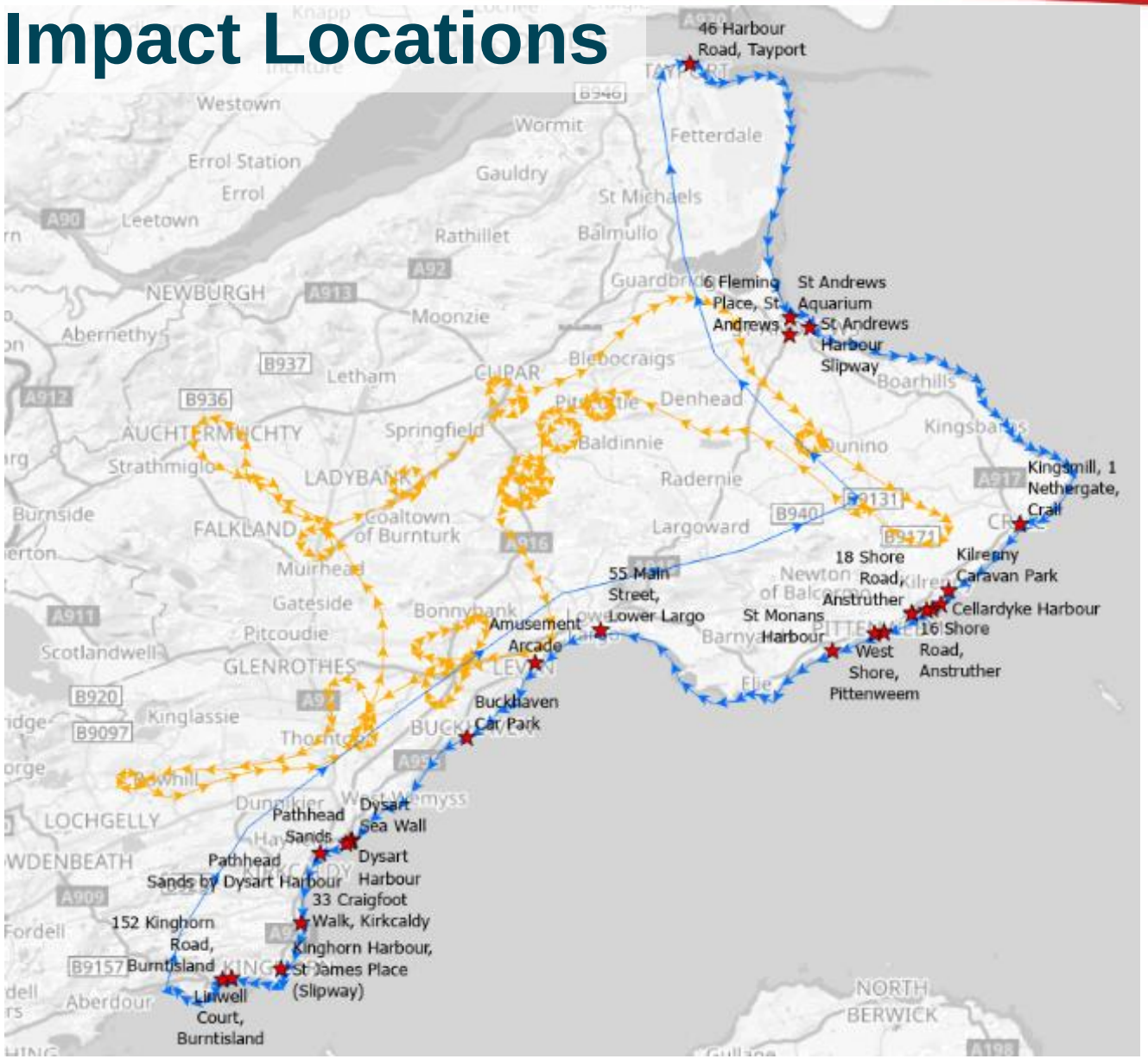
(01-02 November 2023)

- Comparable to ‘Great Storm’ of 1987
- Gusts of 69-81mph
- Typical for fairly major Atlantic Storm
- Exceptionally deep low pressure
- Additional rainfall to Storm Babet
- MetOffice summary: HERE

Weather Response

- Inspectors out post Storm Babet & Storm Ciarán
- Civil Air Support inland imagery flight (Ballingry to ‘Muchty, Leven to Cupar to Strathkinness to Kingsmuir)
- Civil Air Support coastal imagery flight (Dysart to Burntisland):
  - Requested: Fri 03 Nov 2023
  - Flown: Sun 05 Nov 2023
  - Imagery delivered: Mon 06 Nov 2023
- Advice being provided to multiple locations from Mon 06 Nov 2023
- Stabilisation works commenced (Pittenweem) Fri 10 Nov 2023

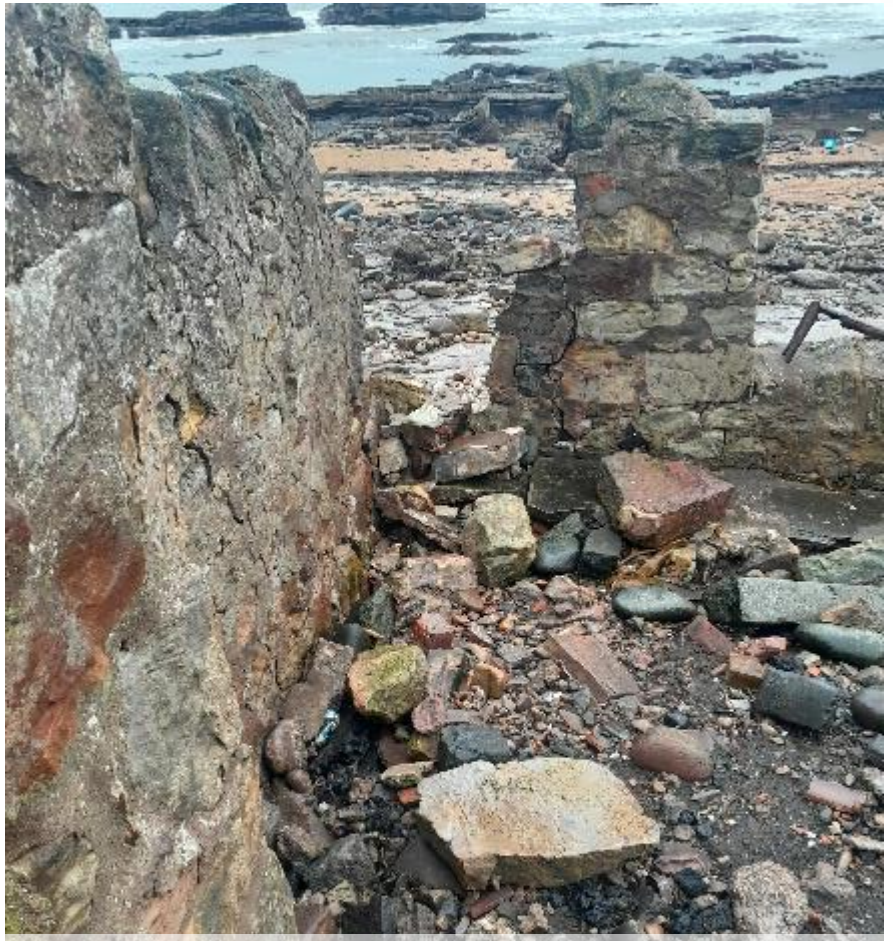
Impact Locations



27 discrete locations damaged

- 205km inland / 157km coastal flights
- Damage to:
  - Coastal Wall
  - Harbour Wall
  - Network Rail Underpass
  - Stone Revetement
  - Dunes & Parking area
  - Gabion Baskets
  - Coastal Paths
  - Destroyed Slipways

Kilrenny Caravan Park – Coastal gabions dislodged



Cellardyke – Coastal Staircase Damaged

Leven – Car Park Retaining Wall Failure

Buckhaven – Car Park Gabions Damaged

Dysart – Coastal Defence Wall Damaged

Seafield – Coastal Path Damaged

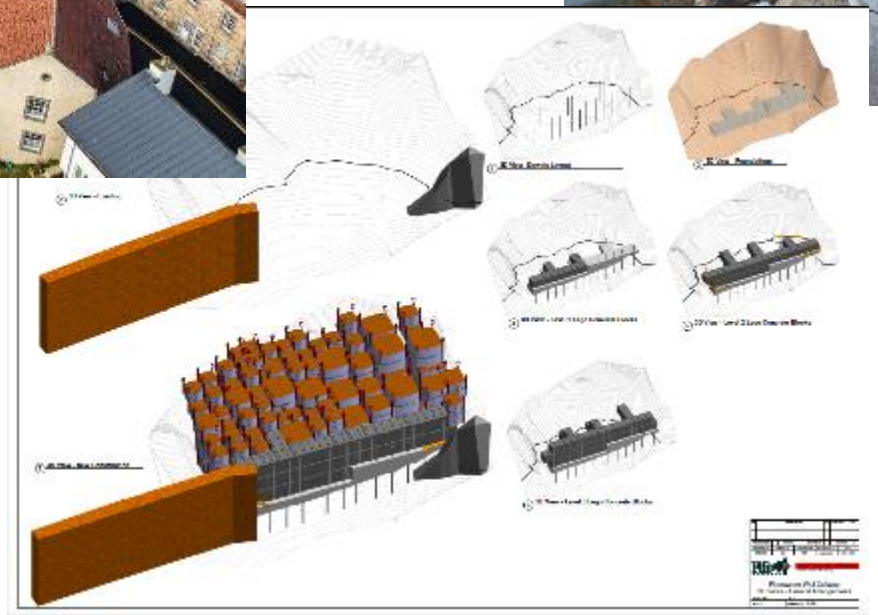
Kinghorn – Slipway Damaged

Anstruther – Shore Road Coastal Wall Collapse

Shore Road, Anstruther - Stabilisation

Pittenweem – Abbey Wall Road Coastal Wall Collapse

Pittenweem, Abbey Wall Road – Stabilisation



St. Andrews Harbour – Slipway destroyed

St. Andrews Harbour – Slipway stabilisation

Lessons Learned

- Emergency response vs Strategic response?
- Private ownership vs Public ownership
- Stabilisation vs Reinstatement?
- Managed Retreat vs Build Back vs Build Back Better?

- No Council Incident Management Team called; would it have helped?
- “Unplanned” / reactionary Fife Council spend: ≈ £152,000+
- Implications on Shoreline Management Plan / Coastal Change Adaptation Plan

John Lavery
Mott MacDonald

MOTT MACDONALD

Coastal Change Adaptation Plans

Lessons from managing contrasting coasts

1 February 2024

MOTT MACDONALD

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Agenda

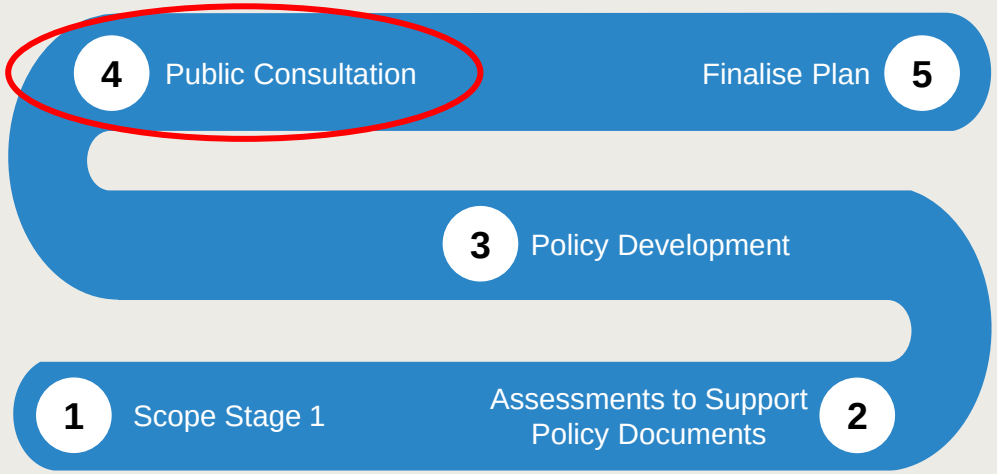
1. Timeline of the projects presented
2. Key points to making the plan
3. Characterising the two sites
4. Comparing coasts
5. Lessons for adaptation planning

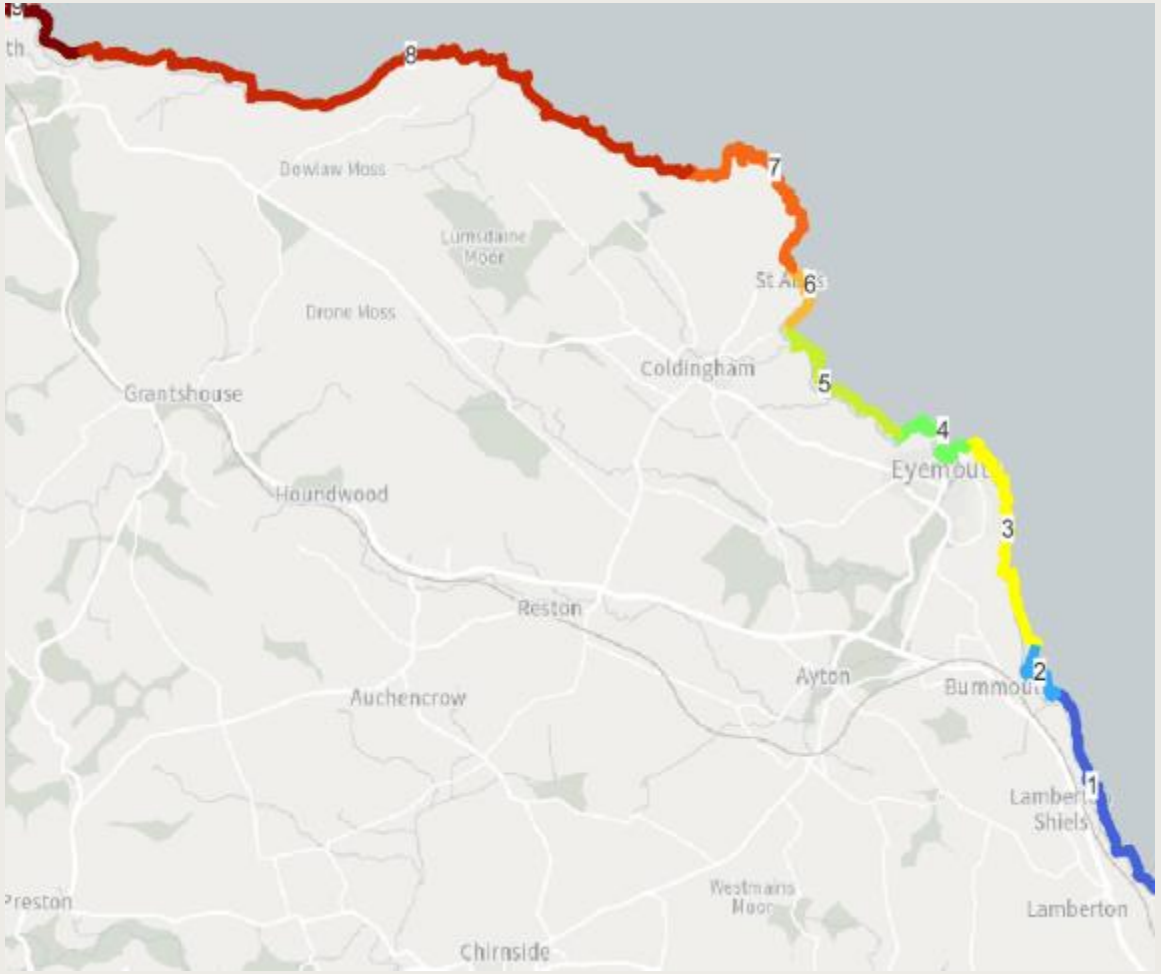
Berwickshire Coastal Change Adaptation Plan

Scottish Borders Council

Timeline of current work

- **2019 –** Shoreline Management Plan update commenced
- **2023 –** Coastal Change Adaptation Plan guidance launched
- **2024 –** Consultation begins on Berwickshire CCAP Phase 1



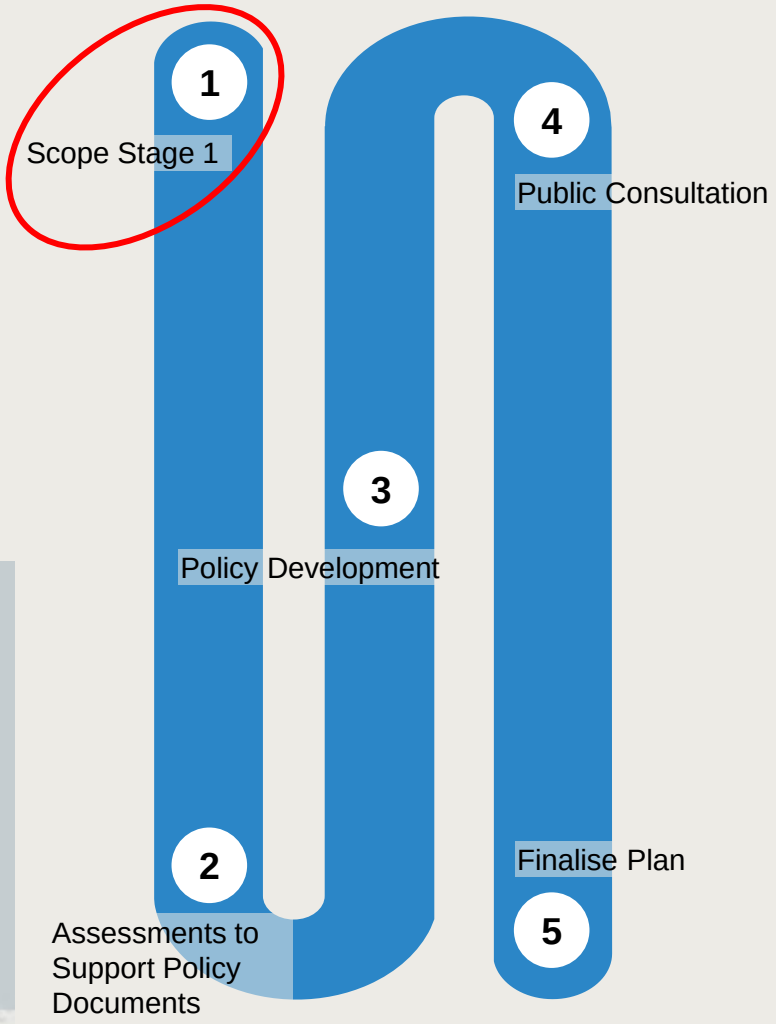


Edinburgh Coastal Change Adaptation Plan

City of Edinburgh Council

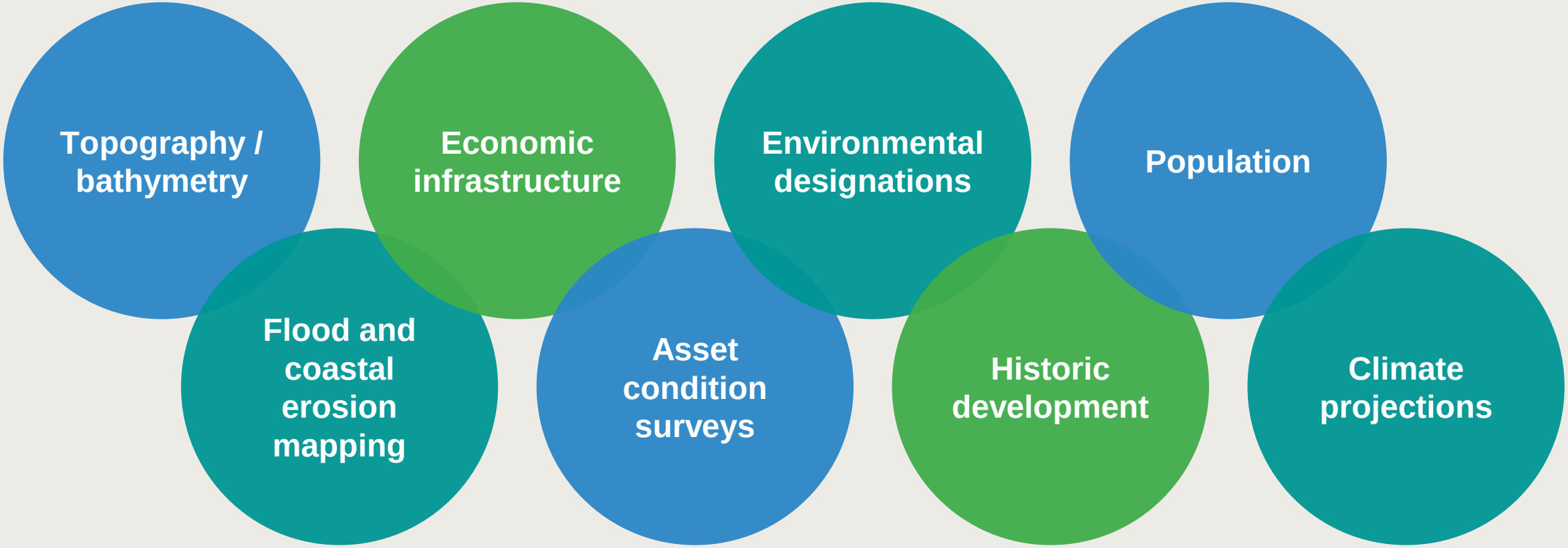
Timeline of current work

- **2023 –** Coastal Change Adaptation Plan guidance launched
- **2023 –** CEC CCAP data gap analysis
- **2024 –** Stakeholder engagement and commencement of CCAP Phase 1



Maintaining an evidence-based approach

‘The *future* is a foreign country; they do things differently there.’



Rocky coast and cliffs
St Abbs (right)

Major clifftop infrastructure
(left, Lamberton)

Historic fishing
(below, Burnmouth; right, Cove)

Coastal defences
(above, Eyemouth)

Tourism
(below left, Pease Bay; below right Coastal Path)

Aging assets

Tourism
(left, Portobello beach)

Regeneration plans
(above and above right, Granton)

Commercial and shipping
(right, Forth Ports Leith)

Historic buildings
(below, Barnbougle Castle)

Aging assets
(Starbank Rd seawall, Seafield rock revetment)

Industrial functions
(above right, Seafield WwTW)

Comparing Berwickshire and Edinburgh Coasts

Commonalities and contrasts

Population density

Economy

Topography relative to MSL

Flood risk

Social vulnerability

Existing Shoreline Management Plan?

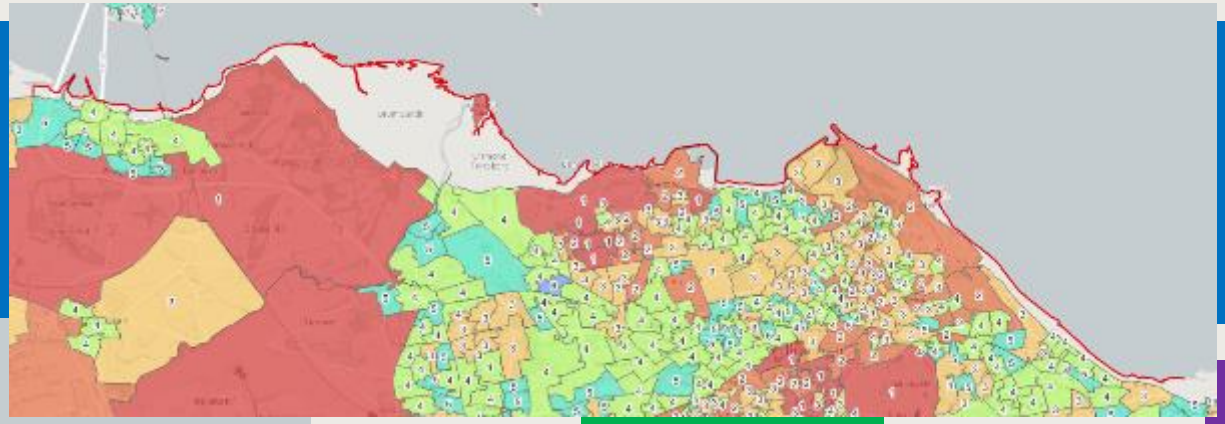
Marine users

Coastal erosion

Comparing Berwickshire and Edinburgh Coasts

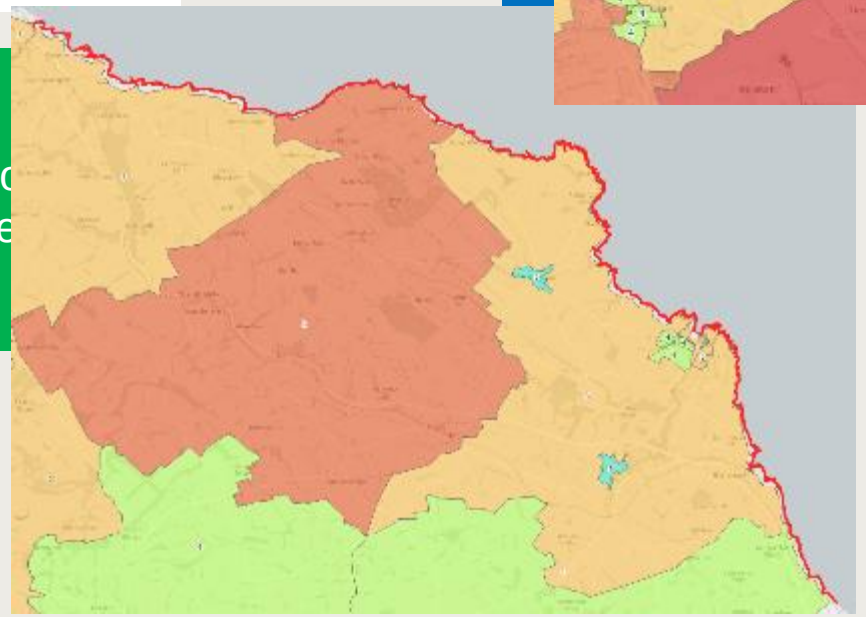
Commonalities and contrasts

Population density



Flood risk

So
vulne



Marine users

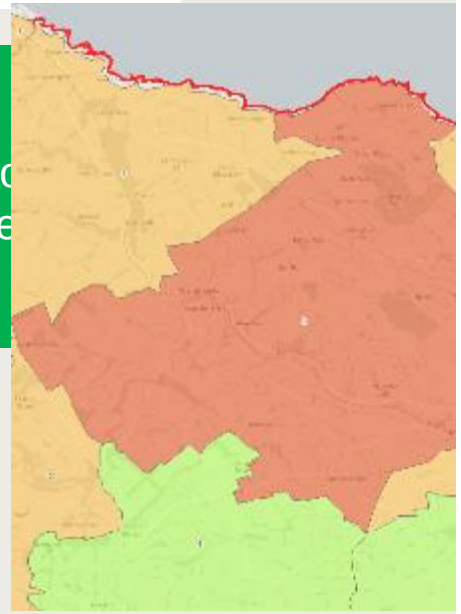
Coastal erosion

Comparing Berw

Commonalities and

Population density

Sc
vulne

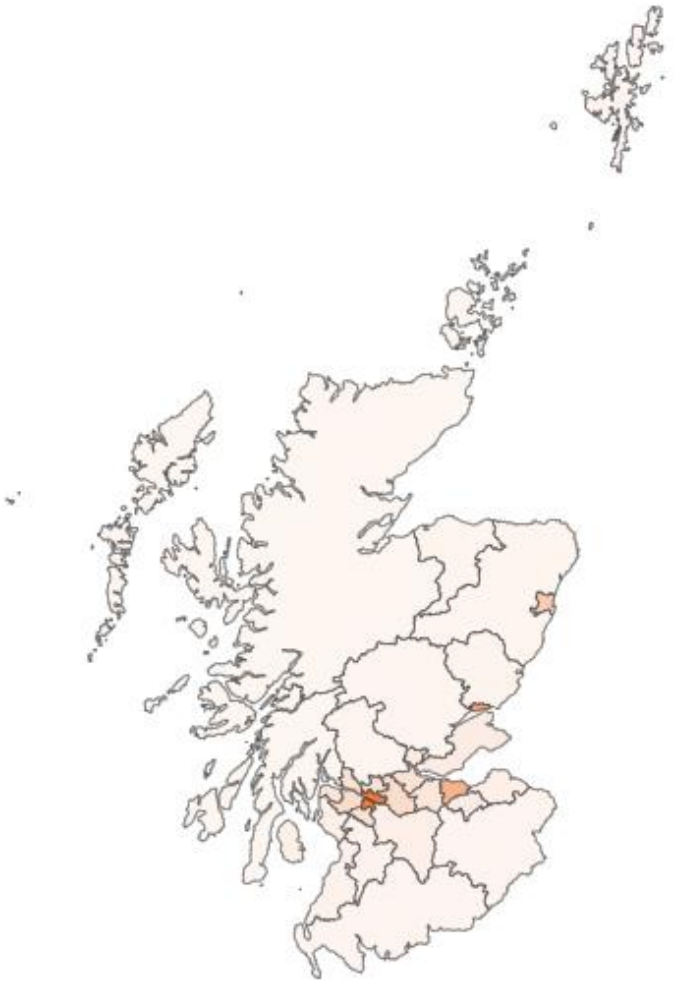


Flood risk

Coastal erosion

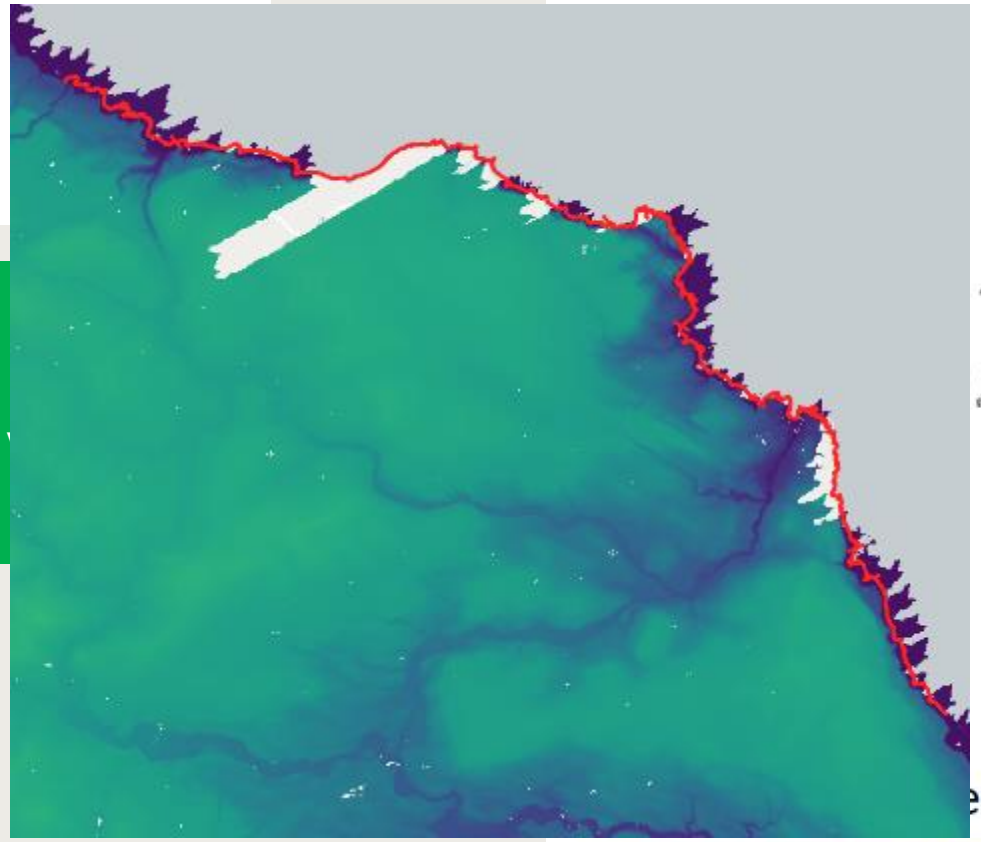
Figure 7: The largest city council areas have a much higher density than others

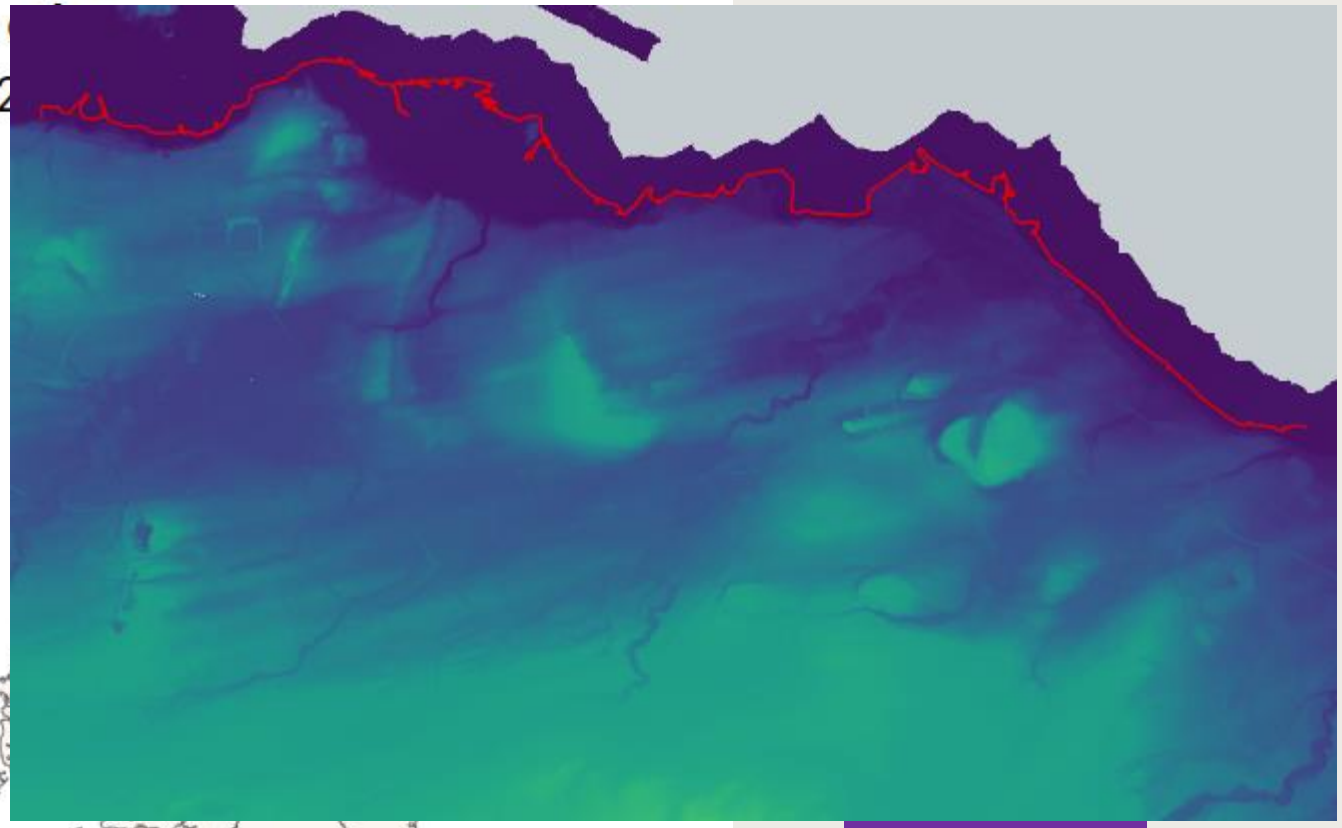
Population density, 2022, council areas in Scotland



Comparing Berw

Commonalities and

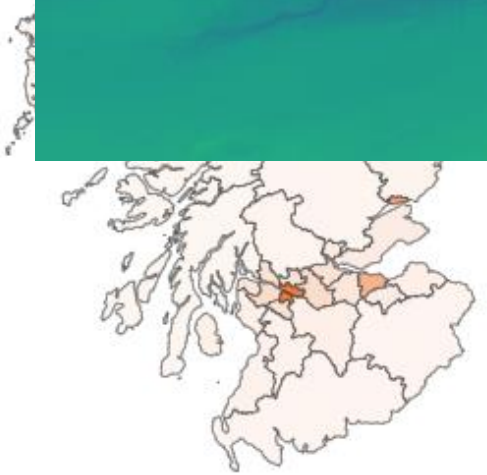




erosion

Figure 7: The largest city council areas have a much higher density than

Population density, 2



kilometre

0 1k 2k 3k 4k

Comparing Berwickshire and Edinburgh Coasts

Commonalities and contrasts

Population density

Low density
- Greater space for adaptation
- Sensitive to small changes

High density
- Wider impacts from smaller changes
- Greater economy of scale

Social vulnerability

Greater vulnerability can lead to:

- Less ability to prepare
- Less ability to respond
- Less ability to recover

Topography relative to MSL

Localised exposure to sea level risks.

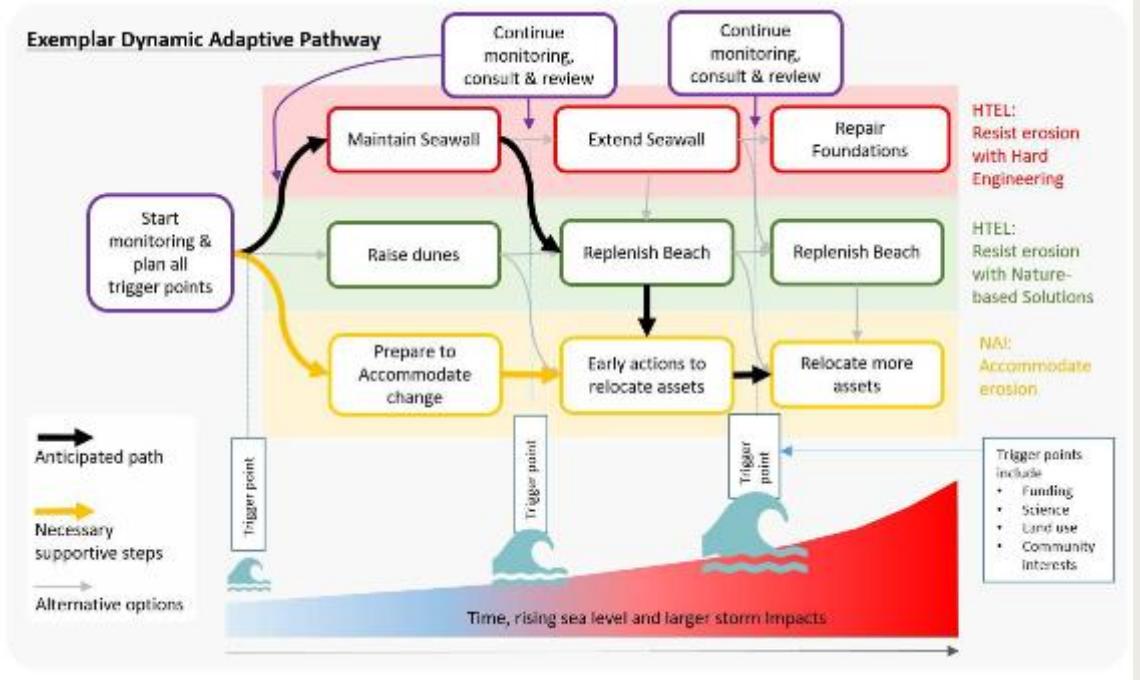
More sensitivity within local areas

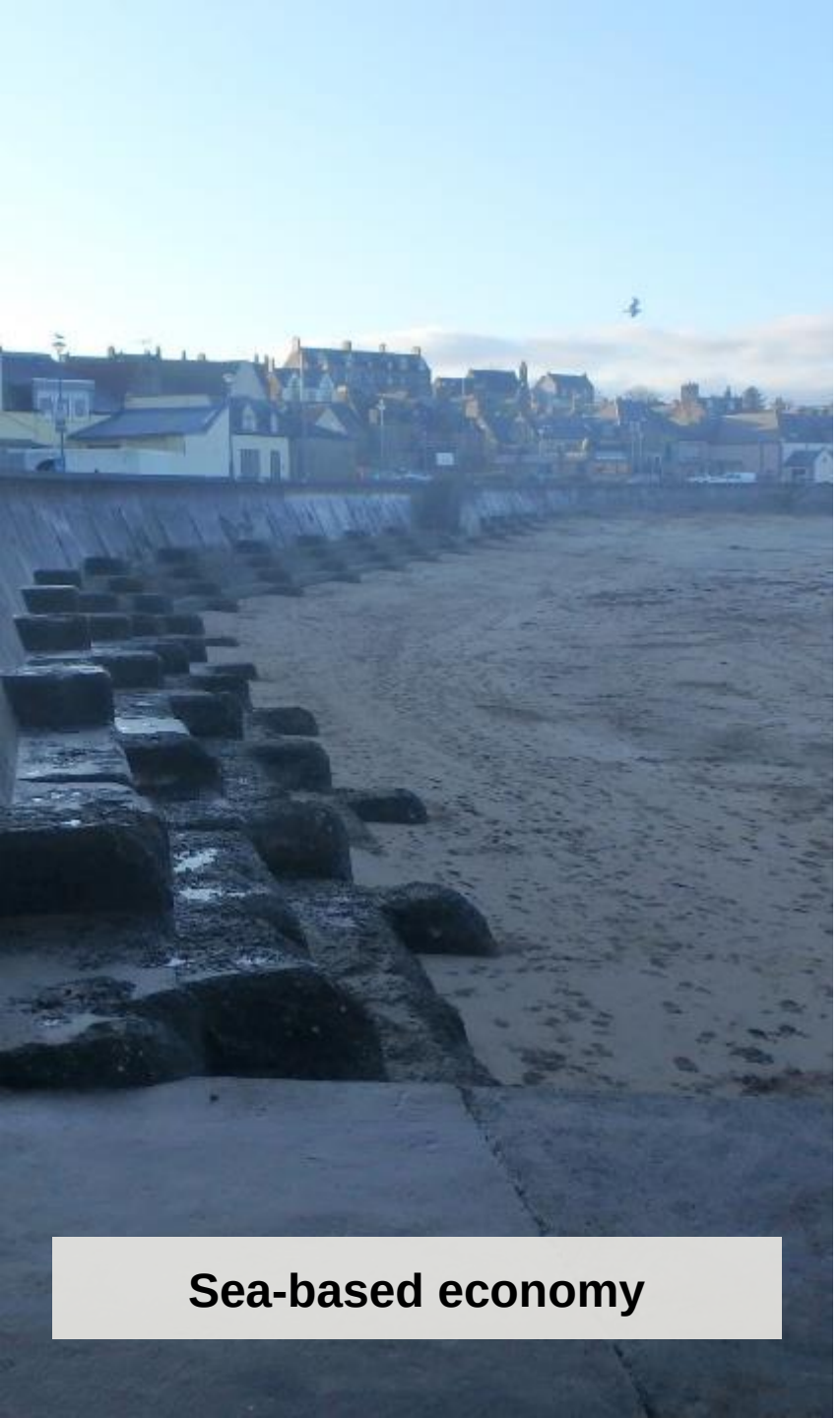
Broadscale change more difficult to achieve in flatter areas

Potential outcomes for adaptation

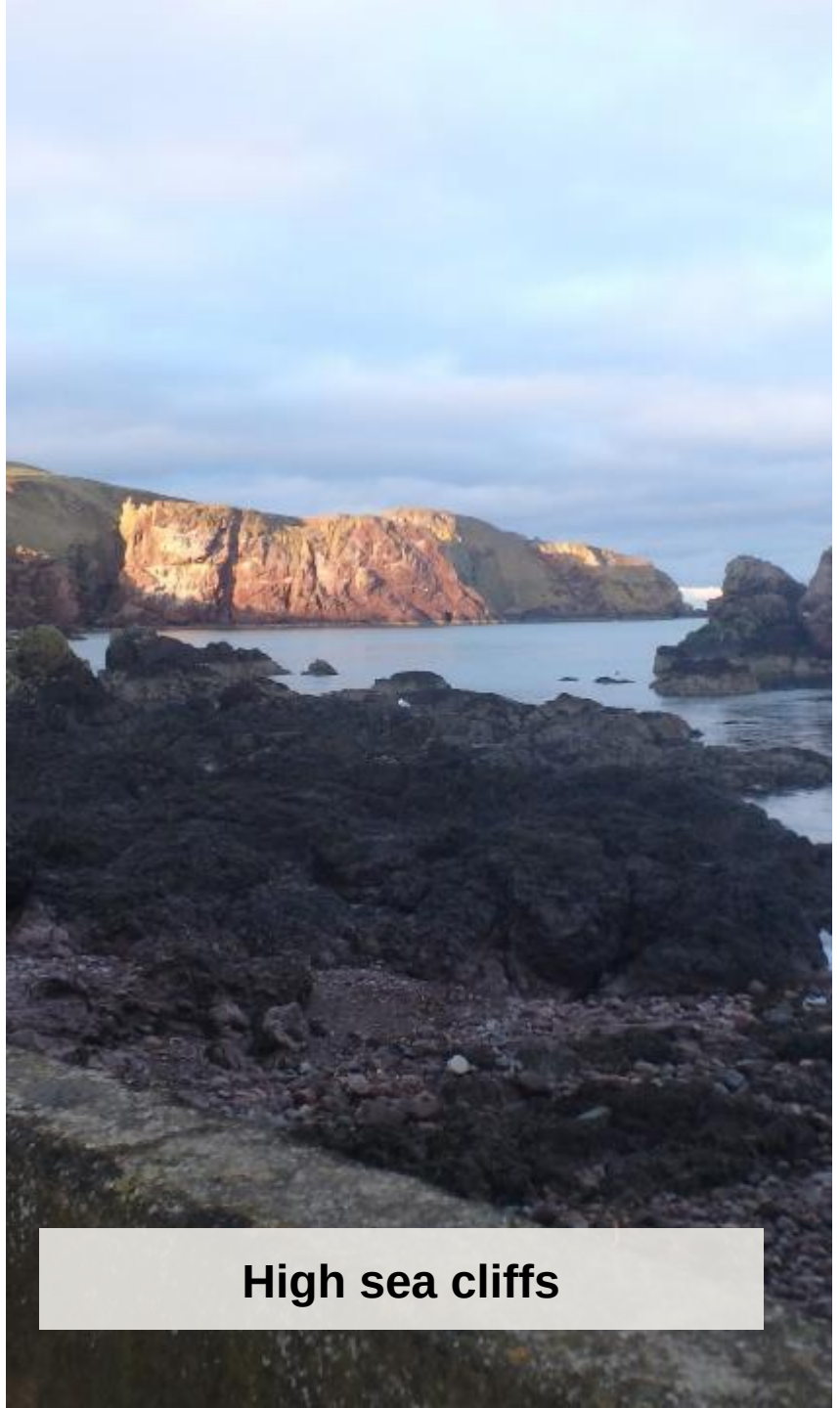
Lessons from these contrasting coasts

- The assumption of a dynamic coast is an assumption against business as usual in most cases.
- BUT because BAU differs from coast to coast, so dynamic change will mean different things.
- It is not possible to consider a dynamic pathway without a concept of how a community can move along the pathway, and their involvement in it.
- The consideration of these different elements may require novel thinking and novel levels of engagement.
- **That novel level of engagement will require different definitions of adaptation and engagement at different levels.**





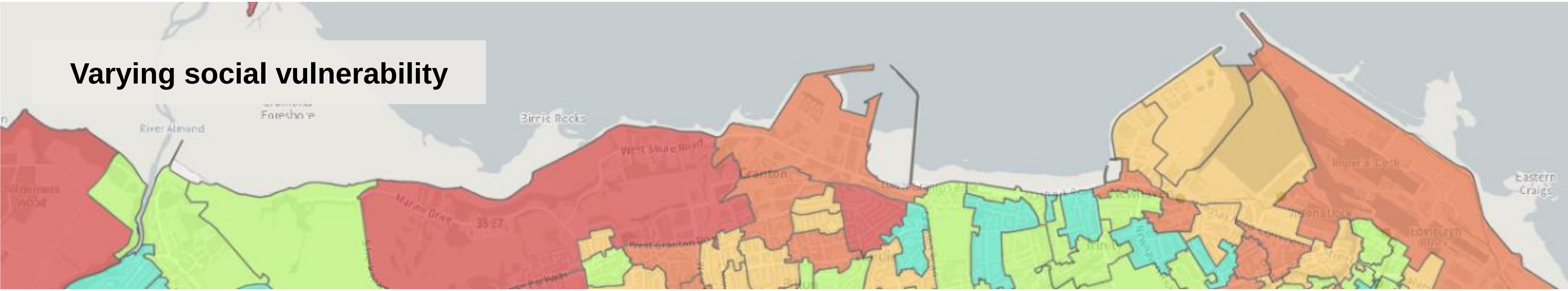
Sea-based economy



High sea cliffs

Remote beach tourism


Varying economic function


Varying social vulnerability
River Almond
Birrie Rocks
West Shore Road
Granton


Varying historic change
The Knoll
Lighthouses
Lighthouses
Martello Tower
Barnie Rks.
Granton
Newhaven
Granton
Cramond
Muirhouse
Trinity

CCAPs on different coasts may have diverging priorities.

Definitions of adaptation will vary from coast to coast.

Coastal Change Adaptation Plan

Next steps

Dr Doug Pender
JBA Consulting

Towards an Index to Measure and Monitor Coastal Resilience

Dr Douglas Pender

Coastal Change Adaptation Workshop
February 2024

Content

- **Part 1 –** Trying to understand, navigate and simplify our approach to Resilience and Adaptation

- **Part 2 –** Small case study example of how we are changing the way we work to support Part 1

What does Resilience look like?

- **Resilience:** Build capacity of the *whole-System* to cope with hazards, reduce vulnerability and enable quicker recovery.
- **Critically,** resilience is not just about communities and infrastructure. Actions need to be taken to support habitat and environmental enhancement.
- It is a layered approach:
  - **Level 1** – *Principles* – The direction of travel. Delivering completely with no definitive end point in time. These ***must*** be applied and not conflict with each other.
  - **Level 2** – *Components* – The building blocks of the *System* that is exposed to hazards/change and define how resilient that *System* is.
  - **Level 3** – *Indicators* – The make-up of the components. The details that are underpinning the Resilience. Where actions are set and change measured.

How does Adaptation support us deliver?

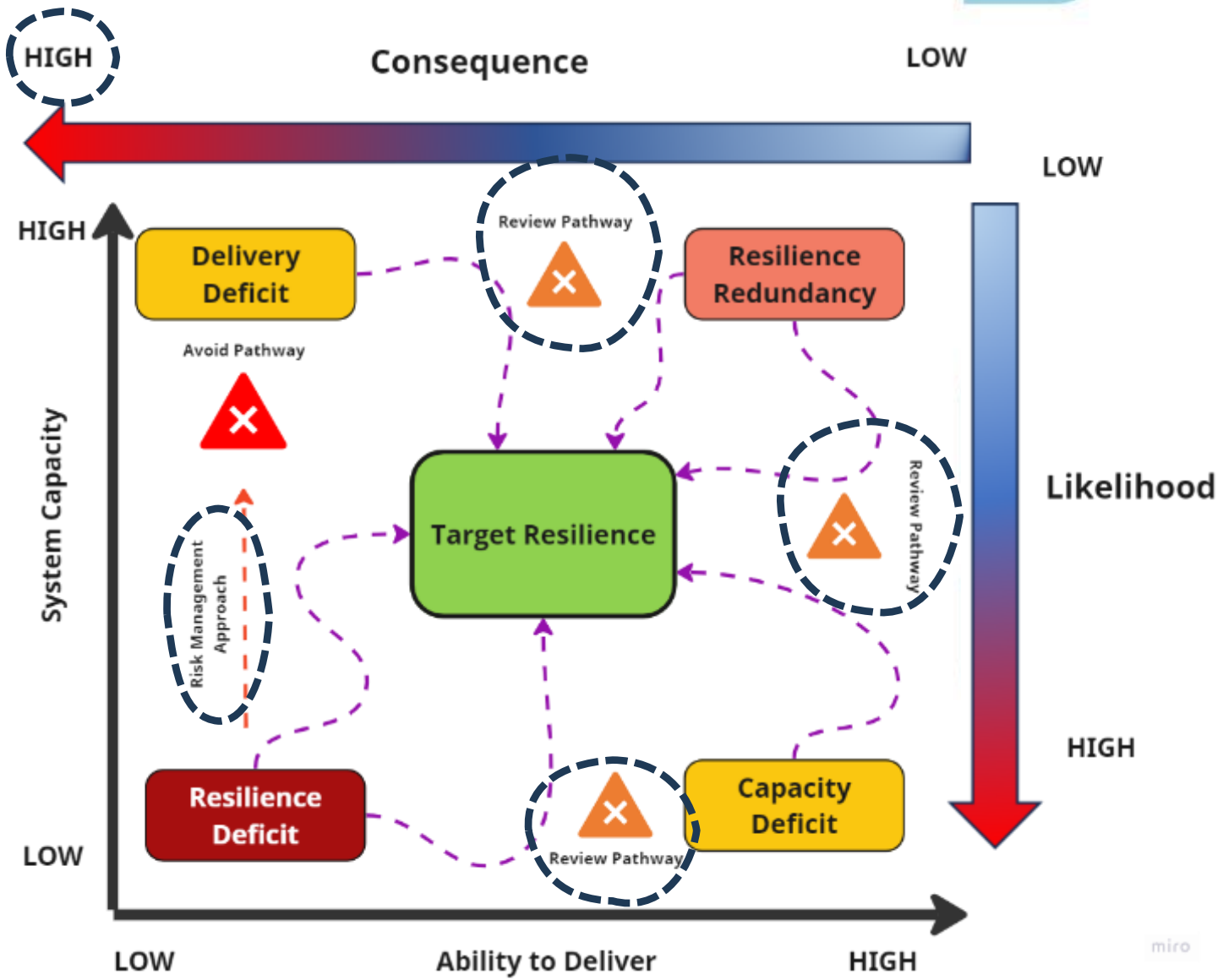
- Resilience will always be a balancing act across **relevant** *Components* and *Indicators*. Each will change at different rates, will require monitoring and be used to make decisions on actions and investment.
- To do this effectively an **Adaptive** approach is needed. One which promotes:
    1. **Working with natural systems**
    2. **Monitoring change**
    3. **Communication and engagement**
    4. **Placemaking**
- This results in parallel delivery streams:
    - Land-based actions to **avoid** future risk.
    - Management actions to **reduce** current and future risk.

Where do we need to be?

- A *Risk Management* approach can lead to ***Deficit*** – **High** consequence when defences overtopped. **Inevitable.**

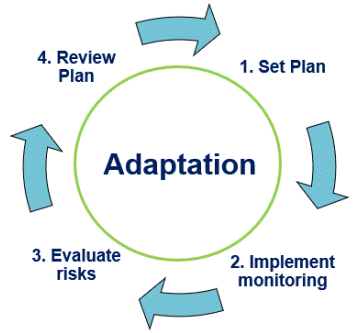
- *Adaptation Pathways* need to be used to move towards the *Target Resilience.*

- These need **regular and effective** monitoring and review to **avoid** undesirable outcomes.
  - ***Deficit***
  - ***Redundancy***



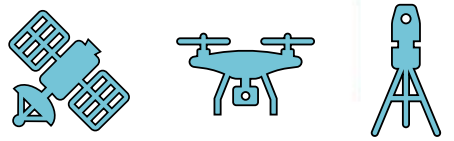
Where do we need to be?

- At any time, any *System* will be floating somewhere in the Resilience space.
- This may change hourly, daily, weekly, monthly or **never**.
- Change could be **positive or negative** and move the *System* to or from the target.
- The position could be influenced by changes to **any** of the underlying *Components*.
- **To deliver Resilience adaptively** this position must be understood, monitored and evaluated as frequently as practical/possible/affordable.



First steps towards a Coastal Resilience Index

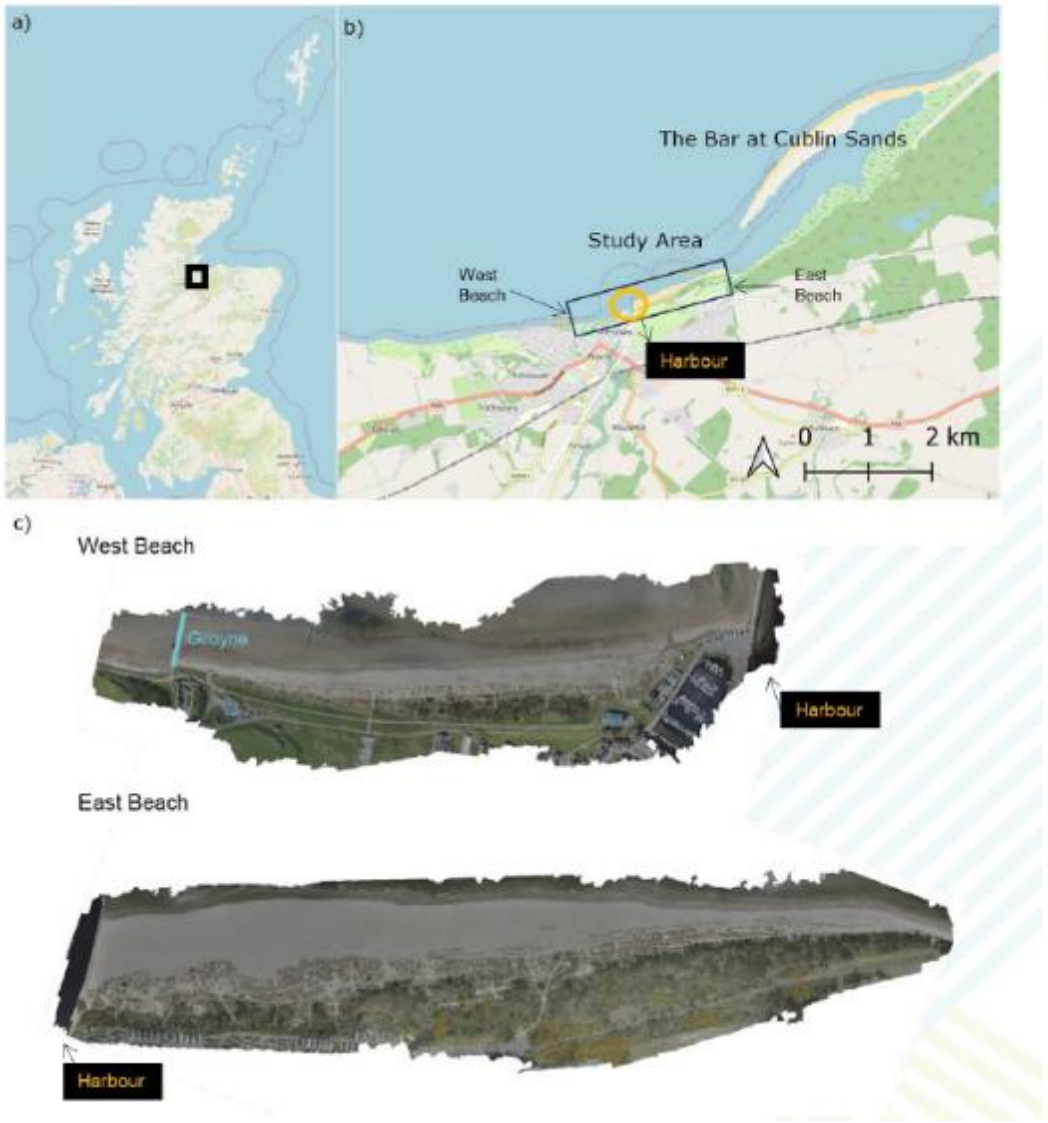
- How do we schematise the *Components* of a simple coastal system?
- How do we set *Indicators* that can help measure resilience?
- How can we monitor this effectively (locally and at scale)?



- ***Is there any value in what we are doing?***

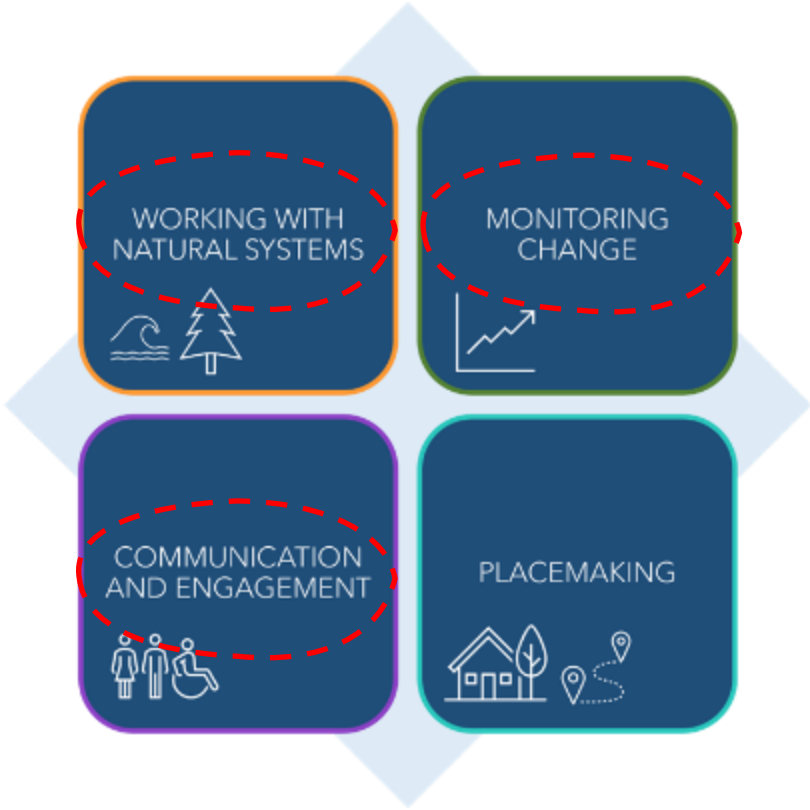
Case Study Location

- Pilot application to Nairn Sand Dunes
- Split into East and West Beaches
- Contrasting behaviours
- Erosion *Hazard* but unknown *Risk*
- Opportunities to manage risk adaptively and promote working with natural processes



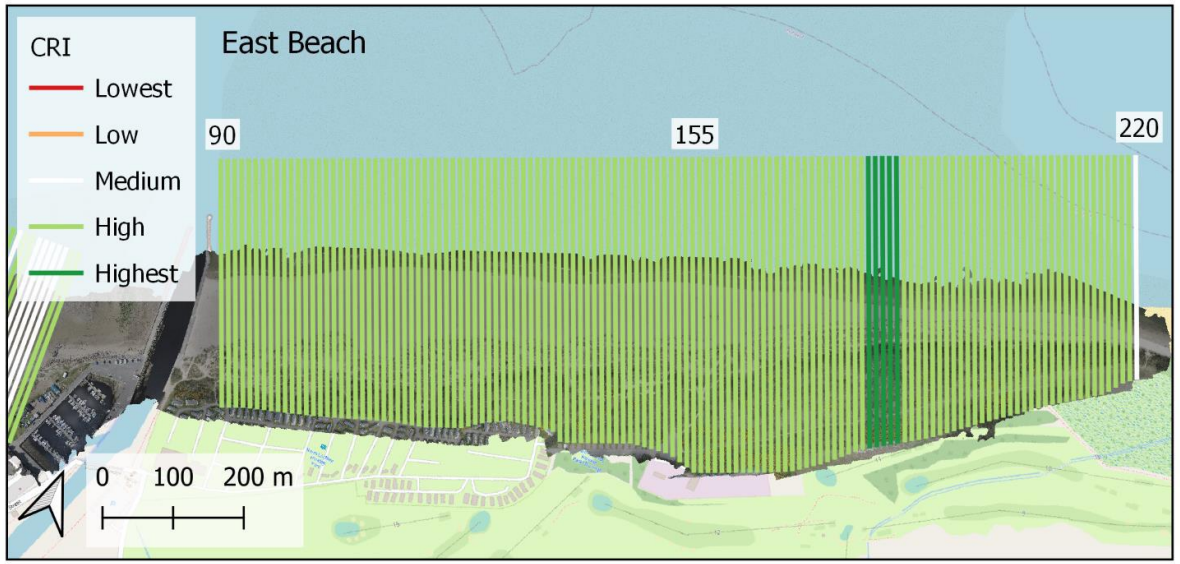
How does the CRI Support Resilience and Adaptation?

- **Resilience Principles**
  - Whole-system Understanding
  - Environmental Sustainability
  - Continual Improvement
- **Resilience Components**
  - Risk Management
  - Natural Resources
  - Education
- **Adaptation Pillars**
  - Working with Natural Systems
  - Monitoring Change
  - Communication and Engagement



What were the outcomes?

$$CRI = 100\frac{(D_{S-A} + CC_{storm} + CC_{SLR} + Veg_0 + Veg_{0-cover} + Veg_{h-change}) - C1}{C2}$$



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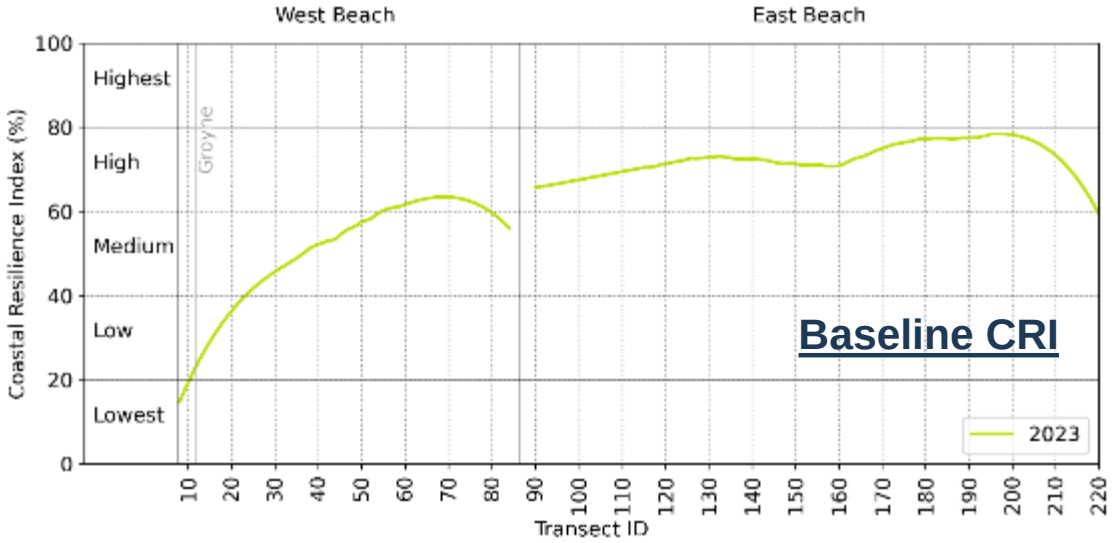
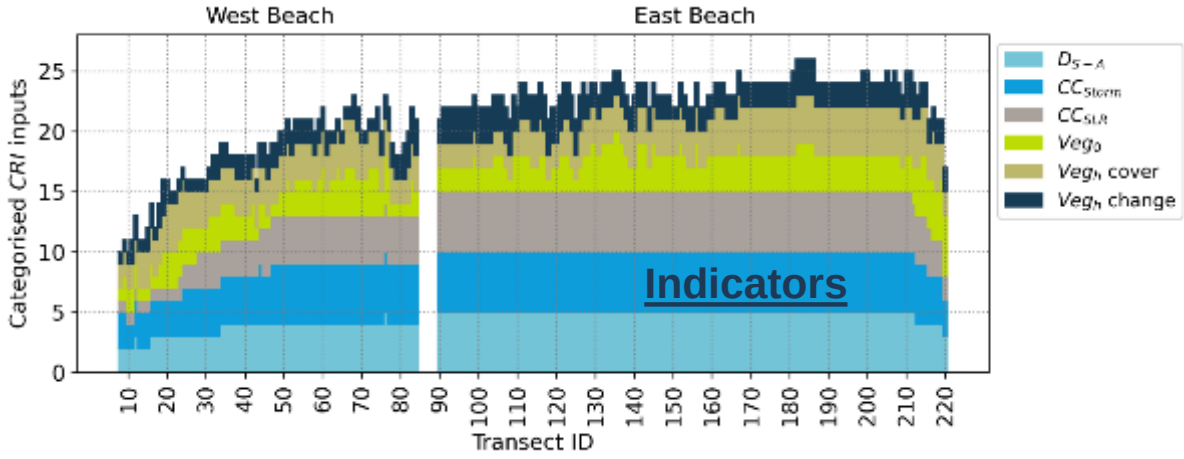
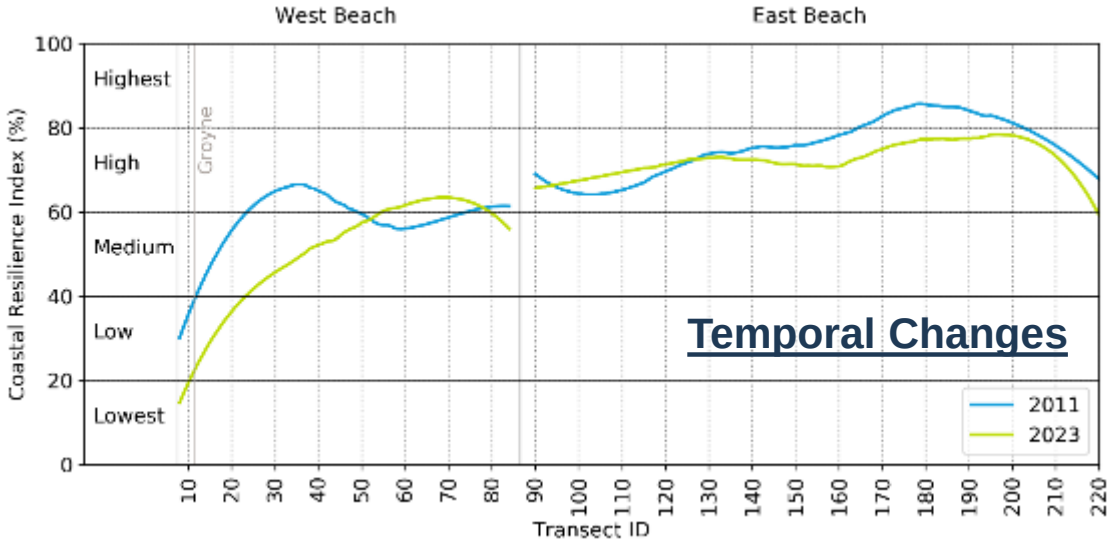
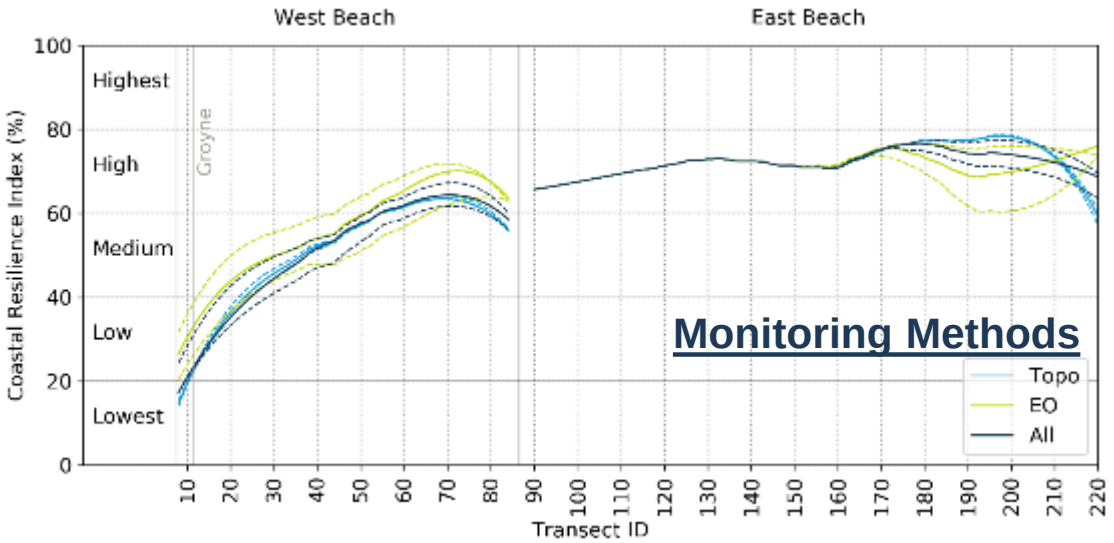
What were the outcomes?









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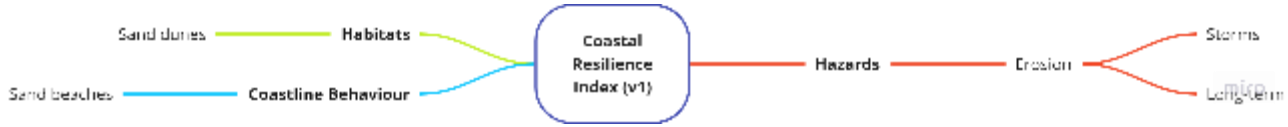
What could be the future direction?

- Low-cost approach to measure natural coastal systems
- National to Local scales

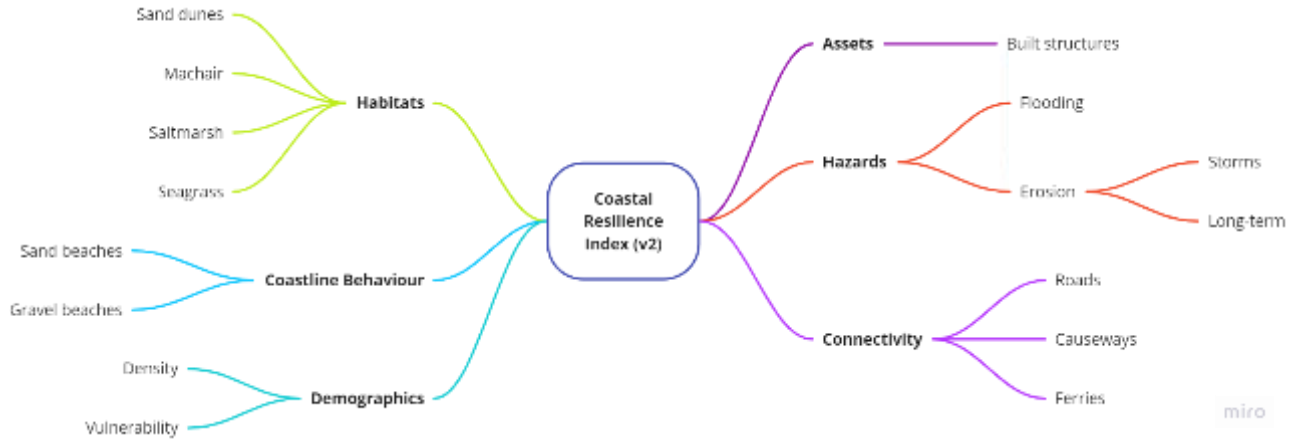
- High-frequency

- Support Adaptation Planning
- Identification of Triggers and Thresholds
- Monitor success of Actions

CRI v1



CRI v2



Gregor Guthrie
Royal Haskoning DHV

Approaches to Coastal Change

If coastal change were not so complex, it would be very simple

Gregor Guthrie

1 February 2024

greg.guthrie@rhdhv.com

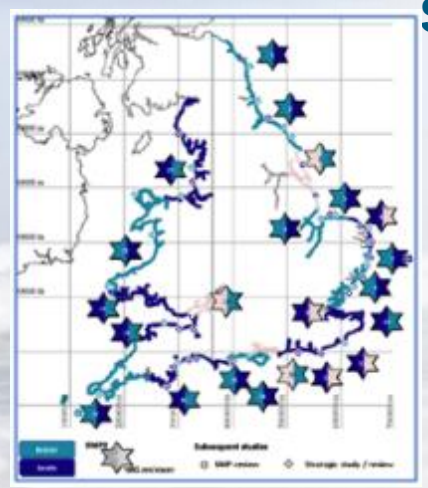
Coastal Change Adaptation in Scotland – Moving from Shoreline Management to Coastal Change Adaptation Planning

Convergence of thought – rather than compare and contrast

however context is important

England and Wales

SMP1 and 2 and the Refresh



Historic defence over 200 years

1949 Coast Protection Act
(taking time by the forelock)

1992 ICZM (EU)

1995 SMP1 guidance

2006 SMP2 guidance

2020 SMP Refresh

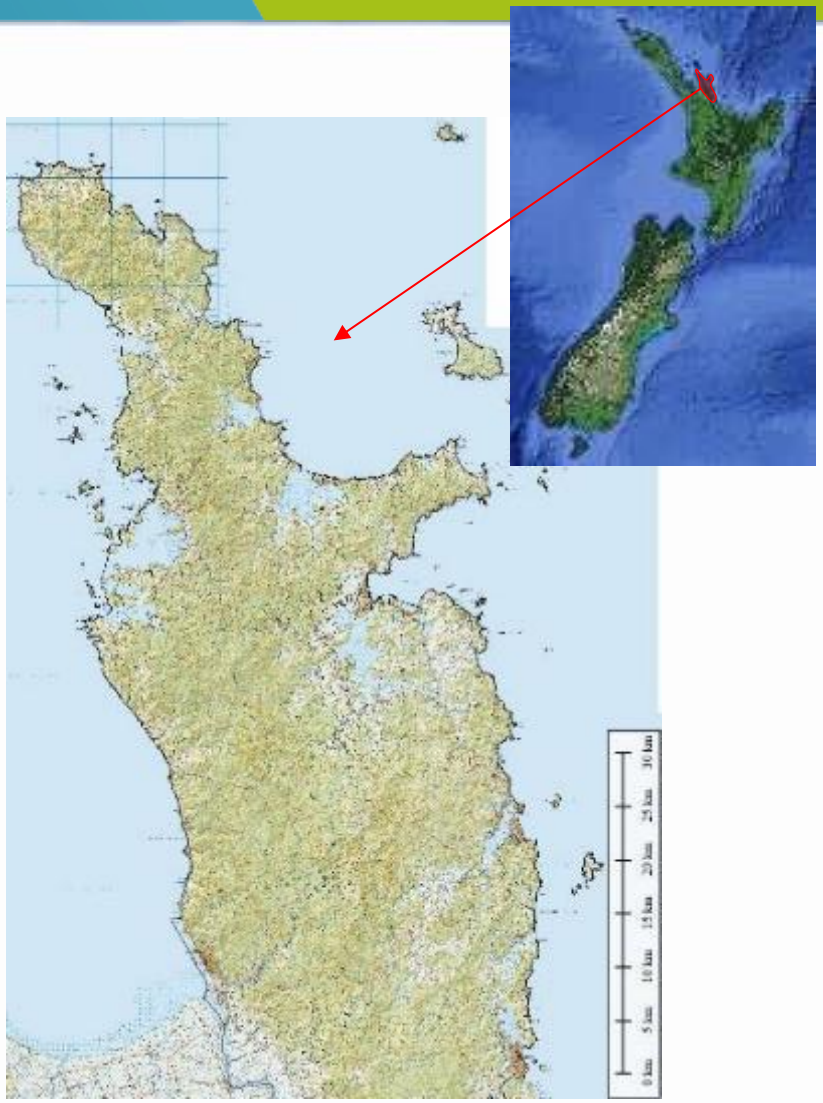
Learning is a two-way process

Thames Coromandel - NZ

SMP / CAP

2010 The NZ Coastal Policy Statement

2017 NZ hazard guidance



SMP 1 – a bit of an experiment and a lot to learn

Managing the coast ain't easy

Coastal Zone Protection and Planning 1992

Risk management

Focused on the now

rigid approach

- **inextricably linked**

Coastal management

Spatial Plans

Catchment Management Plans

Biodiversity Action Plans

Coastal Zone Management Plans??

Shoreline management

Starting to look forward

Understanding where we are going,

But from a SMP 1 perspective

Taking a longer term, broader perspective

How far forward do we plan? - 50 years (defence life?)

(Can we?)

From SMP1 to SMP2 – adapting the thought process (and turning it on its head)

More emphasis on improved links with the planning system, consideration of environmental impacts and the development of longer-term coastal processes - Defra 2001

Considering the coastline as a whole

100 years **(and beyond)** Where do we need to be in the future and how do we get there?

(Not can we? But should we?)

An agreed intent of management

A Continuing and Continuous process

Defra Guidance - 2006

This distinction is made between the **'preferred plan'** and **'policies'.**

The 'plan' - the long-term vision, the interactions and implications across the whole SMP.

The 'policies' are the means of achieving this plan at the local level over discrete timescales.

A starting point for change!

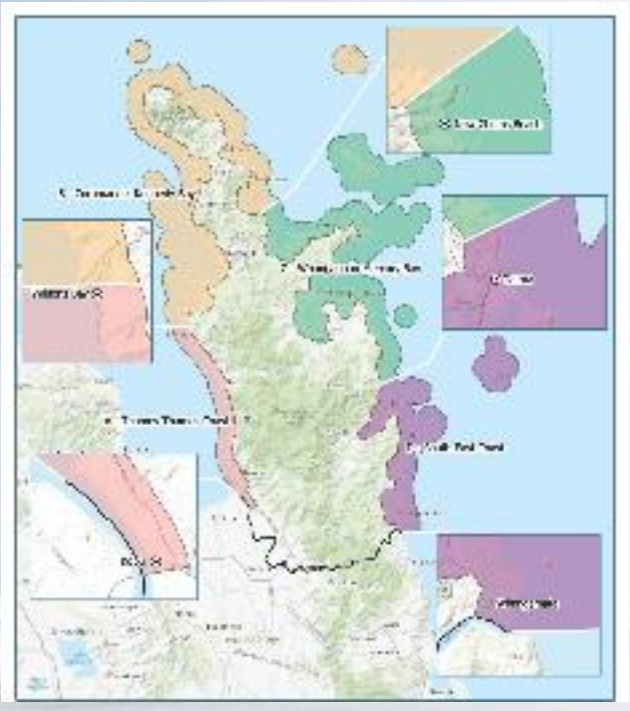
But

An agreed intent of management

agreeing the need for change

And all the people of the lulled and dumbfound town are sleeping now. *Dylan Thomas*

Thames Coromandel – NZ **SMP / CAP**



Four Coastal Panels at the heart of the process

1. Framing the discussion
2. Identifying the values

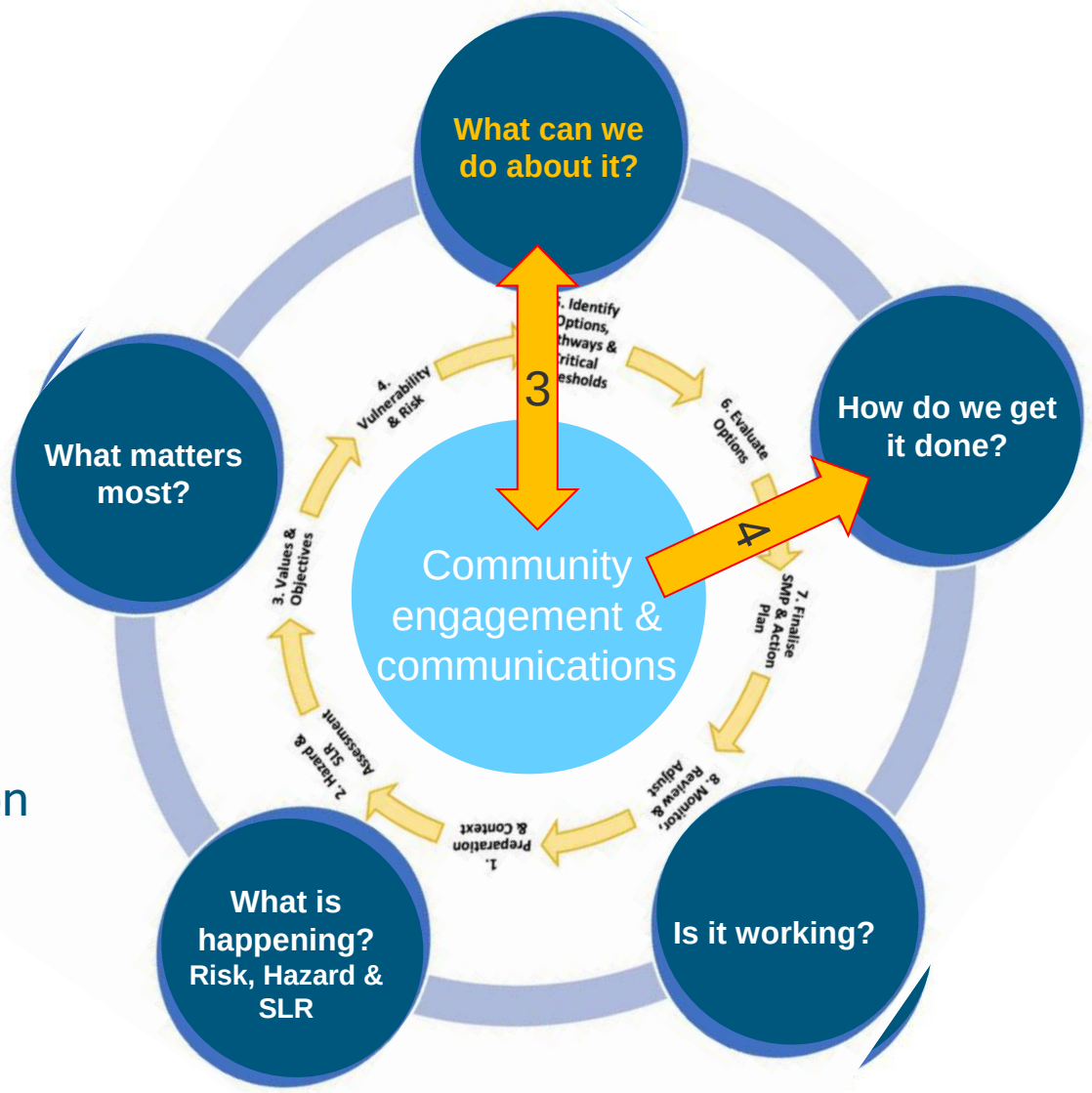
3. Developing locally tailored solutions addressing real issues.

4. Coastal Adaptation Plans (CAPs)

In the UK led by coastal managers, with engagement with Planners.

In NZ, from the outset, the SMP is fundamentally a planning document and founded on community engagement.

Critically, trigger led
With indicative timescales



How this works – Cooks Beach

Minor soft management

Property resilience and locally sustain defence

Plan for and ultimately relocate property

Design for the future

By the community

138 different CAPs

Maintain/rehabilitate native species, and manage access (dune fencing) [1]

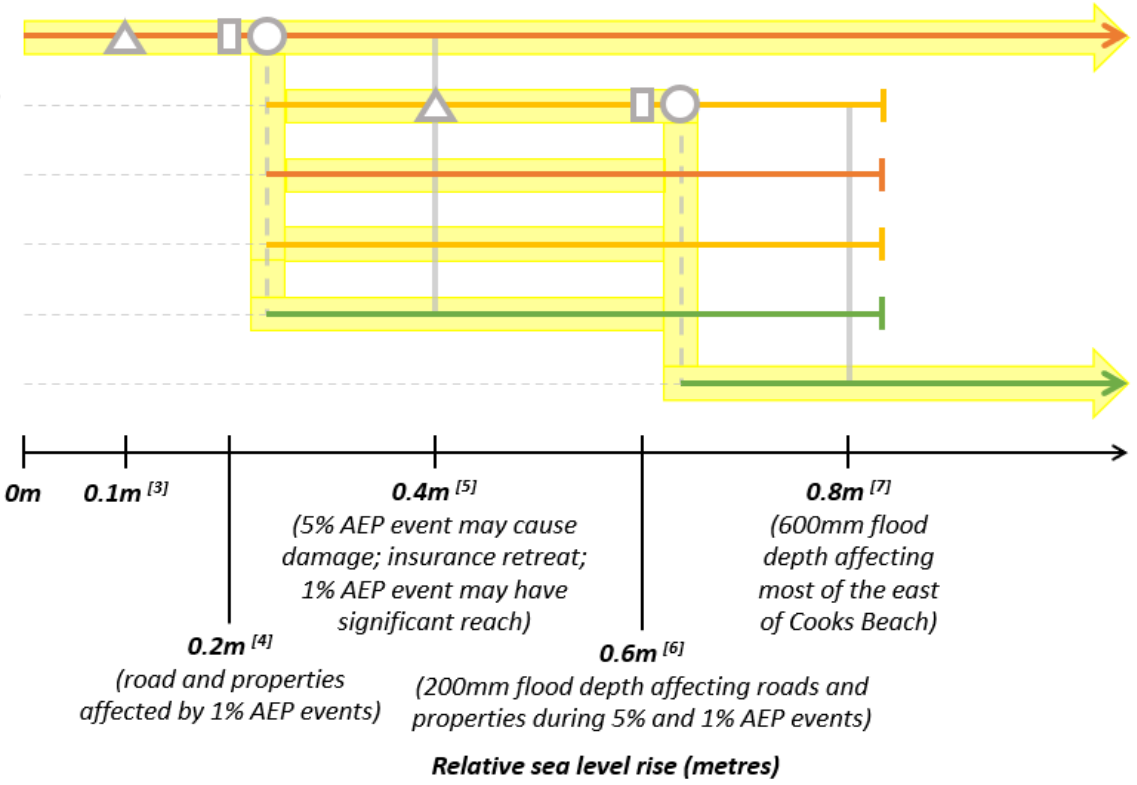
Soft engineering – reinstate dune where it has been modified (e.g. at vehicle beach accessway)

Retrofit/raise hazard affected properties [2]

Maintain existing defences

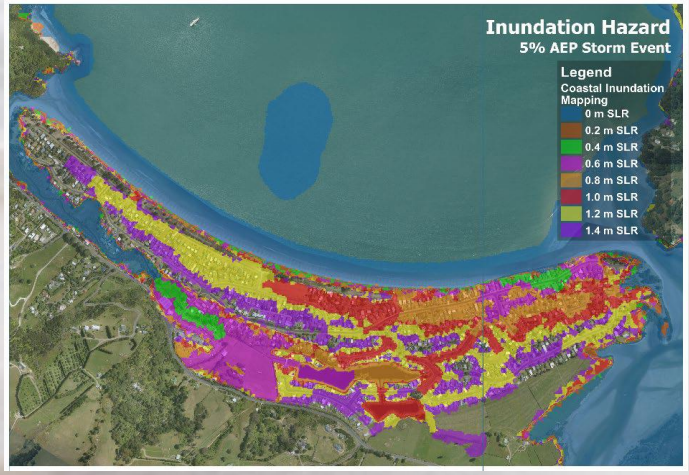
Change planning practices and prepare for the relocation of assets in hazard affected areas

Relocate hazard affected assets at the eastern end of the beach

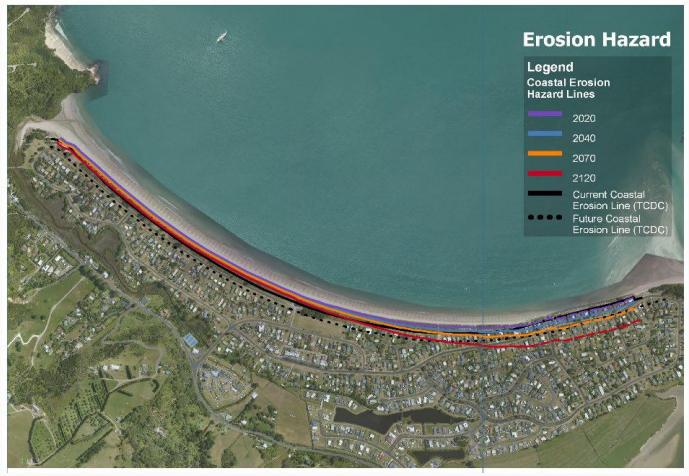


Key:

- No Active Intervention
- Accommodate
- Protect
- Managed Retreat
- Transfer Point
- Adaptation Threshold – hazard or risk no longer tolerable
- Adaptation Trigger – decision point
- Adaptation Signal – decision point approaching
- *Proposed Adaptation Pathway*



				Vulnerability	Consequence
				Moderate	Minor
				Moderate	Moderate
				Moderate	Moderate
Erosion	2120	1% AEP	Extreme	High	Major
Inundation	0 m SLR	1% AEP	Low	Low	Minor
Inundation	0.4 m SLR	1% AEP	Moderate	Moderate	Moderate
Inundation	0.8 m SLR	1% AEP	High	High	Major
Inundation	1.2 m SLR	1% AEP	Extreme	High	Extreme
Inundation	0.4 m SLR	5% AEP	Moderate	Low	Minor
Inundation	0.8 m SLR	5% AEP	High	Moderate	Moderate
Inundation	1.2 m SLR	5% AEP	Extreme	High	Extreme
Inundation	0.4 m SLR	King tide	Low	Low	Insignificant
Inundation	0.8 m SLR	King tide	Low	Low	Insignificant
Inundation	1.2 m SLR	King tide	Moderate	Low	Minor



SMP Refresh

“that the SMPs still provide the sensible overall framework and direction of travel for management.”

Driven by firefighting immediate short-term issues.

Risk management hierarchy

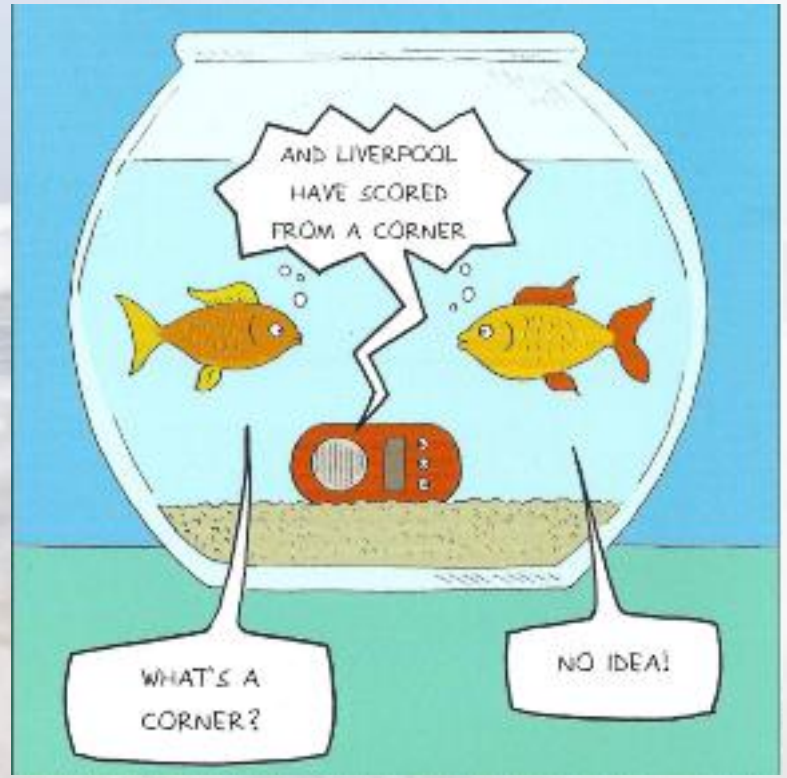
SMP (broadscale, long term thinking) - **Done it!**

⇩

Strategy (often 50 years, practical delivery) – **undone it!**

⇩

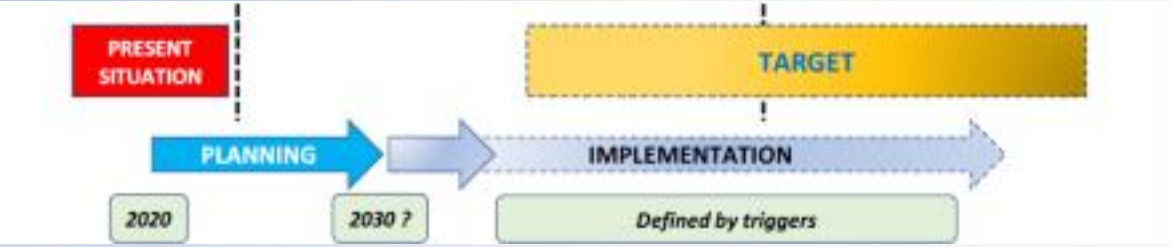
Scheme – (delivers the immediate policy) – **but not necessarily then “the Plan”**



Taking SMPs forward - Evolution not revolution (softer skills, not SMP3!)

- Better governance
- Embedding thinking in coastal management
- Getting ahead of the game
- Clarity and communication

Seeing where we want to go but held back by the present and the past



Shift from the Shoreline Management Plan to **shoreline management** guided by the Plan

But also

Supporting and involving communities

Scenario	base year	Sea Level Rise (m) 0.2	0.4	0.6	0.8	1	1.2	1.4	1.6
H++	2017	2035	2050	2062	2071	2078	2087	2093	2098
RCP8.5 (95%)	2017	2044	2063	2078	2092	2103	2115	2127	2140
RCP8.5 (70%)	2017	2049	2073	2092	2110	2127	2145	2163	2179
RCP8.5 (50%)	2017	2054	2078	2100	2120	2140	2160	2181	
RCP4.5 (95%)	2017	2049	2073	2097	2117	2138	2160	2180	
RCP4.5 (70%)	2017	2057	2092	2126	2160	2195		Key	< 25yrs
RCP2.6 (95%)	2017	2054	2085	2114	2140	2168		< 50yrs	< 75yrs
RCP2.6 (70%)	2017	2064	2117	2170				< 100yrs	> 100yrs

Explaining uncertainty / certainty in different ways

As simple as when property is at risk

Or plotting out when local adaption needs to have been completed – enabling change

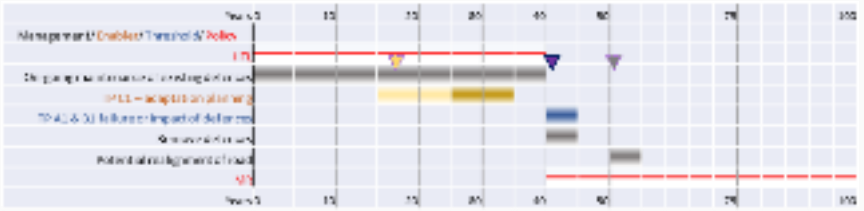
	Policy unit		SMP Management Policy			
SMP	ID	Name	Stage	Policy	Sub-Category	Policy Rationale / Intent of Management
1	13.4	Estuary Outer North	*Present*	Hold The Line	Maintain / Replace	Defend local community from flooding, but through measures which do not impose on the natural system.
			Intermediate	Hold The Line	Maintain / Replace	As above
			Target	Hold The Line	Maintain / Replace	As above
1	14.2	Breakwater Dunes	*Present*	Managed Realignment	Natural Features	Maintain natural development of the shore, with little justification for defence
			Intermediate	Managed Realignment	Natural Features	As above
			Target	No Active Intervention	Local Activity Only	Management associated with long term management of estuary entrance.

Improving clarity through the SMP tracker

A	Trigger Point	Description	Type
	Step change in investment	Failure or outflanking of existing defence	physical
		Consequence / Outcome	Timescale
		Loss of road	40 yrs
		Dependency / Enabling / Constraint	
		Having an adaptation plan in place to avoid the need for further investment (Trigger C)	

Indicator / Vector	criteria	action
Defence condition	Requirement for significant investment	On-going review
Outflanking	Requirement of extension of defences	On-going review
Comment		

Developing pathways

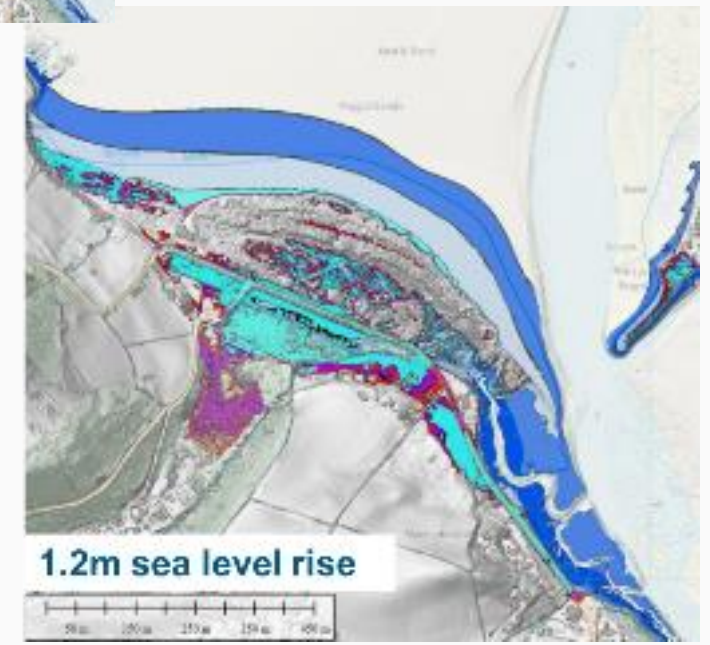


Adaptation

Not when do we stop defending?

But how we get to the situation where we no longer need to defend!

key	
Below MSL	
MSL to MHWN	
MHWN to MHWS	
MHWS to T1	
T1 to T10	
T10 to T100	
T100 to T200	



Thank you

Q&A

14:35 – 14:55

Crovie
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- Video of the presentations will be available shortly on the Sniffer website and Vimeo
- Pdf copies of presentations & links to the videos will be emailed to attendees

Coastal change adaptation guidance and case studies available here
https://www.dynamiccoast.com/cca

sniffer
knowledge brokers for a resilient Scotland

Thank you

Skara Brae
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