

# PREPARING FOR SEA-LEVEL RISE: QUESTIONS FOR AOTEAROA NEW ZEALAND

**Bruce C. Glavovic**

EQC Chair in Resilience and Natural Hazards Planning

Resource & Environmental Planning Seminar

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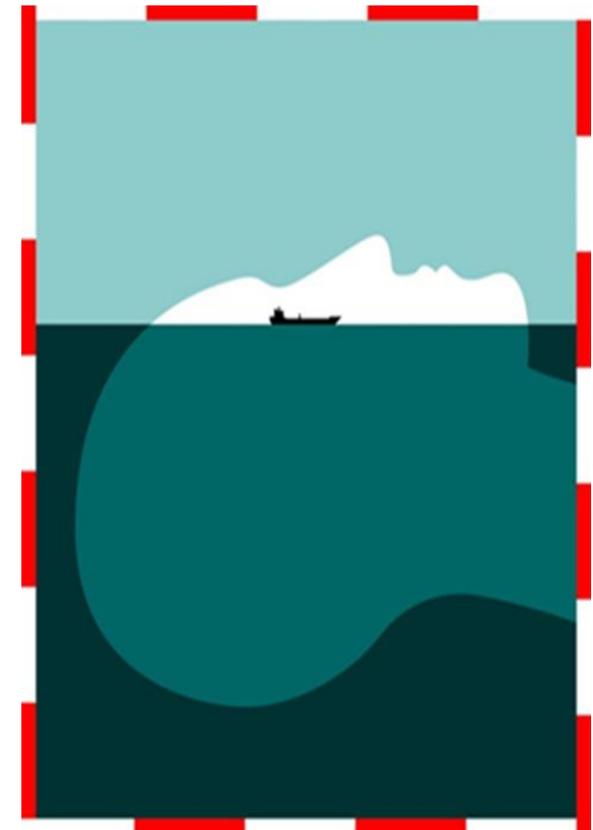
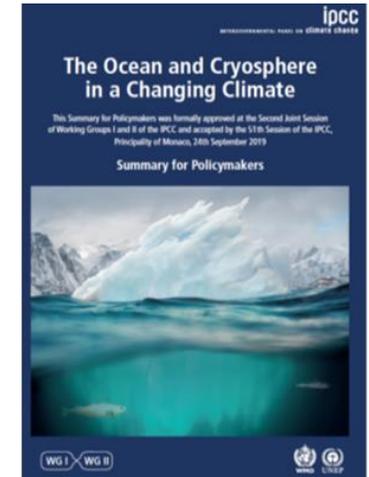


# Overview

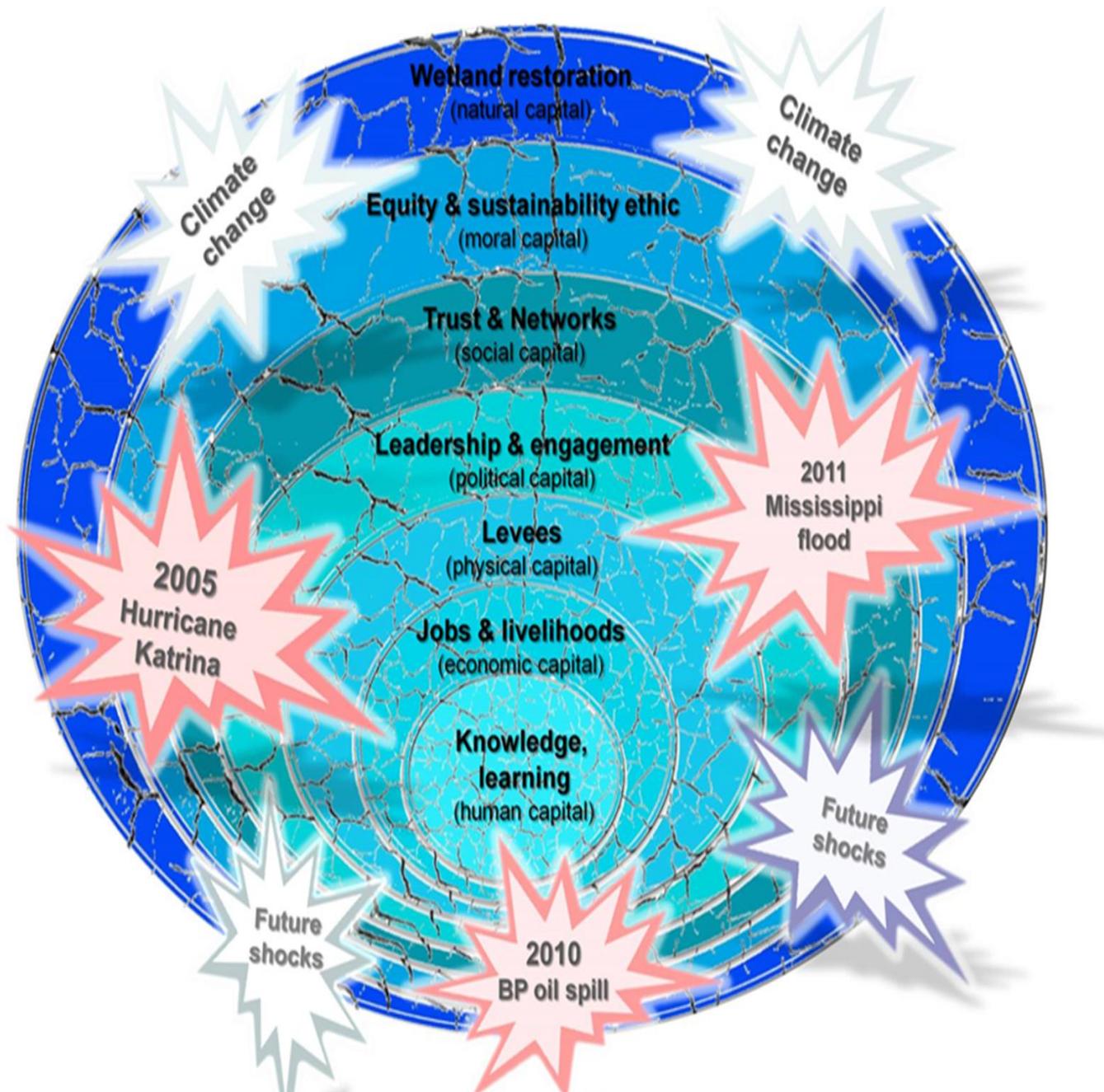
1. Waves of adversity, layers of resilience
2. The IPCC & sea level rise
3. IPCC Special Reports: 2018-2019
4. Governance challenges for SLR responses
5. Enabling conditions
6. Preparing for sea-level rise
7. Questions for Aotearoa NZ
8. Conclusion: Climate change and Covid-19

Download final draft of SROCC:

<https://www.ipcc.ch/srocc/download-report/>



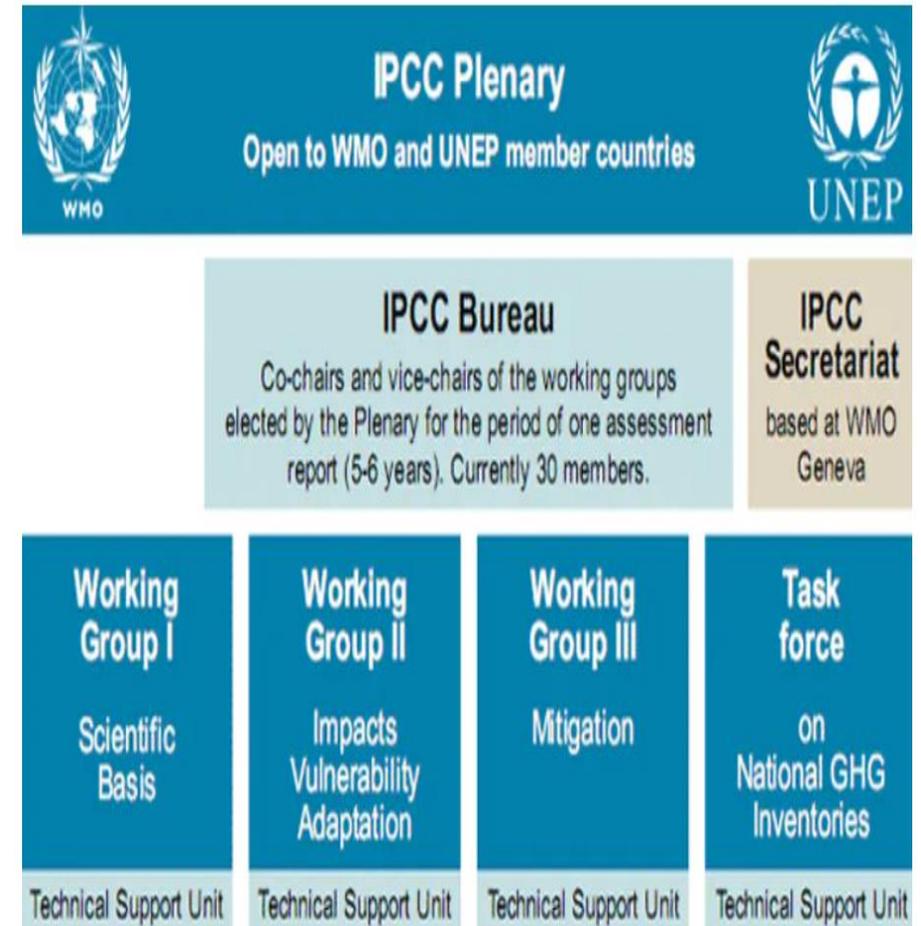
# 1. Waves of adversity, layers of resilience



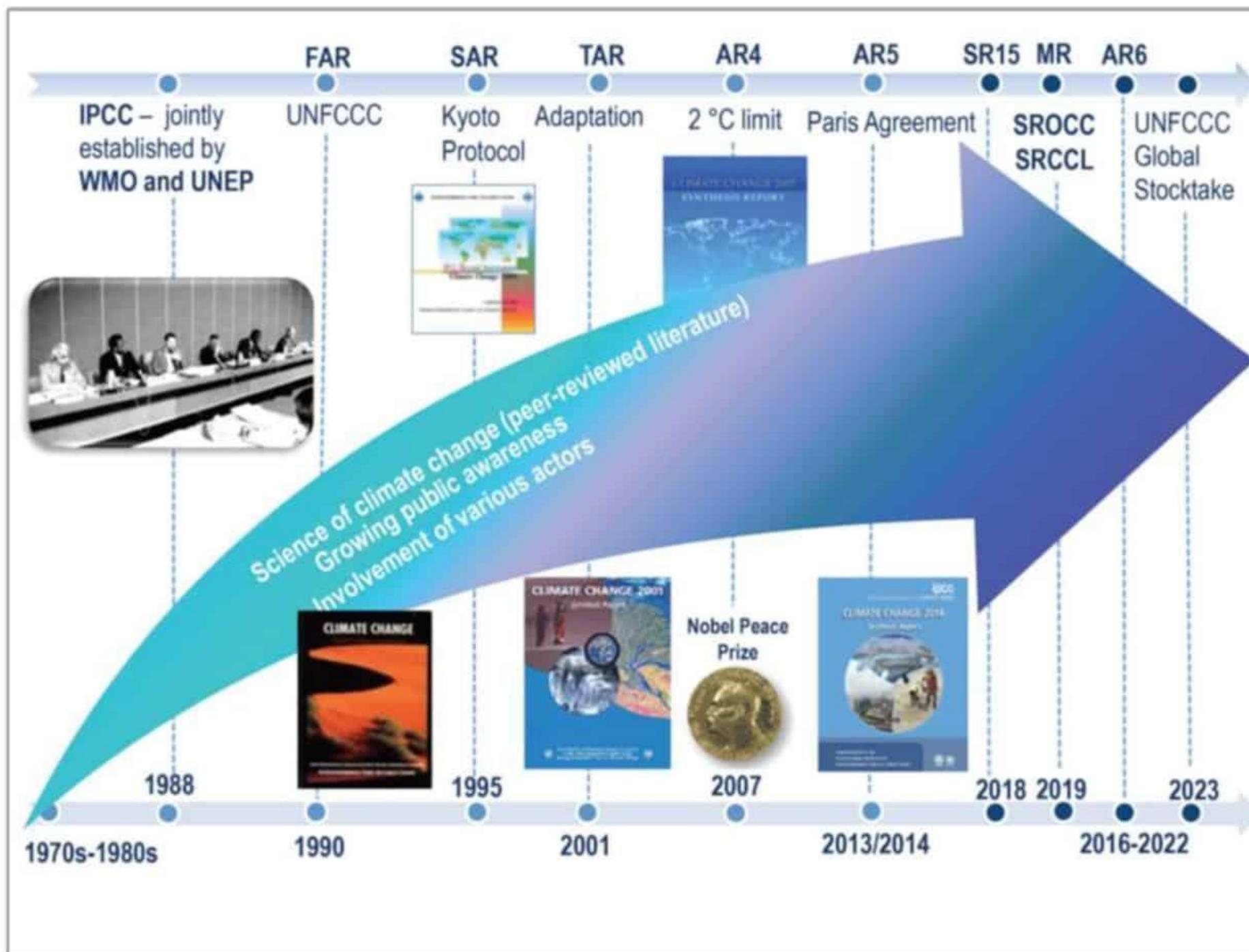
## 2. The IPCC & sea level rise

<https://theconversation.com/explainer-what-is-the-ipcc-anyway-and-how-does-it-work-18164>

- International body with governing Panel made up of government members from 195 countries.
- Assessment Reports drawn up by a very large, global group of scientists and experts
- Best understanding of recently published scientific and technical literature
- Policy relevant but not policy prescriptive



# IPCC Contribution to climate science and Policymaking



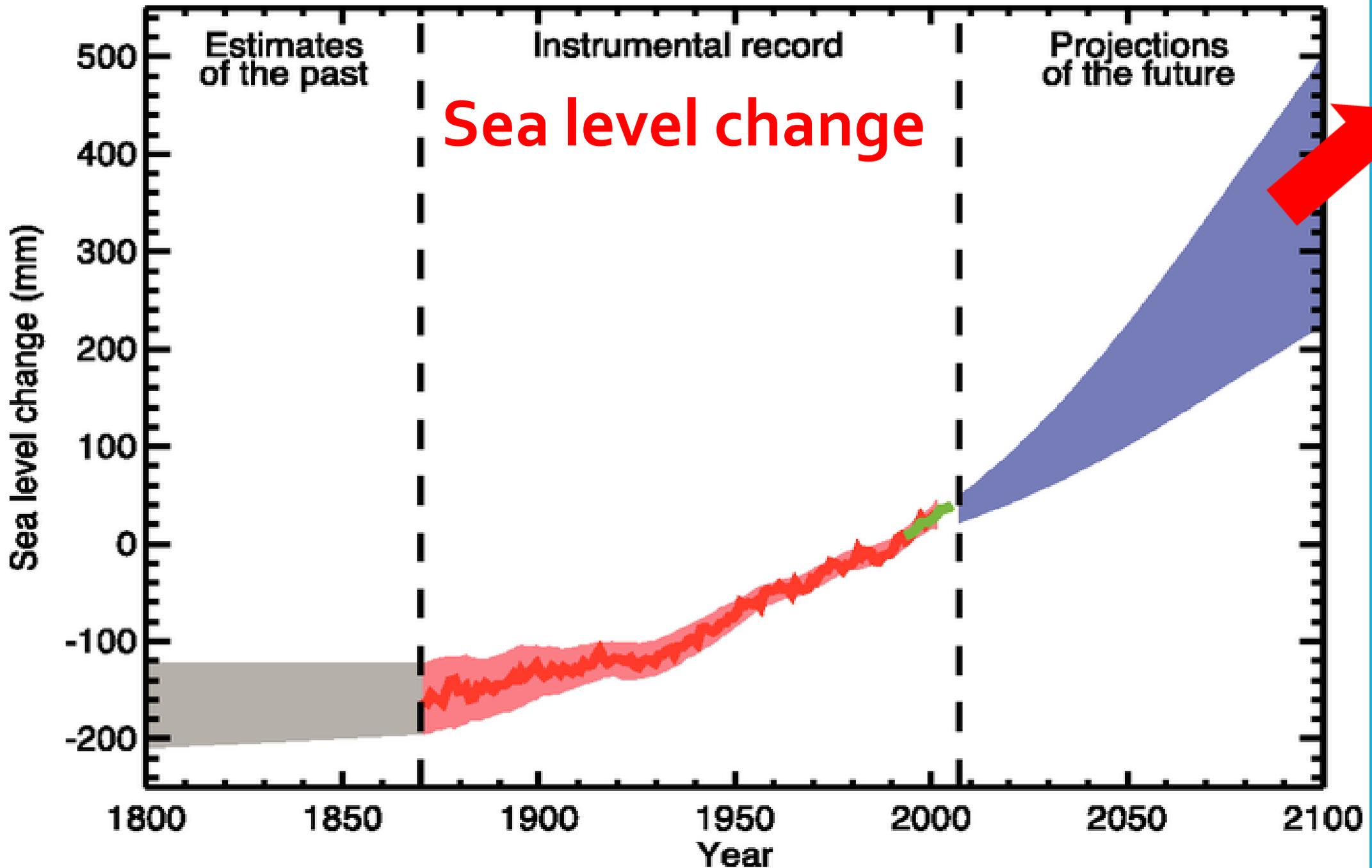
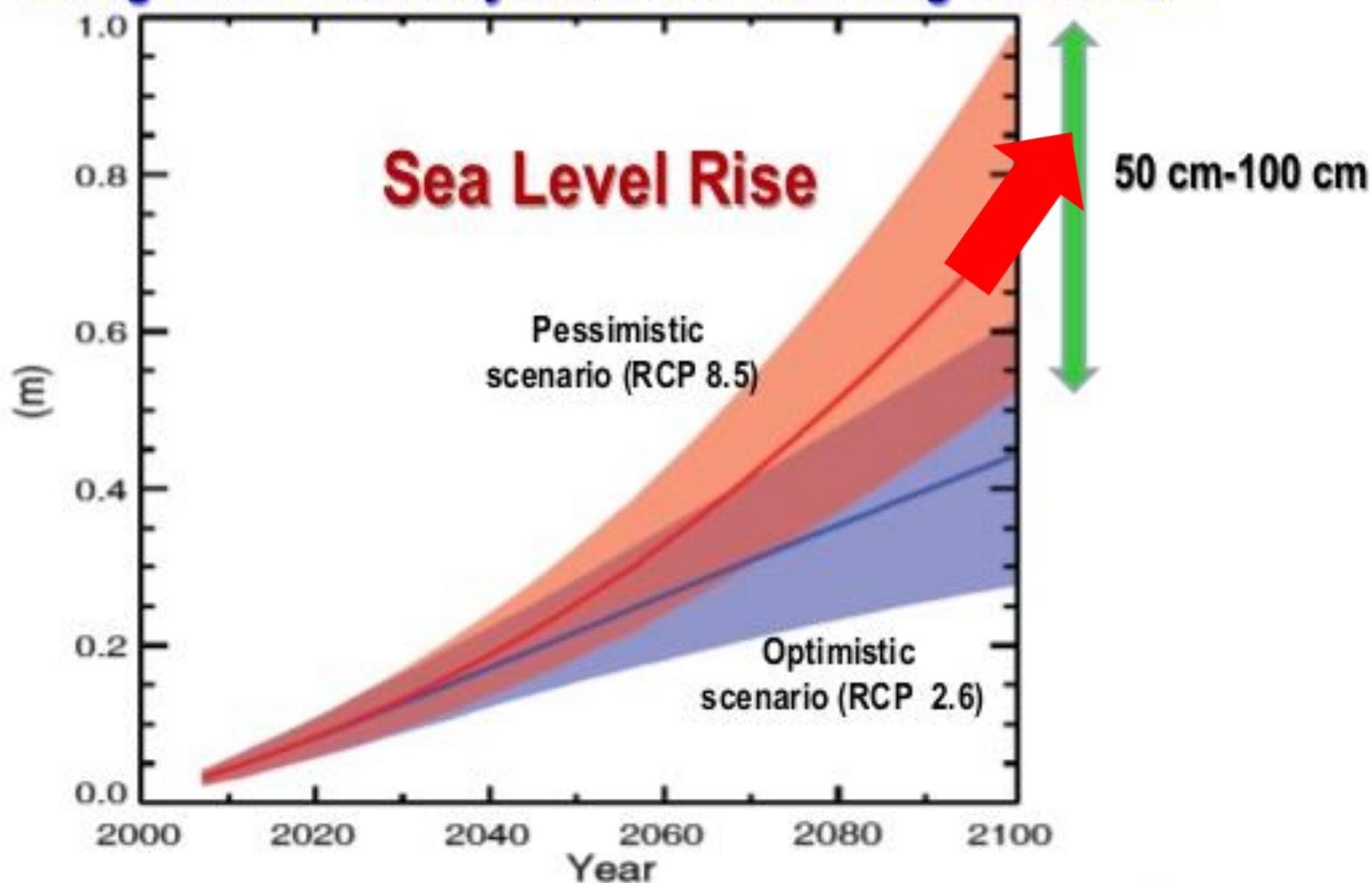


Figure 1. Time series of global mean sea level (deviation from the 1980-1999 mean) in past and projected for future (IPCC, AR4, 2007).

## IPCC-AR5 projections of Global Mean Sea Level Rise during the 21<sup>st</sup> century under two warming scenarios



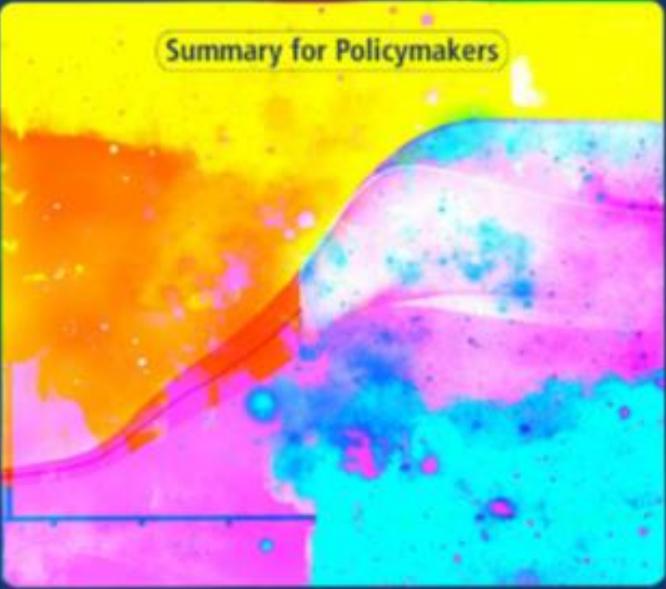
# 3. IPCC Special Reports: 2018-2019

**ipcc**  
INTERGOVERNMENTAL PANEL ON climate change

## Global Warming of 1.5°C

An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

Summary for Policymakers



WG I WG II WG III

WMO UNEP

**ipcc**  
INTERGOVERNMENTAL PANEL ON climate change

## Climate Change and Land

An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems

Summary for Policymakers



WG I WG II WG III

WMO UNEP

**ipcc**  
INTERGOVERNMENTAL PANEL ON climate change

## The Ocean and Cryosphere in a Changing Climate

This Summary for Policymakers was formally approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted by the 51th Session of the IPCC, Principality of Monaco, 24th September 2019

Summary for Policymakers



WG I WG II

WMO UNEP

# SR1.5 – oceans & coasts

- Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels ... **Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate (*high confidence*)**
- Warming from anthropogenic emissions from the pre-industrial period to the present **will persist for centuries to millennia** and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (*high confidence*) ...
- **By 2100, global mean sea level rise is projected to be around 0.1 metre lower with global warming of 1.5°C compared to 2°C (*medium confidence*)**. Sea level will continue to rise well beyond 2100 (*high confidence*), and the magnitude and rate of this rise depend on future emission pathways. A slower rate of sea level rise enables greater opportunities for adaptation in the human and ecological systems of small islands, low-lying coastal areas and deltas (*medium confidence*).

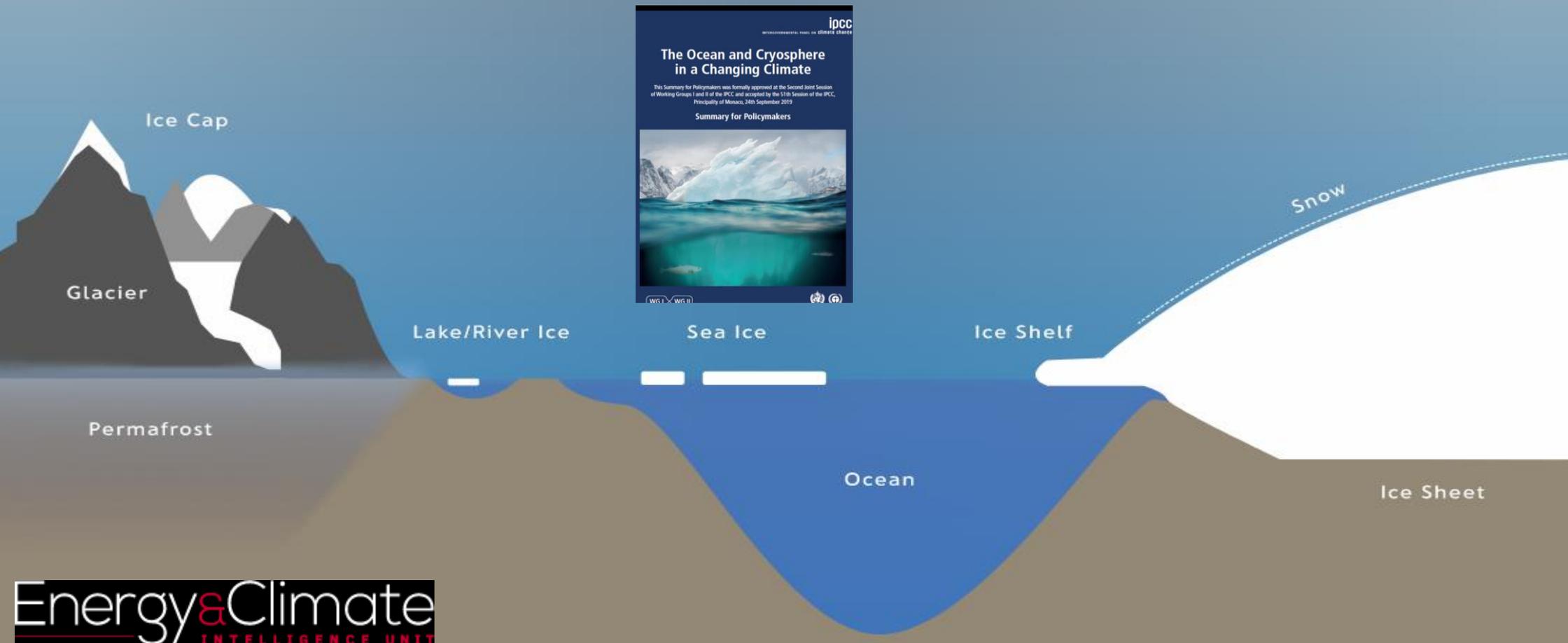
## SR1.5 – oceans & coasts

- ... limiting global warming to 1.5°C is projected to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans ... (*high confidence*).
- Sustainable development supports, and often enables, the fundamental societal and systems transitions and transformations that help limit global warming to 1.5°C. ...
- Strengthening the capacities for climate action of national and sub-national authorities, civil society, the private sector, indigenous peoples and local communities can support the implementation of ambitious actions implied by limiting global warming to 1.5°C (*high confidence*). International cooperation can provide an enabling environment for this to be achieved in all countries and for all people, in the context of sustainable development. International cooperation is a critical enabler for developing countries and vulnerable regions (*high confidence*).

OCEANS, POLAR REGIONS, MOUNTAINS, COASTS AND SEA-LEVEL RISE

# IPCC SPECIAL REPORT

ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE



# SROCC Report by the numbers



104 authors



31% of authors  
are women



36 countries



6981 studies



31,176  
comments

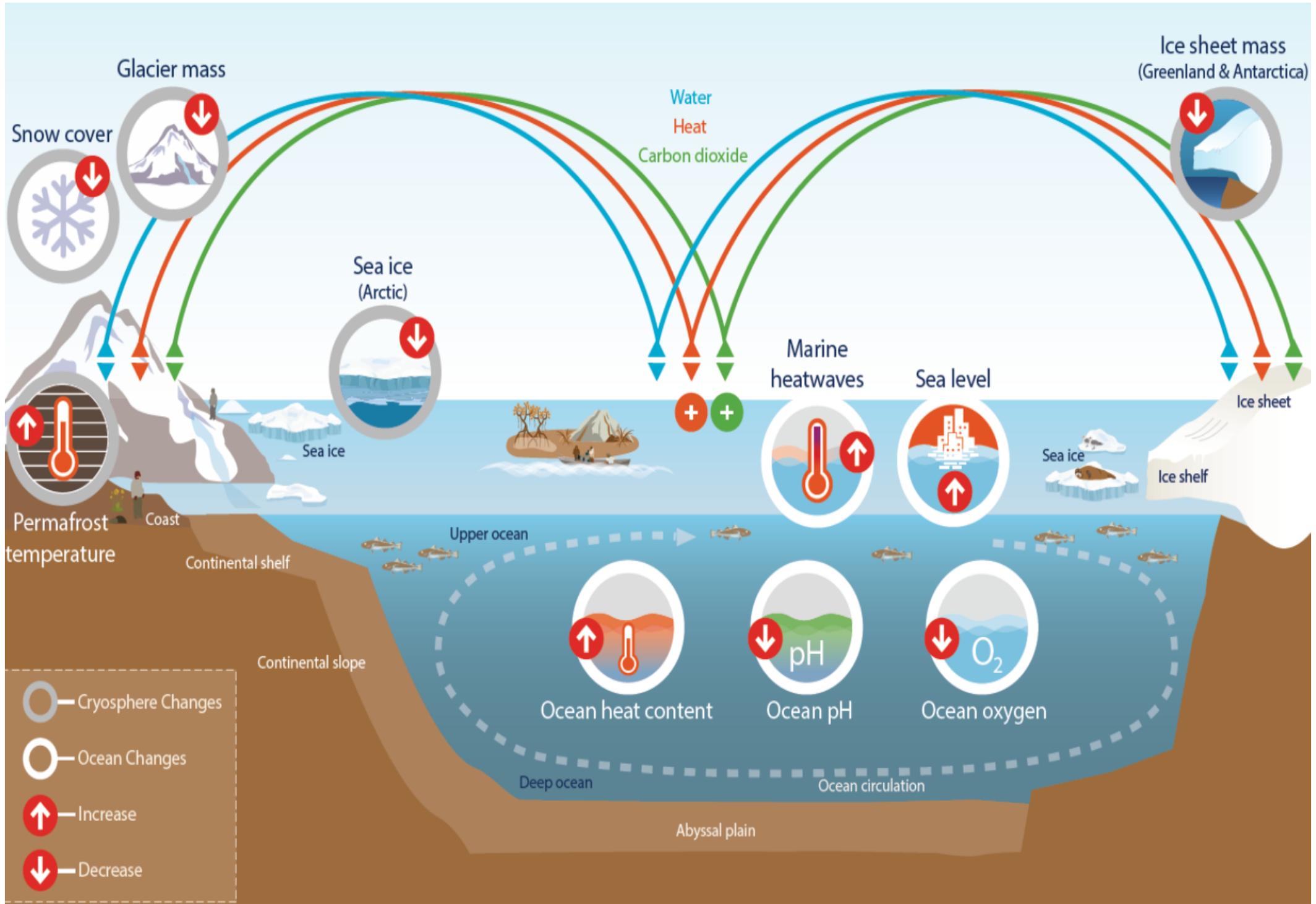
ipcc

INTERGOVERNMENTAL PANEL ON climate change



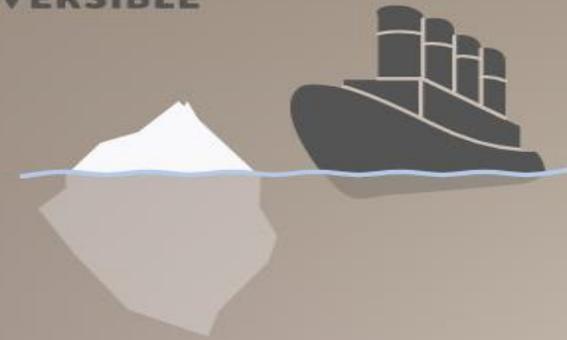
# How were authors selected for SROCC?

- Call for nomination of authors sent to IPCC member governments, Observer Organizations and Bureau Members on 5 April 2017.
- IPCC received 569 nominations from 57 countries. Selection by members of IPCC Working Group I and II Bureaus. 101 experts from 41 countries were invited to take on roles SROCC.
- 86 are Coordinating Lead Authors and Lead Authors who have collective responsibility for contents of assigned chapters. 15 experts are Review Editors who ensure all substantive comments during review stages are given appropriate consideration by Authors. Additional Contributing Authors.

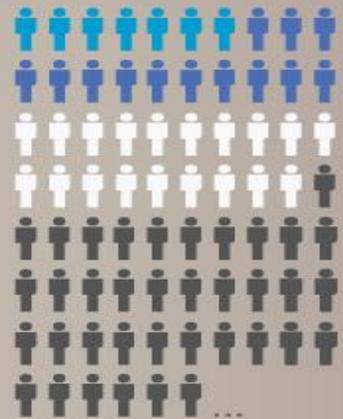


# WHY IS IT IMPORTANT?

MUCH OF THE DAMAGE CAUSED BY **CLIMATE CHANGE** IS **IRREVERSIBLE** ON TIMESCALES RELEVANT TO HUMAN SOCIETIES.



OF THE WORLD'S 7.6 BILLION PEOPLE ...



 Live in low-lying coastal zones

 Live on coasts

 Rely on the the water that flows from the Hindu Kush Himalayan glaciers for drinking, agriculture, energy, or other purposes.

 = 100 million

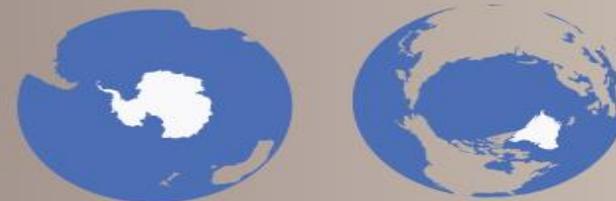


Ocean covers most of Earth's surface. Since 1970, the ocean has absorbed over 90% of the extra heat caused by human-caused global warming.

**680**  
**66%**

**MILLION PEOPLE LIVE IN LOW-LYING COASTAL AREAS**

**OF HINDU KUSH HIMALAYAN GLACIERS MAY BE LOST BY 2100**



Ice sheets and glaciers cover 10% of Earth's surface.

**WE WILL SEE AROUND 1M OF SEA-LEVEL RISE BY 2100 IF EMISSIONS DO NOT STOP, BUT SEA-LEVEL RISE IS ACCELERATING. WITHOUT EMISSION CUTS, THE OCEAN WILL RISE MORE THAN 10X FASTER IN 2100 THAN IT DID DURING THE 20TH CENTURY.**



**GLOBALLY, SEA LEVELS ARE RISING AND THE RATE OF RISE IS ACCELERATING.**

**3.6MM**  
PER YEAR SINCE 1993

Flood losses of up to \$1 trillion per year may occur in the largest coastal cities within 30 years.



**ICE SHEETS AND GLACIERS ARE THE DOMINANT SOURCE OF SEA-LEVEL RISE.**

**278**  
BILLION TONNES

... of ice lost from the Greenland ice sheet each year raises sea level nearly 0.7mm annually.



**15 DEVELOPING COUNTRIES ARE HOME TO 90% OF THE WORLD'S LOW-LYING RURAL POOR.**

**18**  
MILLION PEOPLE

... could be displaced in the country of Bangladesh alone by sea-level rise before 2050.

# WHAT COULD OUR FUTURE LOOK LIKE?

**WELL, IT DEPENDS. BY CUTTING EMISSIONS, RISKS CAN BE REDUCED OR AVOIDED, AND ADAPTATION MADE EASIER AND MORE EFFECTIVE. BUT THAT MEANS "RAPID, FAR-REACHING AND UNPRECEDENTED CHANGES" IN ALL ASPECTS OF SOCIETY.**

"A 66% chance of limiting global warming to 2°C"

## LOW EMISSIONS

Extreme sea level events that are historically rare (once per century in the recent past) are projected to occur frequently (at least once per year) at many locations by 2050 in all RCP scenarios, especially in tropical regions (high confidence).

## HIGH EMISSIONS

Continued and sustained growth in atmospheric GHG emissions.



**SEA-LEVEL RISE BY 2100**



THERE IS A 17% CHANCE THAT SEA-LEVEL RISE COULD EXCEED 1.1M. WHILE AN INCREASE OF MORE THAN 2M "CANNOT BE RULED OUT".

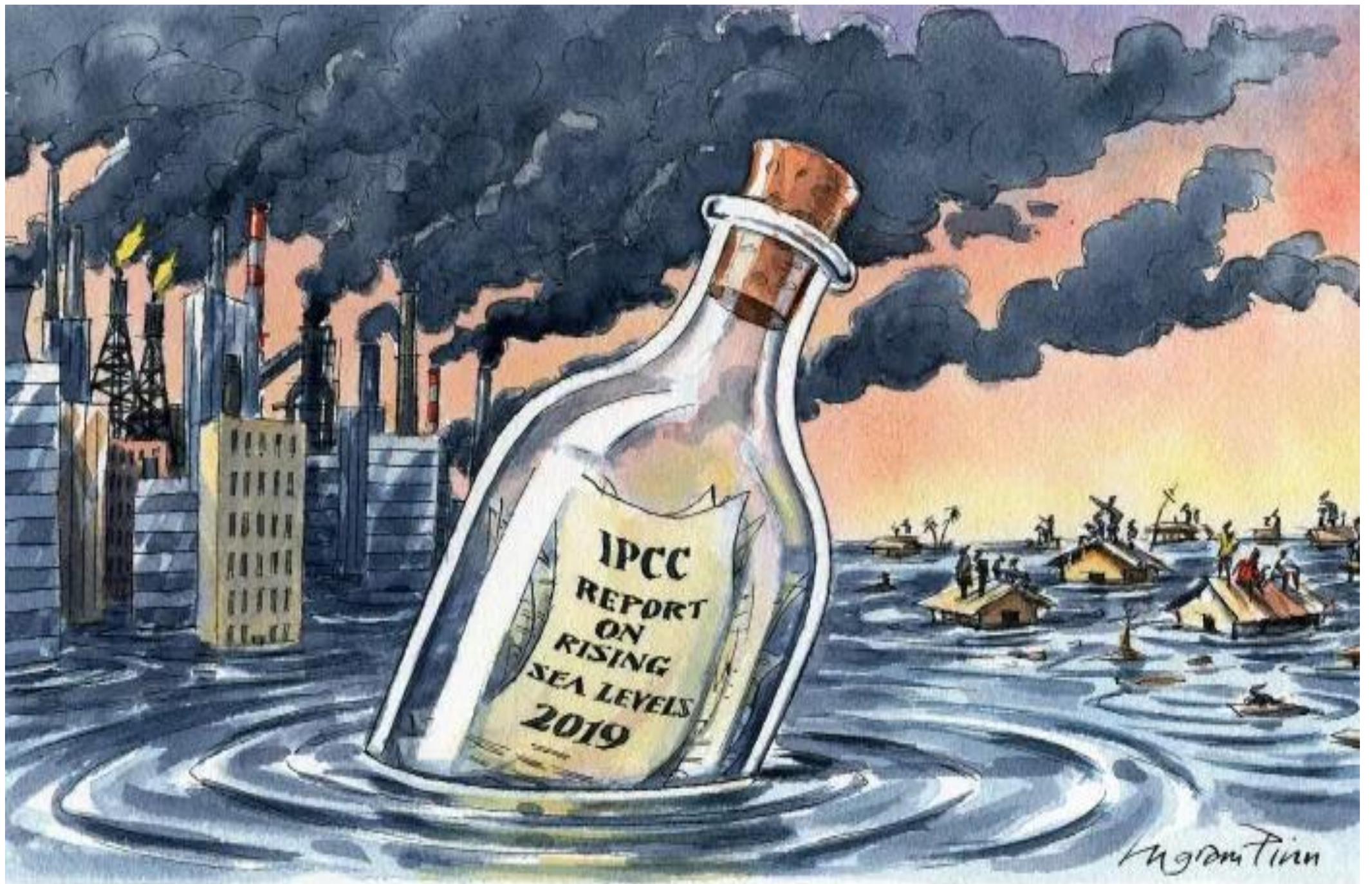


**THE RATE OF SEA-LEVEL RISE PER YEAR BY 2100**



**SEA-LEVEL RISE BY 2300**





**MESSAGE IN A BOTTLE**

# Implementing responses to ocean & cryosphere change

- **C1.** Impacts of climate-related changes in the ocean and cryosphere increasingly **challenge current governance efforts** to develop and implement adaptation responses from local to global scales, and in some cases pushing them to their limits. **People with the highest exposure and vulnerability are often those with lowest capacity to respond** (*high confidence*).
- **C3.** Coastal communities face **challenging choices** in crafting context-specific and integrated responses to sea level rise that balance costs, benefits and trade-offs of available options and that can be adjusted over time (high confidence). ...
- **C4.** **Enabling climate resilience and sustainable development depends critically on urgent and ambitious emissions reductions coupled with coordinated sustained and increasingly ambitious adaptation actions** (*very high confidence*). ... This report reflects the state of science for ocean and cryosphere for low levels of global warming (1.5°C), as also assessed in earlier IPCC and IPBES reports.

## 4. Governance challenges for SLR responses

1. Time horizon and uncertainty
2. Cross-scale and cross-domain coordination
3. Equity and social vulnerability
4. Social conflict
5. Complexity

# 5. Enabling conditions

## 1. Time horizon and uncertainty

- Take action now with the long-term in mind, keeping options open so that new responses can be developed over time
- Avoid new development commitments in high-risk locations

## 2. Cross-scale and cross-domain coordination

- Build vertical and horizontal governance networks and linkages across policy domains and sectors to legitimise decisions, build trust and improve coordination
- Social learning, experimentation and innovation inform technical solutions, build shared understanding, and develop locally appropriate SLR responses

## 3. Equity and social vulnerability

- Recognise the political nature of adaptation and explicitly address vulnerability and equity implications to achieve enduring, enabling impact of responses
- Focus on enabling community capabilities for responding to SLR, where necessary complementing community knowledge, skills and resources, and political influence and problem-solving abilities, with external assistance and government support

# 5. Enabling conditions

## 4. Social Conflict

- Social conflict can be reduced by tailor-made design and facilitation of participation processes, and involving stakeholders early and consistently throughout decision-making and implementation of SLR responses
- Social conflict can be managed by creating safe arenas for inclusive, informed and meaningful deliberation, negotiation and collaborative problem-solving

## 5. Complexity

- Drawing upon multiple knowledge systems to co-design and co-produce SLR responses results in more acceptable and implementable responses
- Build governance capabilities to tackle complex problems



**RISING  
SEAS**

Frontiers of Climate Science

# 6. Preparing for sea-level rise

## Actions to reduce Hazards include, e.g.:

- Ecosystem-based measures to reduce coastal flooding
- Mangroves to alleviate coastal storm energy
- Water reservoirs to buffer low-flows and water scarcity

## Actions to reduce Vulnerability include, e.g.:

- Social protection
- Livelihood diversification
- Insurance solutions
- Hazard-proof housing and infrastructure

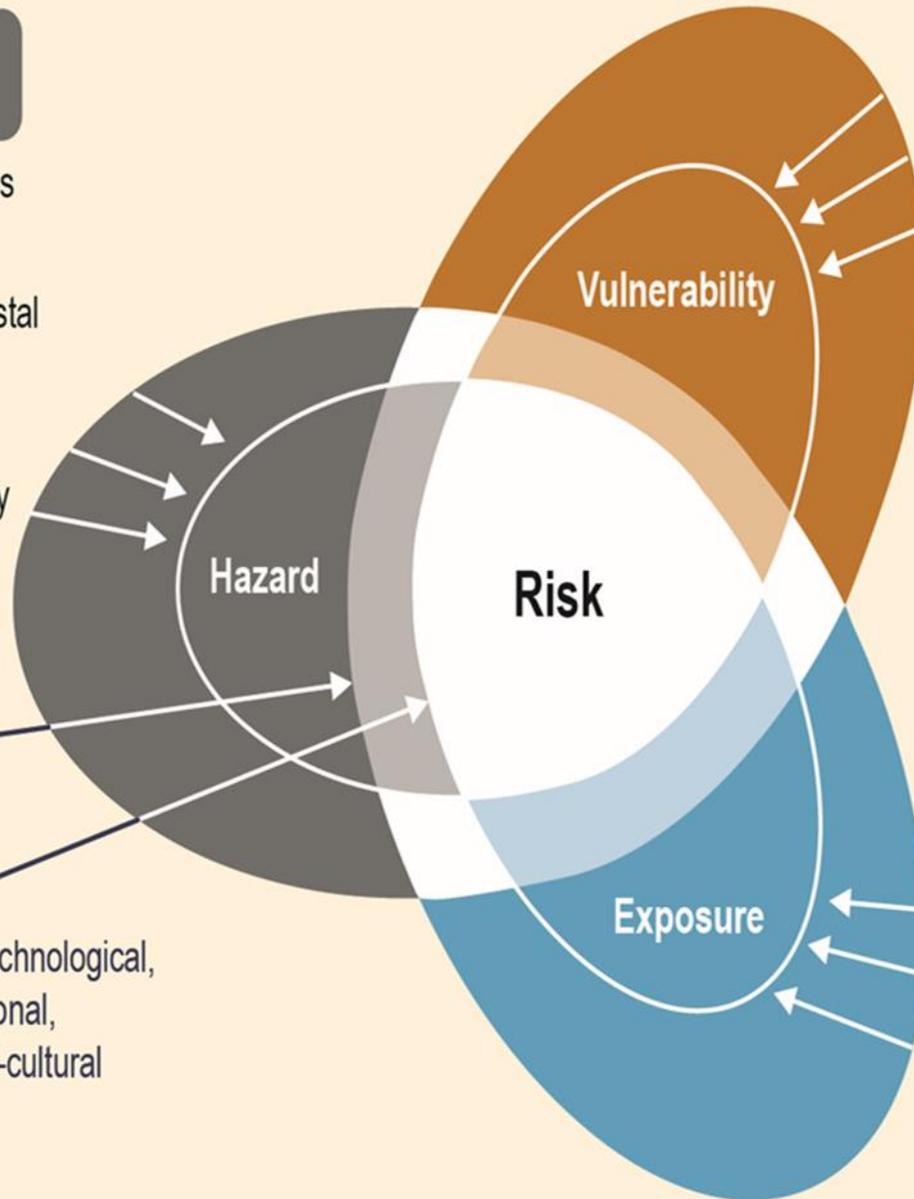
## Actions to reduce Exposure include, e.g.:

- Coastal retreat and resettlement
- Risk sensitive land use planning
- Early warning systems and evacuations

Initial state of Risk

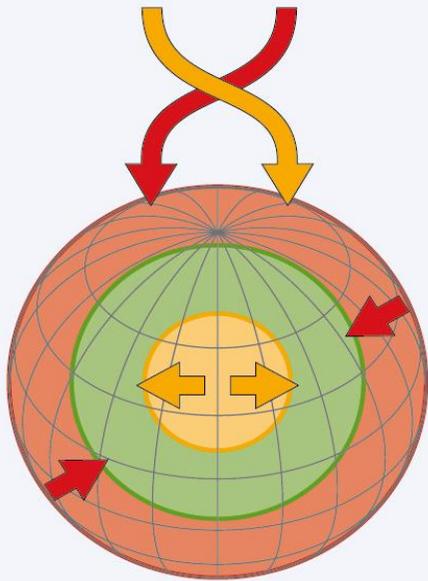
## Limits to Adaptation

- E.g. physical, ecological, technological, economic, political, institutional, psychological, and/or socio-cultural



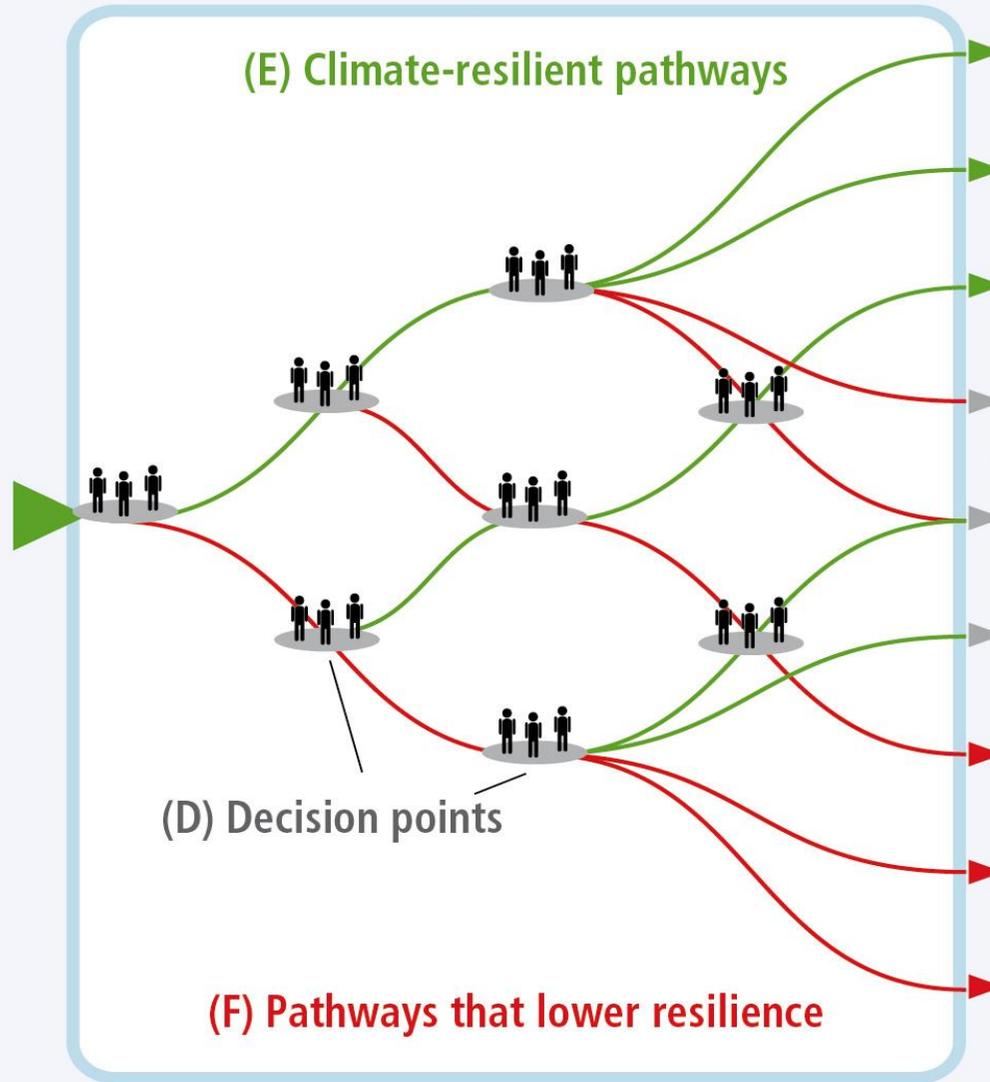
(A) Our world

Multiple stressors including climate change



- Biophysical stressors
- Resilience space
- Social stressors

(B) Opportunity space



(C) Possible futures

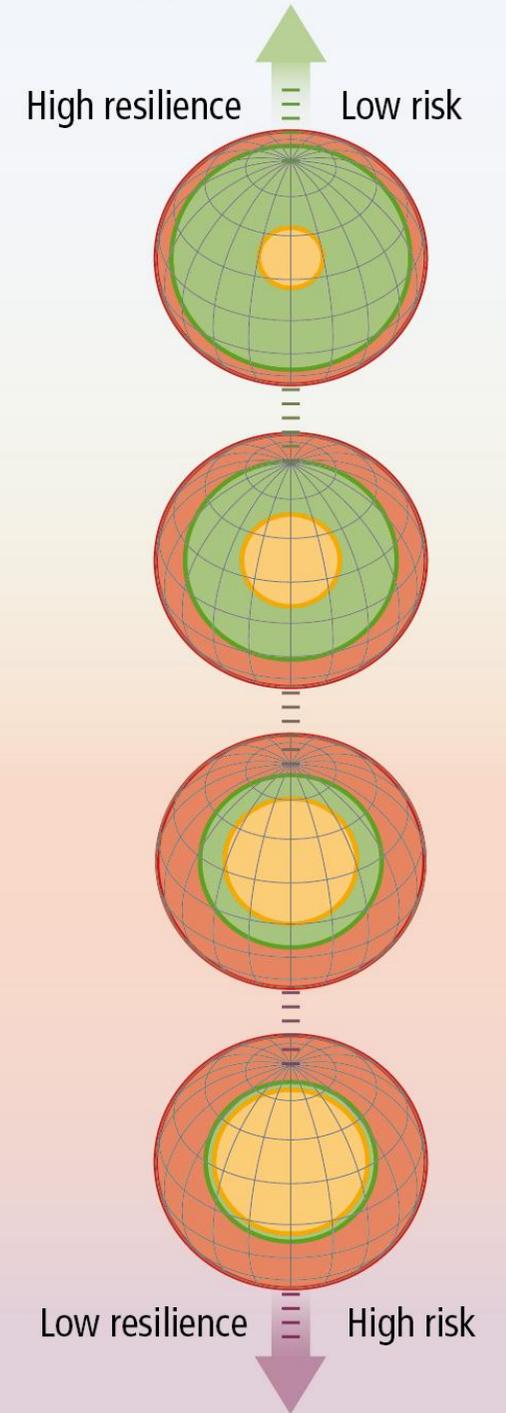
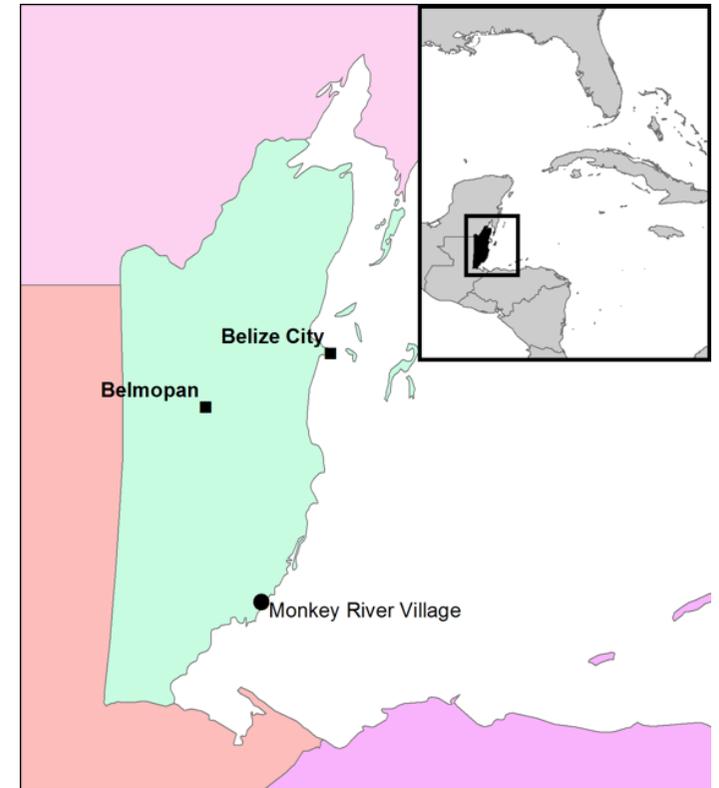


Fig. 1.5, WGII, AR5

# Successful examples?

- Successful adaptation depends on social groups' ability to act collectively, but many social-ecological challenges exceed local adaptive capacity which require assistance from governmental institutions. *How can local collective action be used to enrol external support for adaptation?*
- Different strategies can be used by local residents to influence government authorities to support adaptation efforts. Can get support to address threats to place-specific way of life.



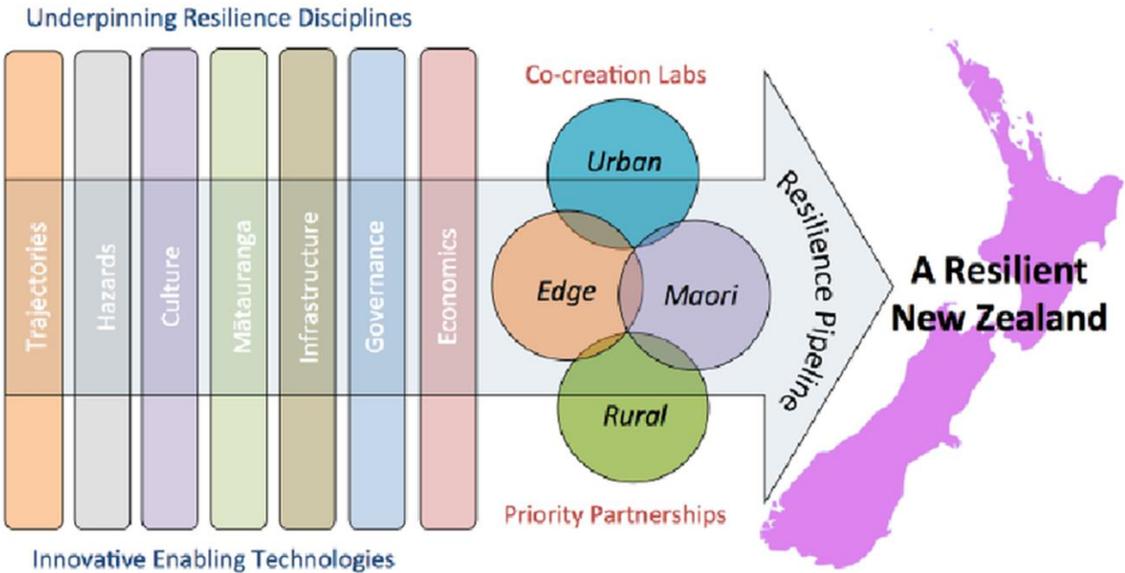
Karlsson & Hovelsrud, 2015. Local collective action: Adaptation to coastal erosion in the Monkey River Village, Belize, *Global Env Change*, 32: 96-107

# Local collective action: Adaptation to coastal erosion in the Monkey River Village, Belize

“... essential that the villagers could ally with journalists, researchers and local NGOs to make their claims for protection heard by the government ... local collective action, seen as contestation over rights to protection from environmental change, can be a means for places and communities not prioritised by formal policies to enrol external support for adaptation. Our study supports and adds to the perspective that attention to formal arrangements such as adaptation policy alone has limited explanatory power to understand collective responses to change.”

# Clifton-Tangoio Coastal Hazards Strategy 2120

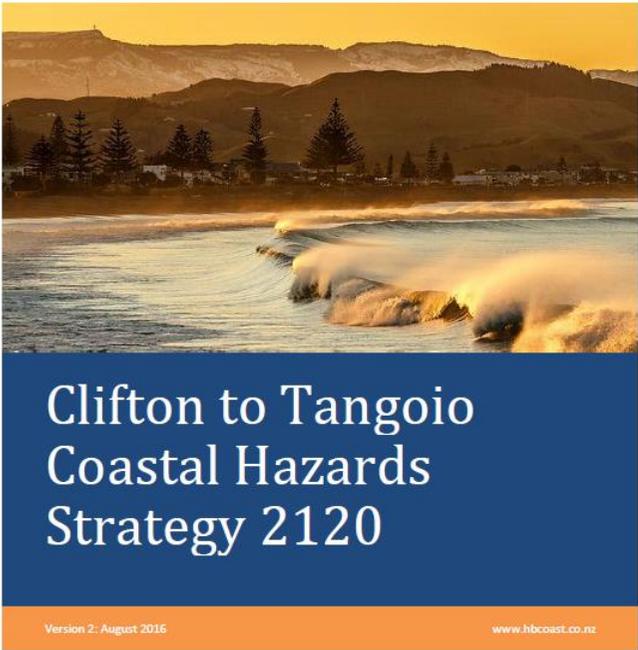
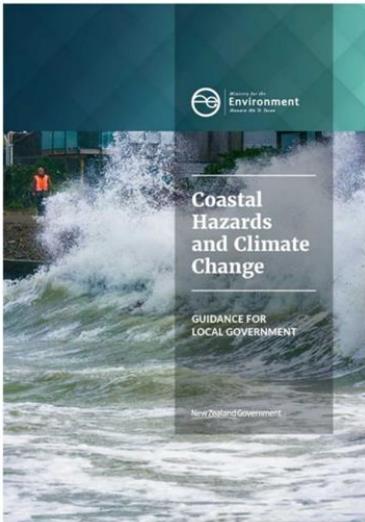
## Research Strategy – Resilience to Nature’s Challenges



Living at the Edge –  
Transforming the  
Margins



Resilient Governance  
for New Zealand’s  
Future



## Some preliminary reflections by Edge team

- Conventional methods for assessing adaptation options do not adequately address changes in risk & uncertainty over time.
- Decision makers face immediate challenges in managing coastal risk in the face of sea-level rise, with more frequent coastal flooding, rising groundwater & coastal erosion.
- Importance of well-designed collaborative & interactive community & decision making processes that can increase community understanding about changing nature of risk over time & need to take early actions that enable a shift before they are no-longer effective.
- It is very difficult to shift short-term thinking about short-term actions e.g. coastal protection, to longer-term anticipatory strategies.
- An adaptation pathways approach can help transition from short-term 'protection' measures to alternative options in medium & longer term.
- Ongoing political leadership, governance & monitoring systems need to be built & sustained by local authorities & communities, with enabling support from Government.

# 7. Questions to consider in Aotearoa NZ

1. How might ANZ communities develop shared understanding about local sea level rise prospects – given shoreline changes, such as subsidence, & plausible changes in exposure, vulnerability & risk over time?
2. How can ANZ communities build political will to initiate & sustain effective sea level rise responses over time?
3. What mix of legislative, policy & enabling provisions, including funding & technical capabilities, are required to develop adaptive capacity & institutionalize action at the local level?
4. What are the best ways to involve community members in adaptation efforts, especially those most at risk?
5. How might insights be drawn from science together with local knowledge & indigenous knowledge to inform local adaptation efforts; & how might the gaps between science, policy & practice be bridged?



## 7. Questions to consider in Aotearoa NZ

6. What combination of response measures, in what sequence over time, might ANZ communities choose to reduce risk & build resilience in the face of rising seas & more frequent extreme sea level events?
7. How might formal (e.g., legislative & policy provisions) & informal (e.g., community traditions & norms) institutional processes & practices be aligned to enable effective adaptation over time?
8. How can social learning be built into sea level rise response planning, decision-making & implementation?
9. What can be done to enable institutional flexibility so that changes can be made in the light of lessons learned & when an alternative climate-resilient pathway becomes compelling?
10. What can ANZ communities do to foster dialogue, encourage innovation, & create 'safe spaces' to resolve escalating conflict as the seas rise?



## 8. Conclusion: Climate change and Covid-19

“Climate change responses reveal the underlying inequity in societal development – both in the drivers of climate change and of the impacts and responses. It is the poor and marginalised who bear the brunt of the impacts of human-induced climate change. The climate-development nexus is entwined with public health, human well-being and sustainable development. Development trajectories shape and are shaped by human-nature interactions. The COVID-19 crisis shows that we need to reflect carefully on how decisions have been and will be made, and the role of justice and equity in these processes (Steven and Evans, 2020). Who will be sacrificed? Who will be kept alive? Similarly, with the focus on possible ‘bail-outs’ like in the 2008-9 financial crisis (Farrer, 2020), which services and functions do we think need to be preserved, and which can be forfeited?”

## 8. Conclusion: Climate change and Covid-19

“Climate change and COVID-19 are entwined through the development pathways we choose or are subjected to through decisions made by governments, businesses, civil society and ultimately each one of us as citizens. These decisions are based implicitly or explicitly on ethical and political considerations. Importantly, how we frame development pathways is inherently political and value-laden. An implication of the global support for the sustainable development goals, including the principle of ‘leave no-one behind’, is that development pathways that are climate resilient are those that foster well-being – even in the face of COVID-19 – for people and the planet.” (Schipper et al., in press. The global pandemic response and implications for climate resilient development: How can we ensure justice and equity? *Climate and Development*)