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# Rollout event of the IPCC Special Report on The Ocean and Cryosphere in a Changing Climate

## Chap.1 Framing and Context of the Report

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# Ocean and Cryosphere in a changing Climate

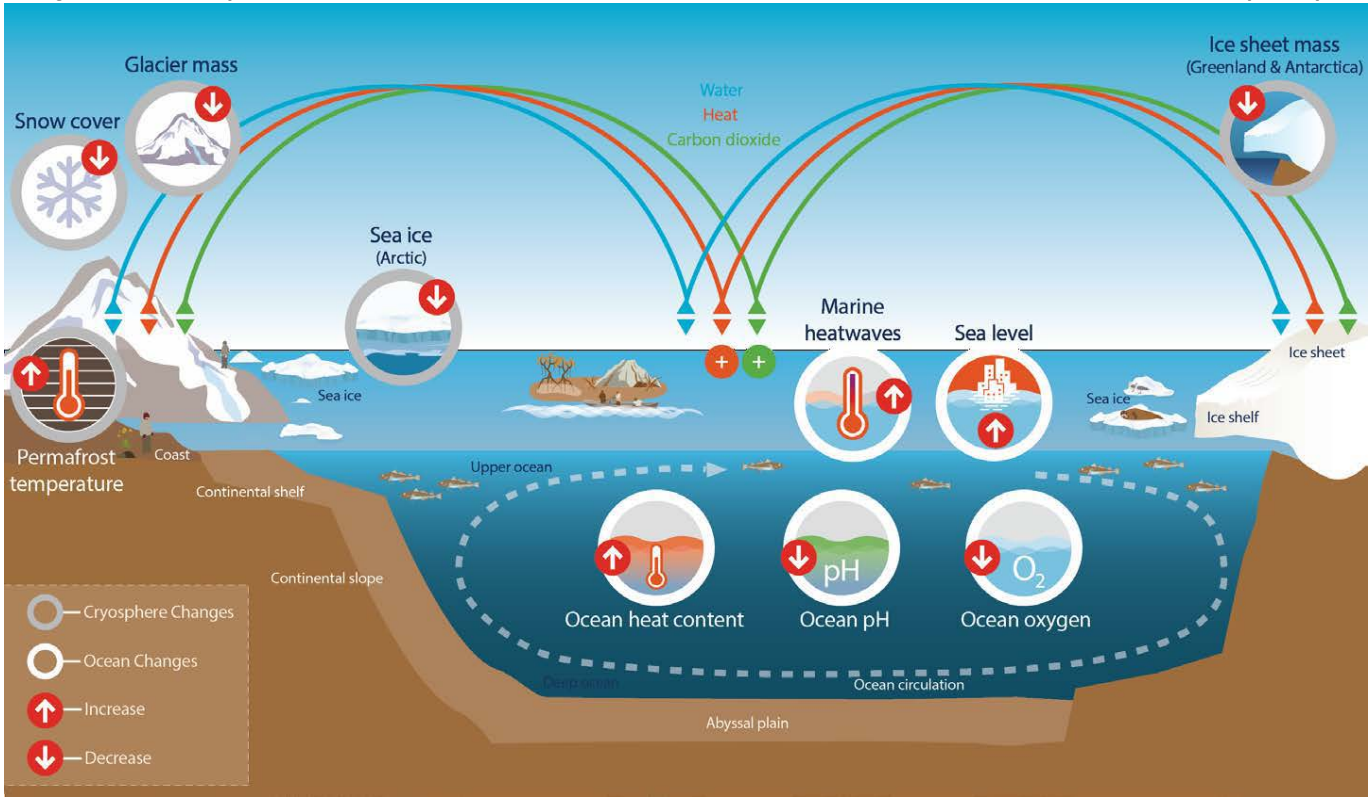
# Why this Special Report?

- All people depend directly or indirectly on the ocean and cryosphere (population, livelihoods, food security, well-being, cultural identity, hazards).
- Even people living far from the ocean or cryosphere depend on these systems (connection).
- Human activities are estimated to have so far caused approximately 1℃ of global warming (evidence) →Global response to the threats of climate change.
- Pervasive ocean and cryosphere changes are observed from high mountains, to the polar regions, to coasts and into the deep reaches of the ocean (evidence, impact, cost).
- Sustainable Development Goals (SDGs) are all connected to varying extents with the ocean and cryosphere (progress).
- The characteristics of ocean and cryosphere change present particular challenges to climate resilient development pathways (challenge over time and place).

*SROCC : Interconnected ways of ocean and cryosphere changes, new knowledges, integrated approaches.*

# Role of the Ocean and Cryosphere in the Earth System - Energy, Water, and Biogeochemical elements-

## Major Components and Characteristics of the Ocean and Cryosphere




Ocean: 71% of the Earth surface. 97% of the Earth's water, 99% of the Earth's biologically-habitable space, half of the primary production on Earth.

Coasts: ocean and land processes interact, and includes coastal cities, deltas, estuaries, and other coastal ecosystems such as mangrove forests. Low elevation coastal zones are densely populated and particularly exposed to hazards from the ocean

Cryosphere: Frozen components of the Earth system that are at or below the land and ocean surface. snow, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost and seasonally frozen ground.

# Timescales, Thresholds and Detection of Ocean and Cryosphere Change

Schematic of key concepts associated with changes in the ocean and cryosphere.

(a) Differing responses of systems to gradual forcing.

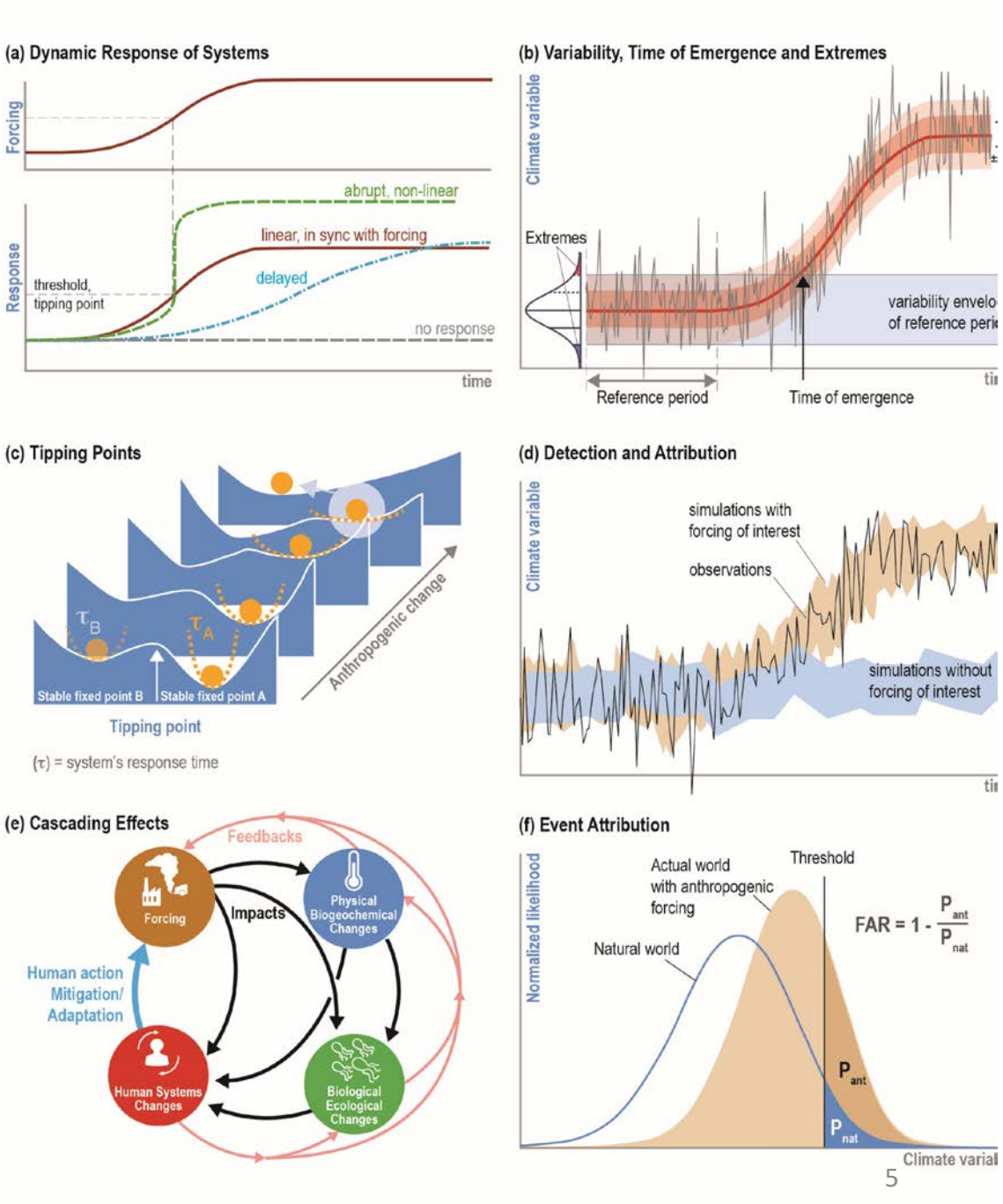
(b) Evolution of a dynamical system in time.

(c) Tipping points and the change of their behaviour through time in response to anthropogenic change.

(d) Detection and attribution.

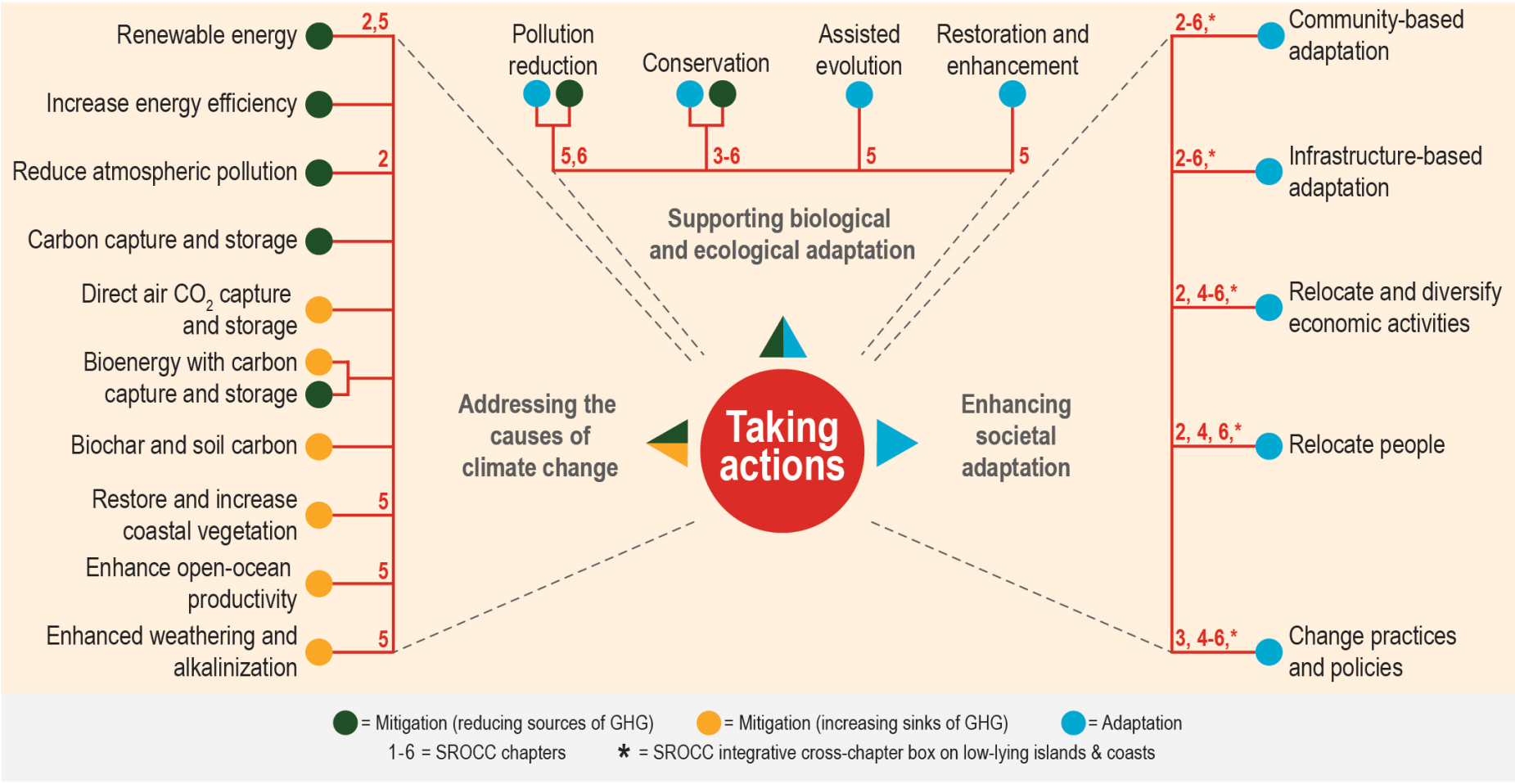
(e) Cascading effects.

(f) Event attribution and fraction of attributable risk.



# Mitigation and Adaptation Options in the Ocean and Cryosphere

Overview of the main ocean-cryosphere mitigation and adaptation measures to observed and expected changes.



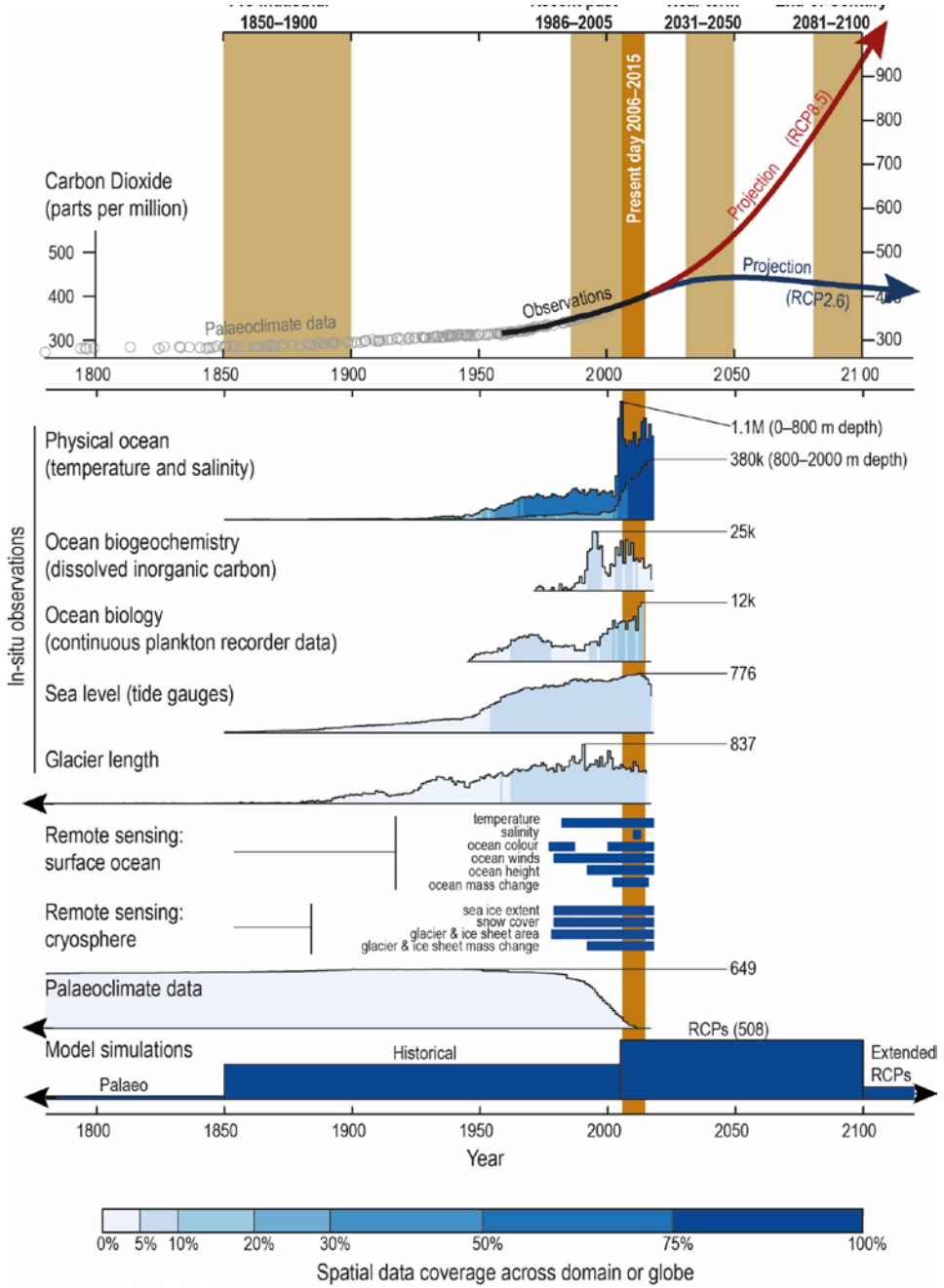
# Knowledge Systems for Understanding and Responding to Change

### *Scientific Knowledge*

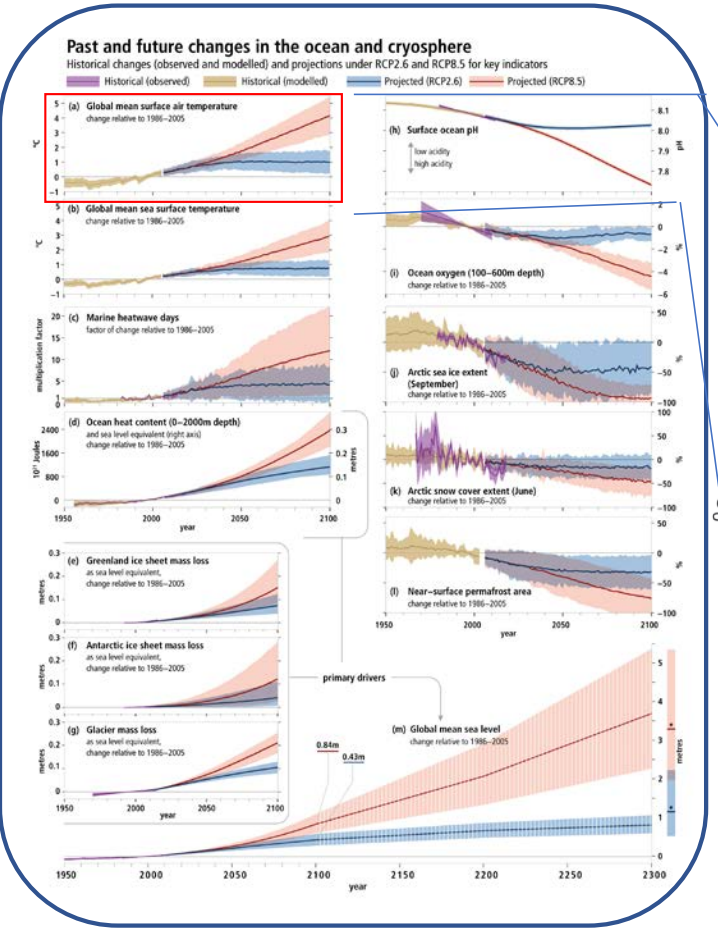
- Ocean and Cryosphere Observations
- Reanalysis Products
- Model Simulation Data
- Palaeoclimate Data

### *Indigenous knowledge (IK) and/or local knowledge (LK)*

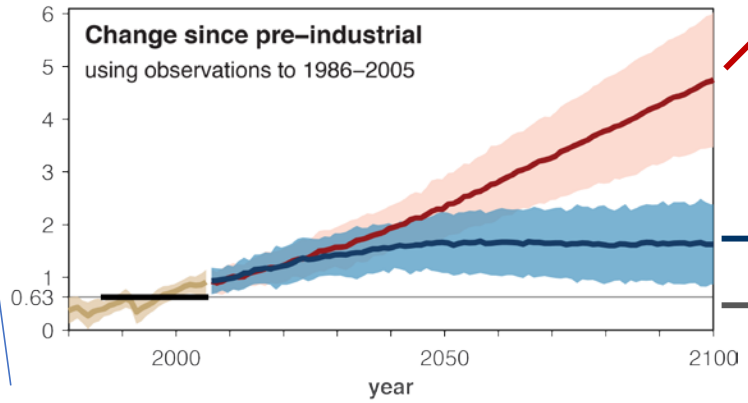
- Knowledge co-production using scientific knowledge, IK and/or LK to create new understandings for decision making.
- IK and LK are critical to observing, responding to, and governing the ocean and cryosphere in a changing climate.



# Integrated Storyline of this Special Report




# Contrasting future scenarios of change



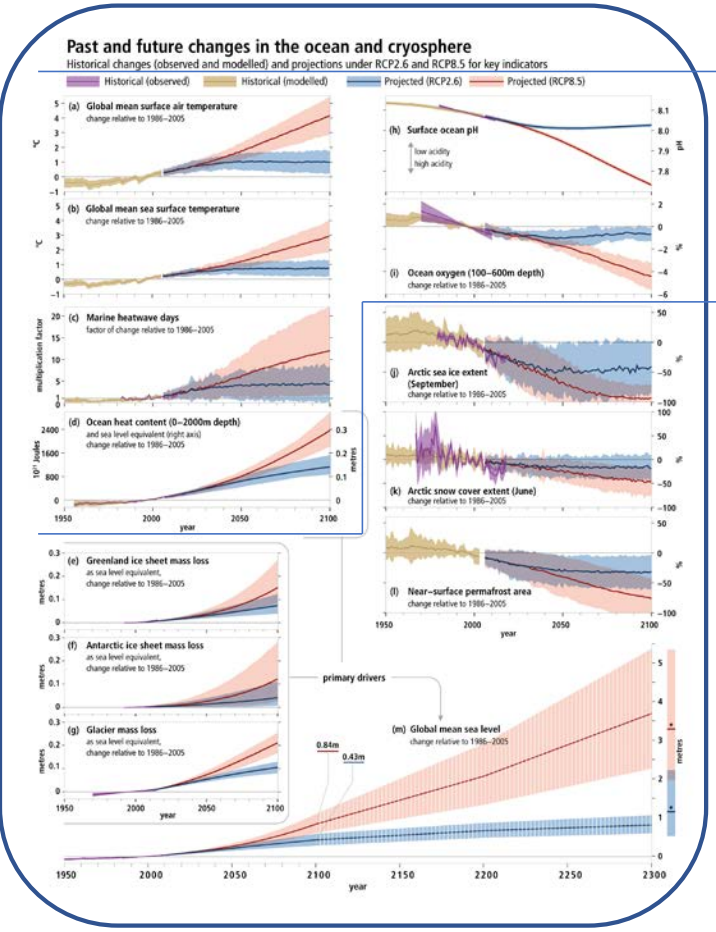

High greenhouse gas emission scenario in the absence of policies to combat climate change (RCP8.5). 2081-2100 temperature = +4.3ºC (±1.1ºC), $CO_2$ concentration = 850 ppm

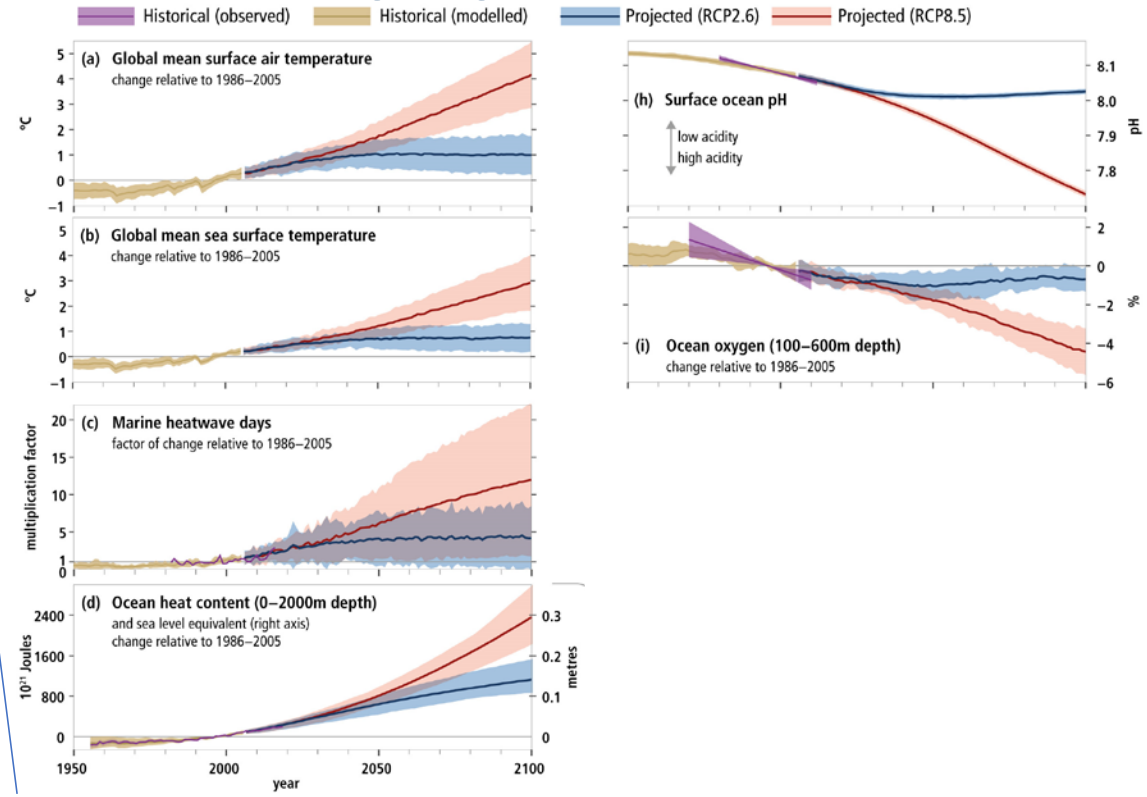
Low greenhouse gas emission scenario, with high mitigation (RCP2.6). 2081-2100 temperature = +1.6ºC (±0.7ºC), $CO_2$ concentration = 426 ppm

Observed temperature increase from 1850-1900 to 1986-2005 of 0.63ºC (±0.06ºC). SR1.5.

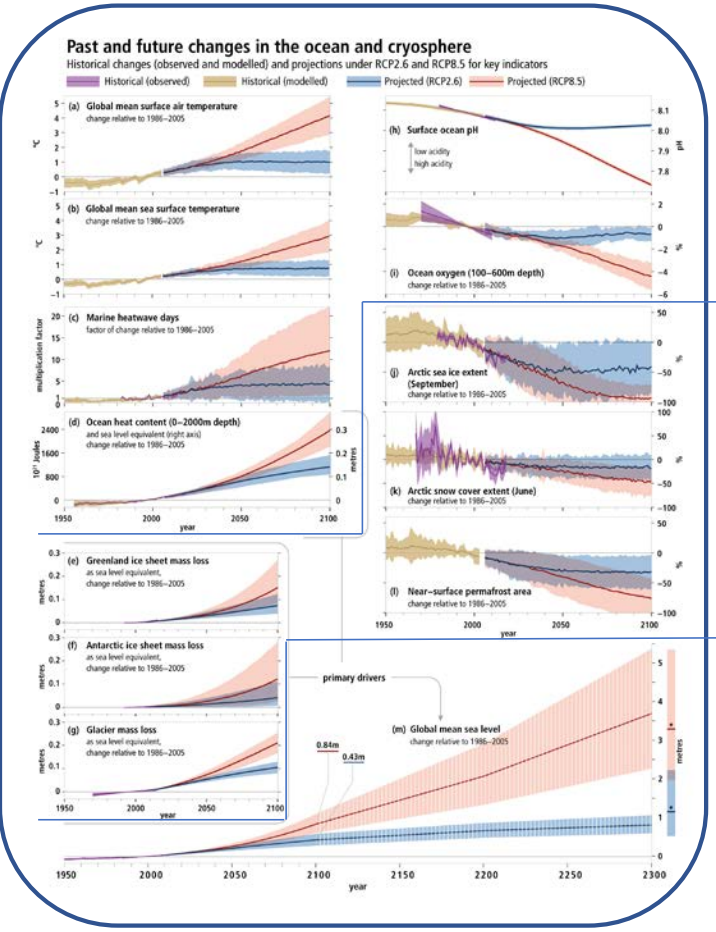
# Integrated Storyline of this Special Report

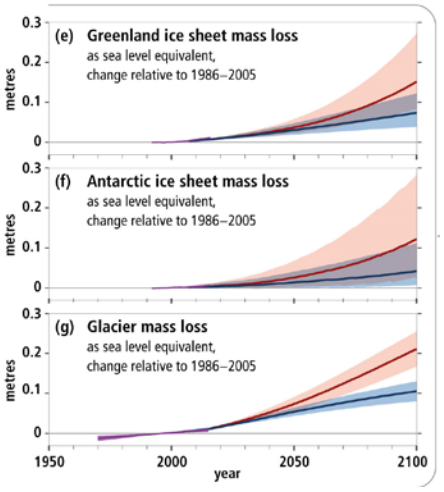
## Changing ocean

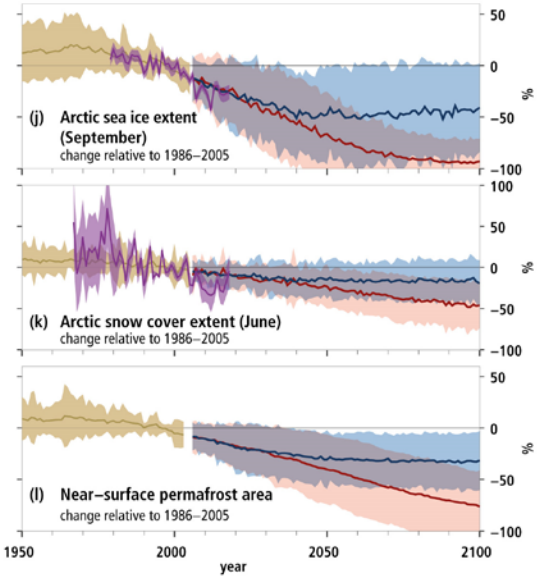


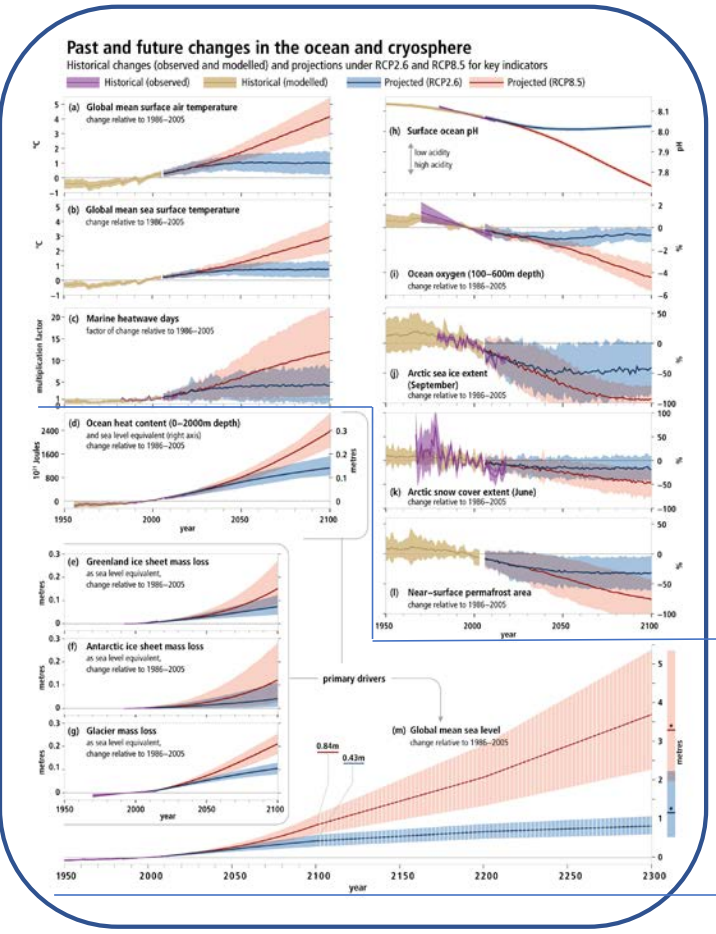



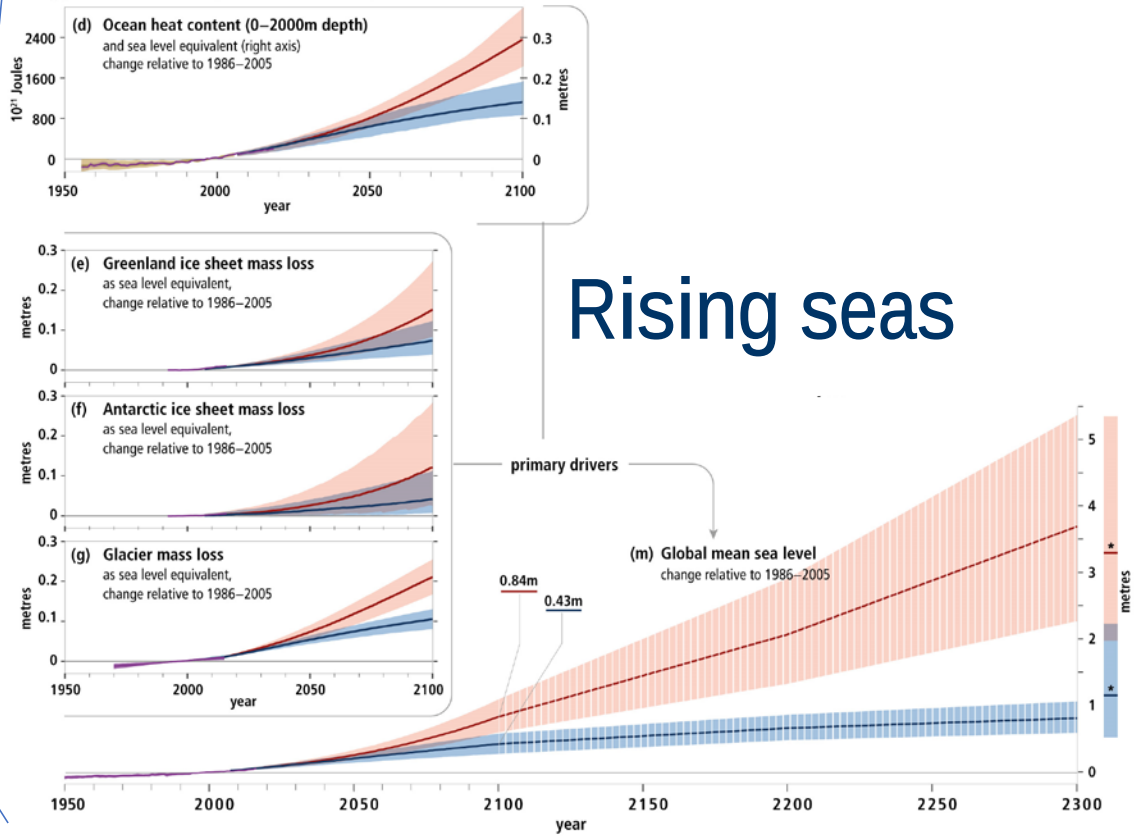
# Shrinking cryosphere




Past and future changes in the ocean and cryosphere
Historical changes (observed and modelled) and projections under RCP2.6 and RCP8.5 for key indicators
Historical (observed)
Historical (modelled)
Projected (RCP2.6)
Projected (RCP8.5)
(a) Global mean surface air temperature
change relative to 1986–2005
(b) Global mean sea surface temperature
change relative to 1986–2005
(c) Marine heatwave days
factor of change relative to 1986–2005
(h) Surface ocean pH
low acidity
high acidity
(i) Ocean oxygen (100–600m depth)
change relative to 1986–2005
(j) Arctic sea ice extent (September)
change relative to 1986–2005
(k) Arctic snow cover extent (June)
change relative to 1986–2005
(l) Near-surface permafrost area
change relative to 1986–2005
(d) Ocean heat content (0–2000m depth)
and sea level equivalent (right axis)
change relative to 1986–2005
(e) Greenland ice sheet mass loss
as sea level equivalent,
change relative to 1986–2005
(f) Antarctic ice sheet mass loss
as sea level equivalent,
change relative to 1986–2005
(g) Glacier mass loss
as sea level equivalent,
change relative to 1986–2005
primary drivers
0.84m
0.43m
(m) Global mean sea level
change relative to 1986–2005
year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change relative to 1986–2005
primary drivers
0.84m
0.43m
(m) Global mean sea level
change relative to 1986–2005
year

# Rising seas

# From the Executive Summary of Chap.1

- *All people on Earth depend directly or indirectly on the ocean and cryosphere.*
- *Sustainable development is at risk from emerging and intensifying ocean and cryosphere changes.*
- *Communities living in close connection with polar, mountain, and coastal environments are particularly exposed to the current and future hazards of ocean and cryosphere change.*
- *Ocean and cryosphere changes are pervasive and observed from high mountains, to the polar regions, to coasts, and into the deep ocean.*
- *Evidence and understanding of the human causes of climate warming, and of associated ocean and cryosphere changes, has increased over the past 30 years of IPCC assessments (Antarctic Ice Sheet).*
- *Ocean and cryosphere changes and risks by the end-of-century (2081-2100) will be larger under high greenhouse gas emission scenarios, compared with low emission scenarios.*

# Thank you for your kind attention

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