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Rising sea levels and coastal communities

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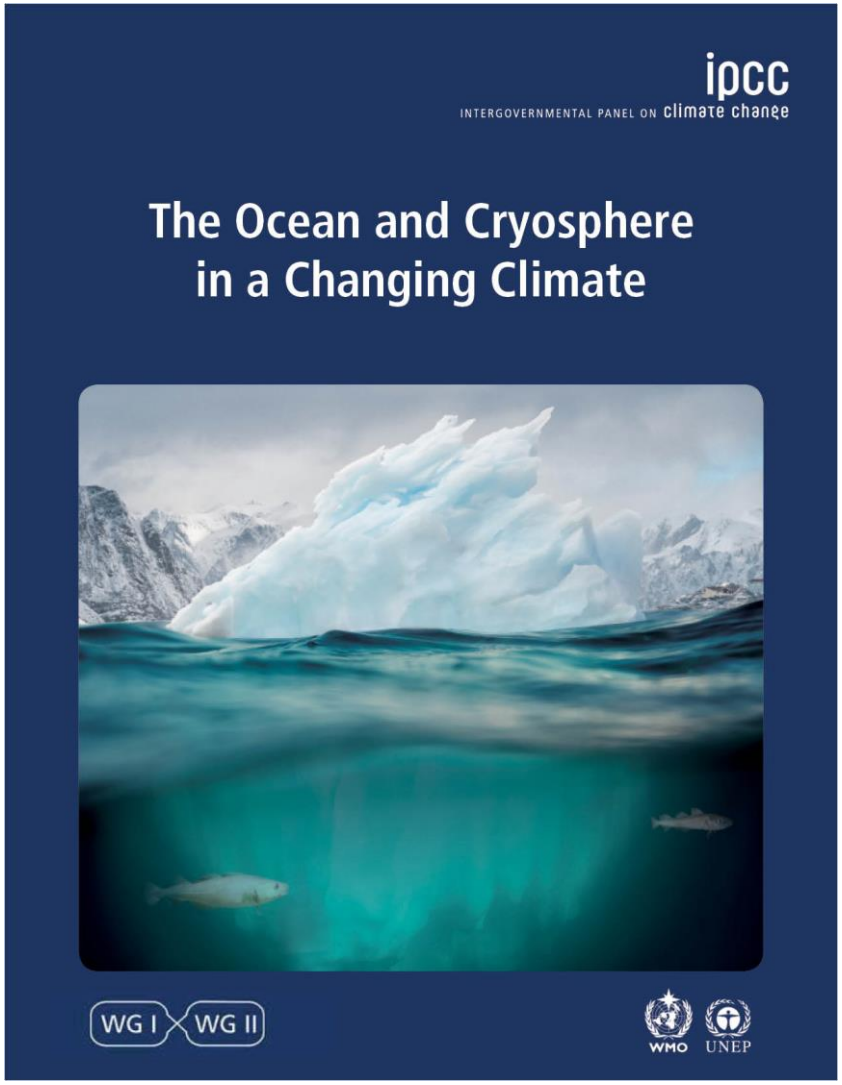
PLAN

Sea-level rise

Coastal impacts and adaptation

Concluding remarks



Intergovernmental Panel on Climate Change (IPCC)

"Special Report on the Ocean and Cryosphere in a changing Climate" (SROCC)

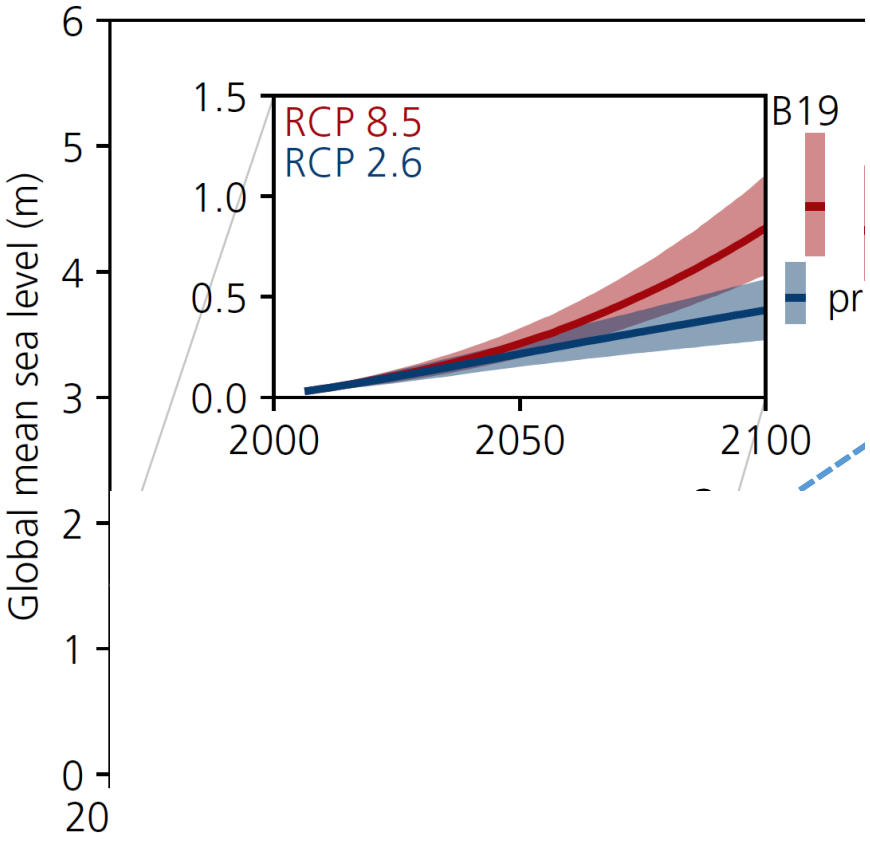
New synthesis of information on sea-level rise and coastal climate, impacts and adaptation

Published
September 2019

GLOBAL-MEAN SEA-LEVEL RISE – BEYOND 2100

RCP8.5 – high emissions;

RCP2.6 – low emissions (Paris Agreement);

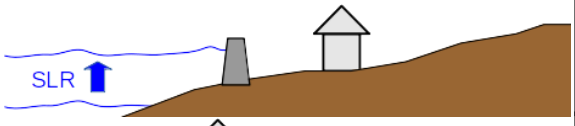


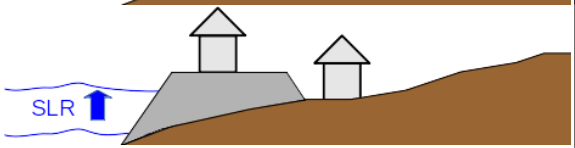
Physical Impacts of Sea-Level Rise

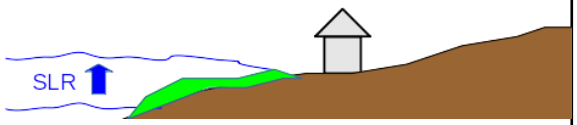
NATURAL SYSTEM EFFECT		INTERACTING FACTORS	
		CLIMATE	NON-CLIMATE
1. Inundation, flood and storm damage	a. Surge (flooding from the sea)	Wave/storm climate, Erosion, Sediment supply.	Sediment supply, Flood management, Erosion, Land reclamation
	b. Backwater effect (flooding from rivers)	Run-off.	Catchment management and land use.
2. Wetland loss (and change)		CO_2 fertilisation of biomass production, Sediment supply, Migration space	Sediment supply, Migration space, Land reclamation (i.e., direct destruction).
3. Erosion (of 'soft' morphology)		Sediment supply, Wave/storm climate.	Sediment supply.
4. Saltwater Intrusion	a. Surface Waters	Run-off.	Catchment management (over-extraction), Land use.
	b. Ground-water	Rainfall.	Land use, Aquifer use (over-pumping).
5. Higher water tables/ impeded drainage		Rainfall, Run-off.	Land use, Aquifer use, Catchment management.

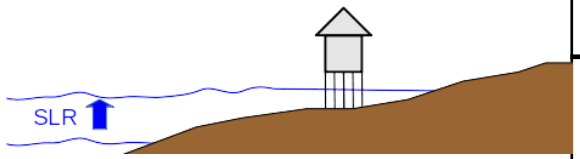
Source: Nicholls (2010) Book on "Understanding Sea-Level Rise and Variability"

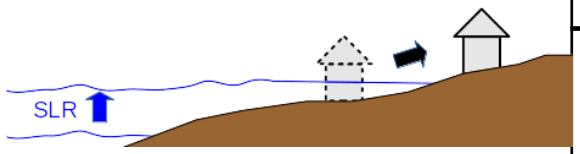
SLR Adaptation Responses IPCC (2019)





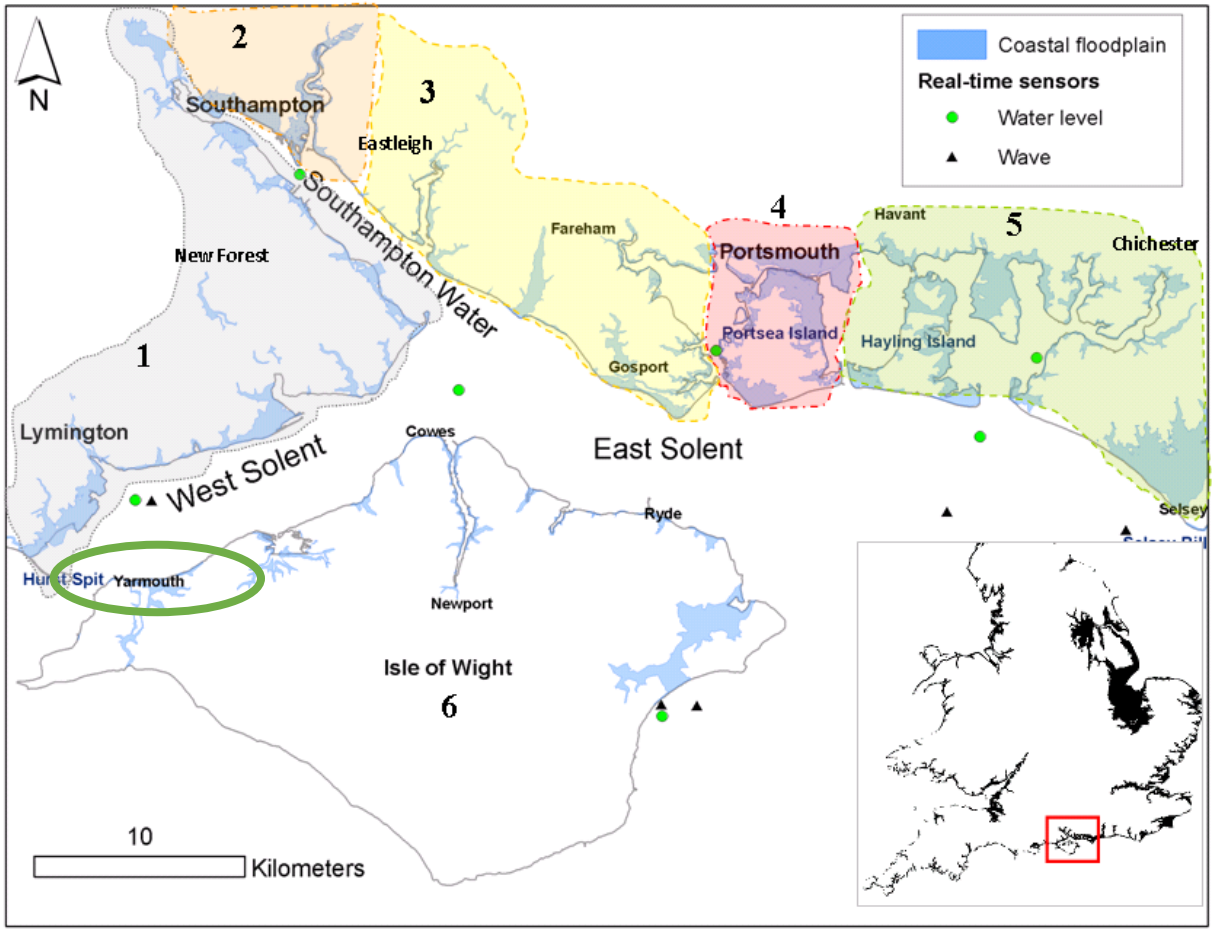






Measures		Potential effectiveness in reducing SLR risks	Caveat
Coastal protection		Up to several metres of SLR (*high confidence*)	Cost efficient for cities, not affordable for rural and poorer areas
Coastal advance			
Ecosystem-based adaptation	Corals	Effective up to 5 mm/yr SLR (*medium confidence*).	Widely lost at 2°C due to ocean warming and acidification (*high confidence*)
	Marshes, Mangroves	Effective up to 5-10 mm/yr SLR (*medium confidence*)	Decreased at 2°C, limited through pollution, infrastructure (*high confidence*)
Coastal accommodation		Very effective for small SLR (*high confidence*)	Insurance: moral hazard
Coastal retreat	Planned	Effective if alternative safe localities are available	Socially and politically very challenging
	Forced		Loss of life, livelihoods and sovereignty

Yarmouth
The Solent, UK

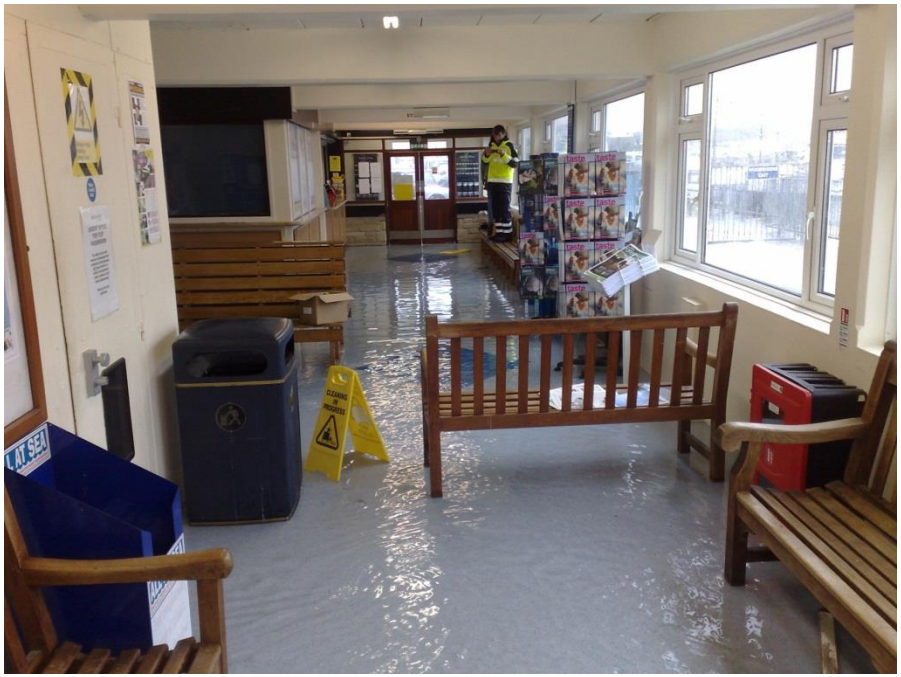


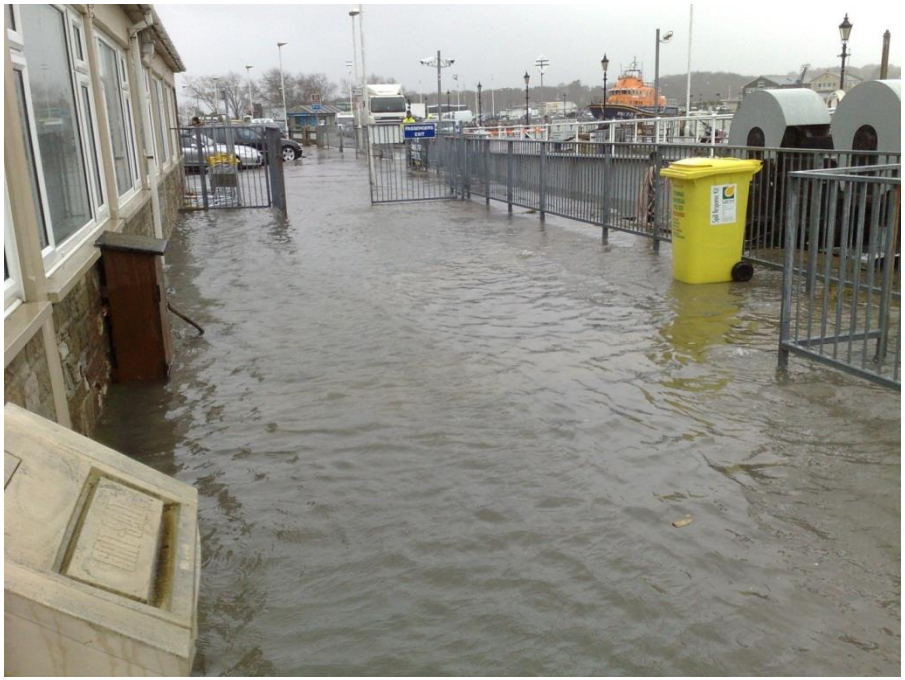
Yarmouth, Isle of Wight

10 March 2008, high tide

Yarmouth, Isle of Wight

Ferry Terminal 10 March 2008, high tide





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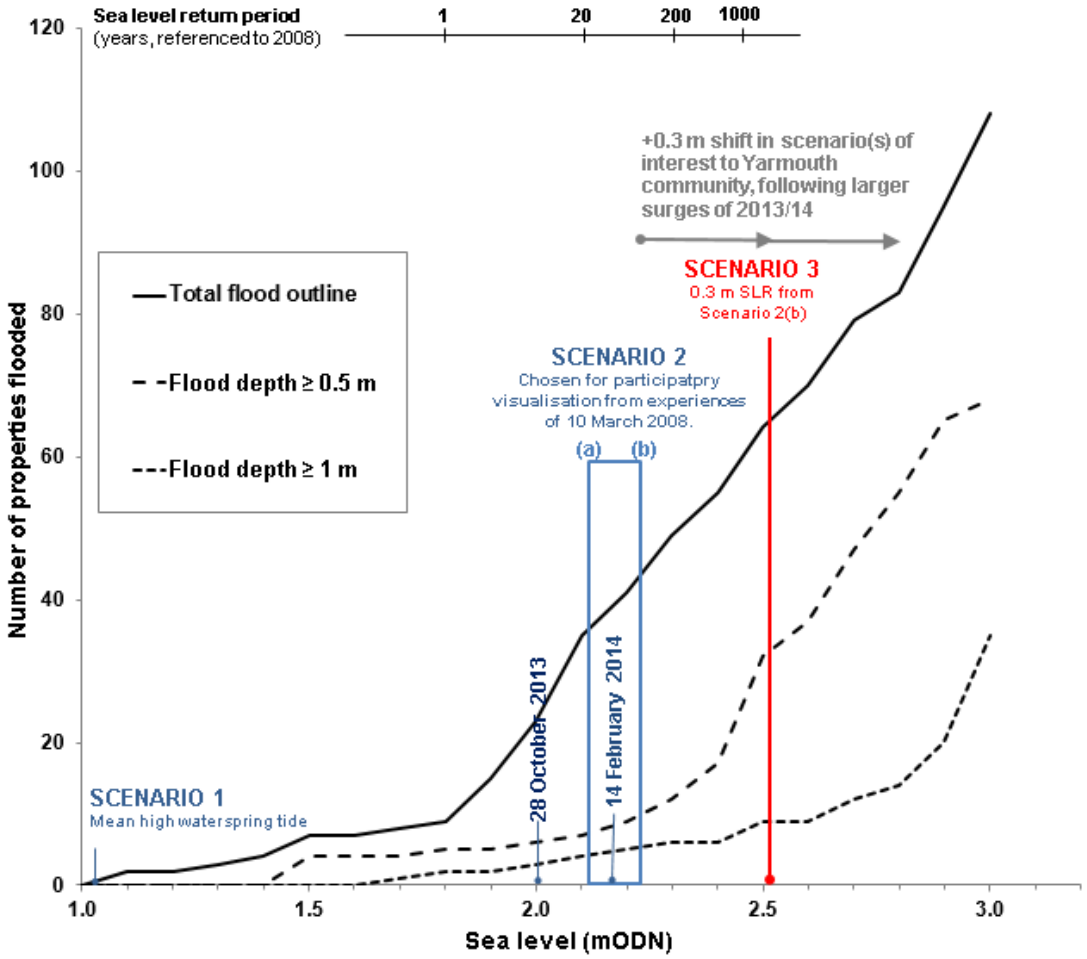
Yarmouth, Isle of Wight

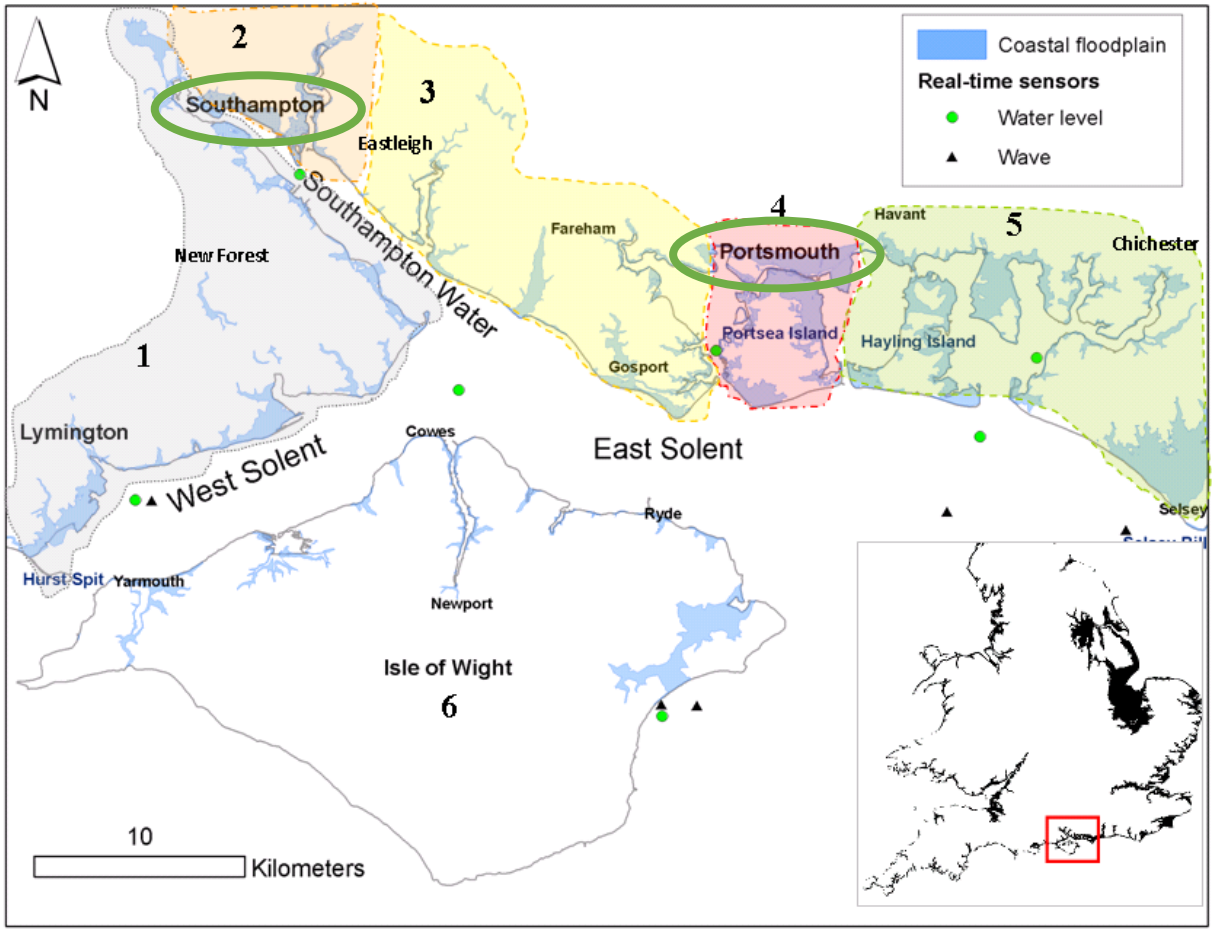
Quay Street, 10 March 2008, high tide

Yarmouth
Properties flooded vs. extreme sea level



Source; Wadey et al (2015) doi.org/10.1016/j.ocecoaman.2015.07.028.

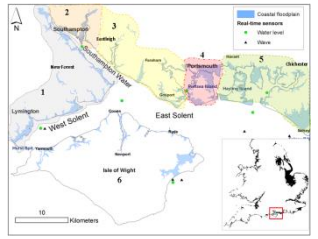
The Solent Region, UK

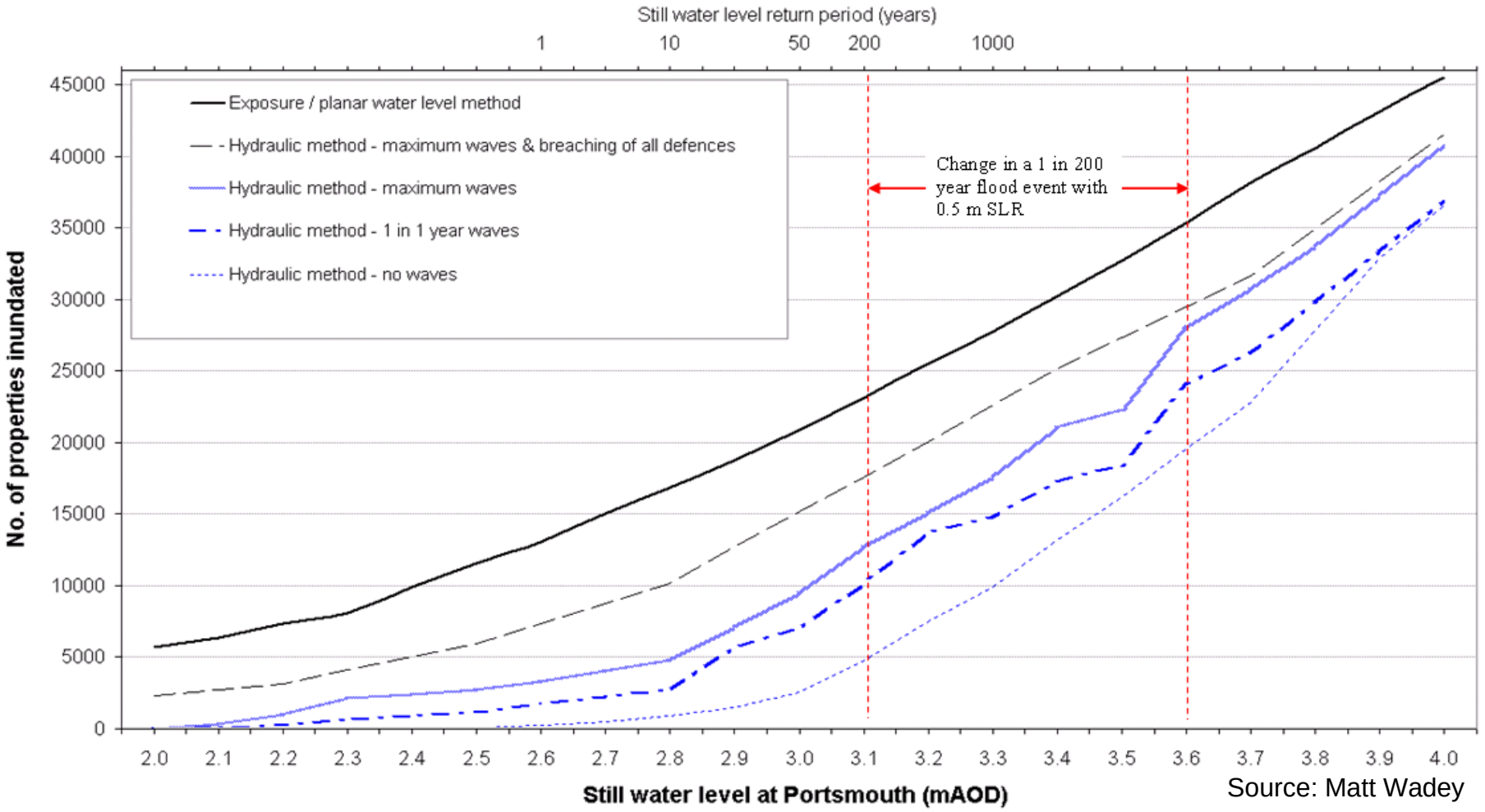


The Solent Region

Buildings in contact with water

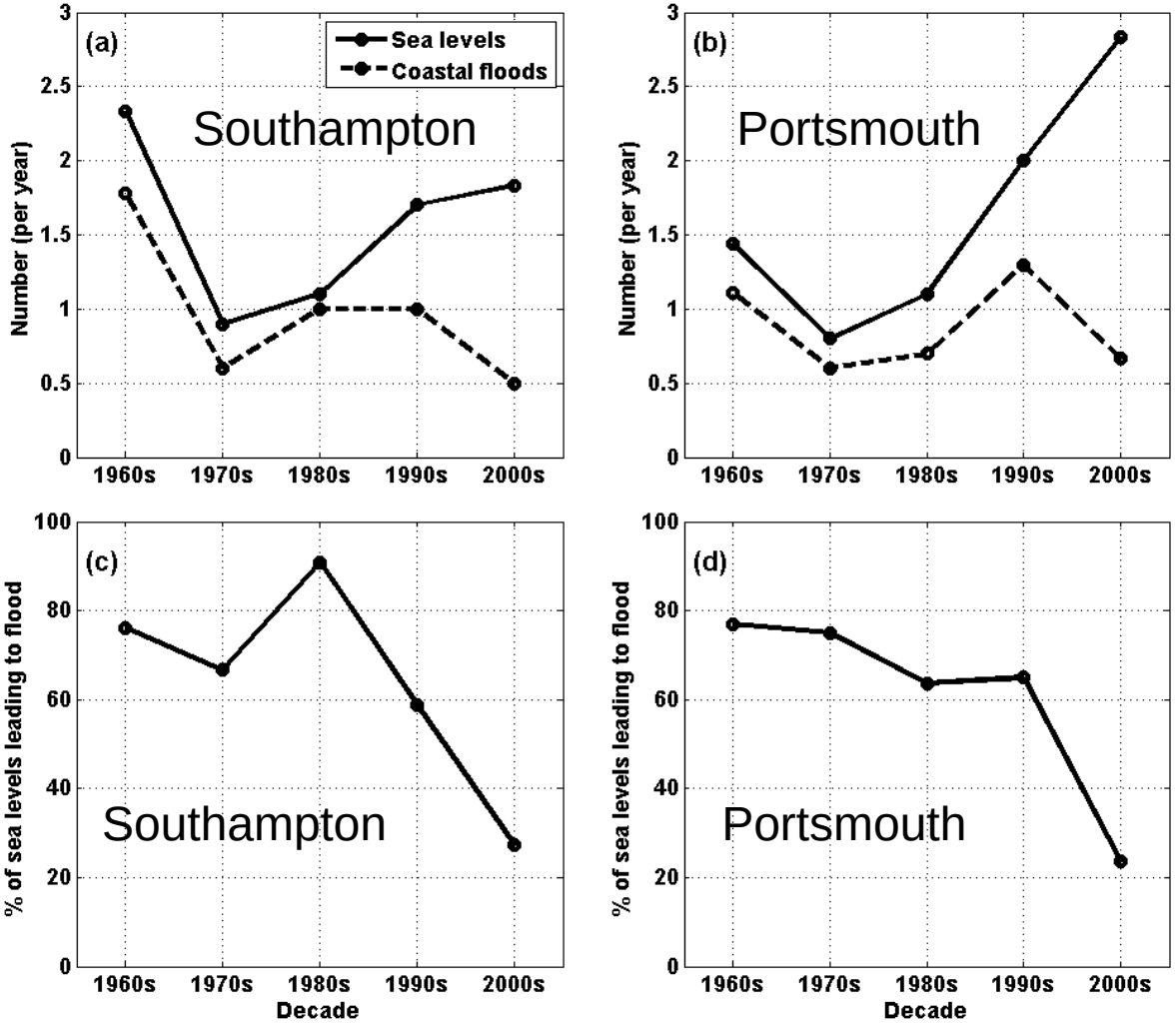
Source: Wadey et al (2012) doi.org/10.3390/w4020430





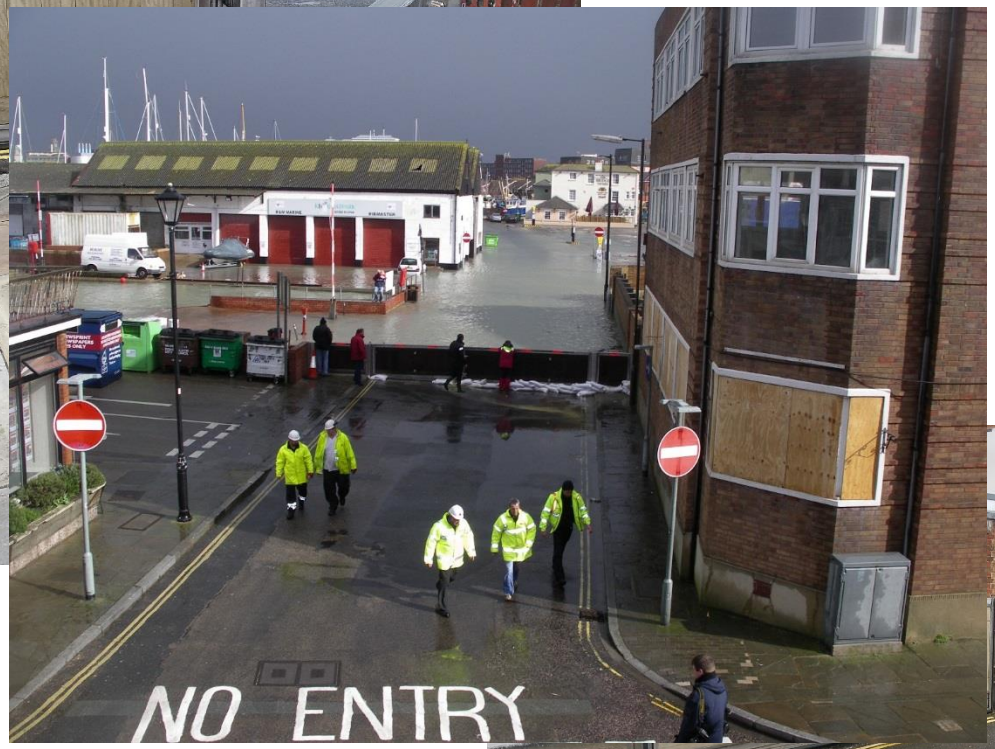
Source: Matt Wadey

Number of coastal floods per extreme sea-level event, Solent, UK



Source: Ruocco et al. (2011)

Mobile Flood Defences, Old Portsmouth



Upgraded Protection Portsmouth, UK

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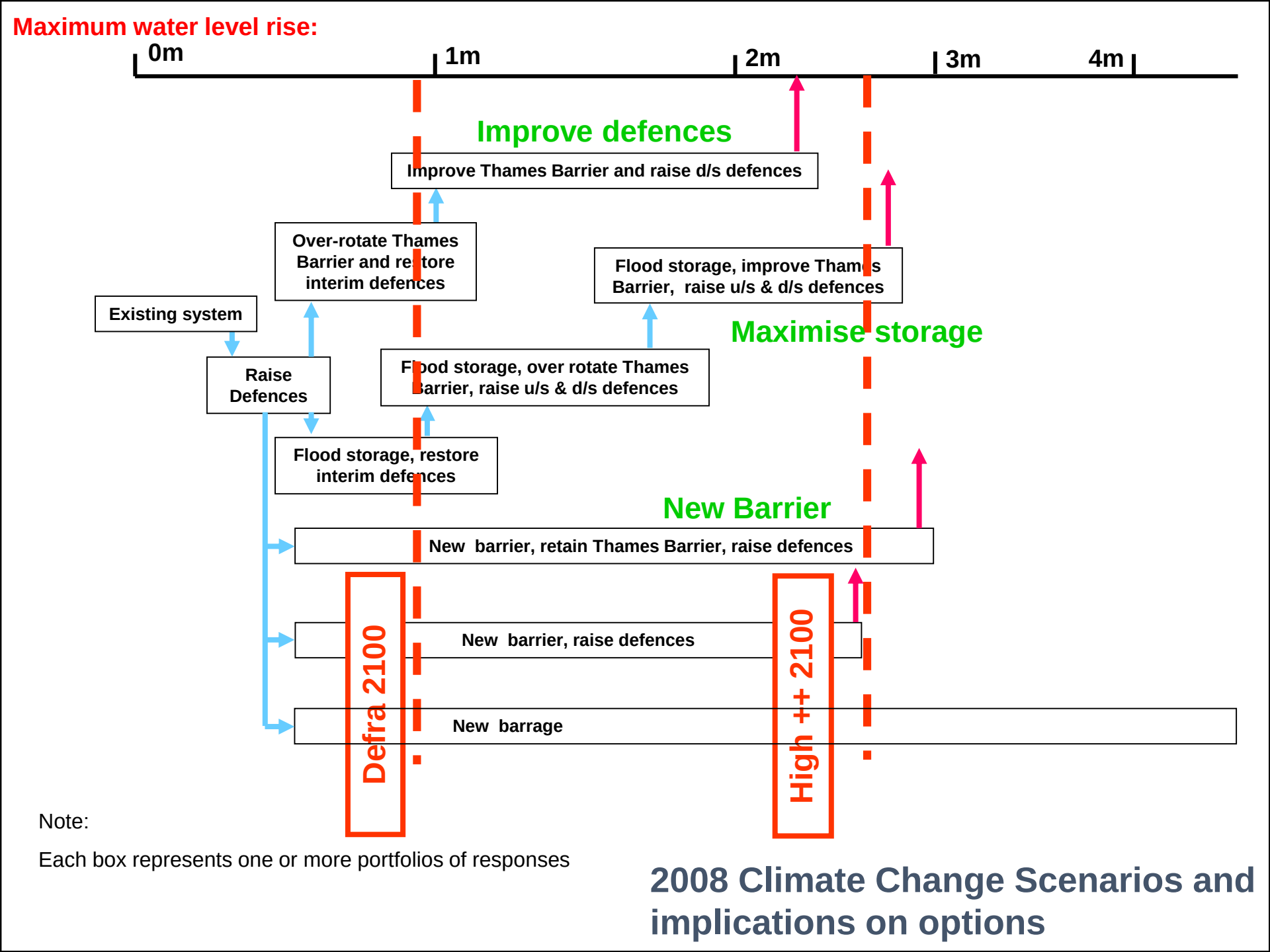
The 100th Thames Barrier Closure



Note:

Each box represents one or more portfolios of responses

Shoreline Management Plans (SMPs)

England and Wales

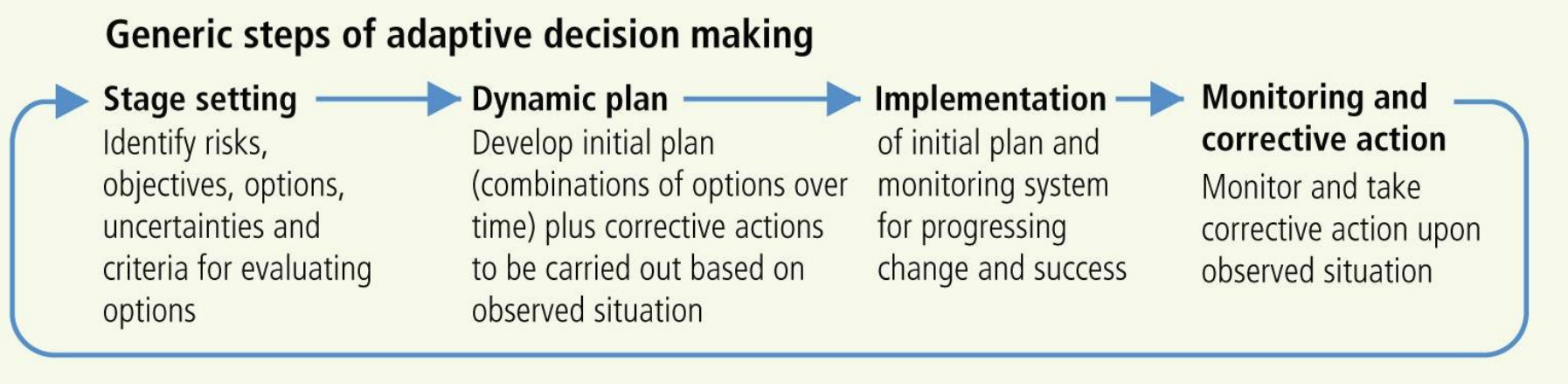
'This is a wake-up call': the villagers who could be Britain's first climate refugees

Fairbourne, North Wales
Guardian, 18 May 2019

22 SMPs
2000 management units
Four policy choices per Epoch
(1) Advance the line
(2) Hold the line
(3) Managed Realignment
(4) Limited Intervention

Recognise three mesoscale epochs
Epoch 1: 0 to 20 yrs
Epoch 2: 20 to 50 yrs
Epoch 3: 50 to 100 yrs

Choosing and enabling sea level rise responses – an adaptation process



Enabling conditions

- Long-term perspective
- Cross-scale coordination
- Address vulnerability and equity
- Inclusive public participation
- Capability to address complexity

Source; SROCC, IPCC (2019)

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Concluding Remarks

- The direction of sea-level rise is certain, but the rate of rise is highly uncertain depending on future emissions, climate sensitivity and ice sheet response
- A global 1-m rise in sea level threatens hundreds of millions of people with flooding worldwide, but this assumes no adaptation so provides a worst case
- Even if we fully implement the Paris Agreement, sea levels continue to rise – there is a commitment to sea-level rise, the resulting impacts and a need to adapt in addition to climate mitigation
- Adaptation can take many forms – protection (hard, soft and ecosystem-based), accommodation or retreat and these approaches are innovating and developing
- Flexible approaches to adaptation allow adjustment and learning with improving understanding of sea-level rise and responses
- However, some communities will have to move and we need to start to grapple with these difficult decisions now

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