#SROCC

The Ocean and Cryosphere in a Changing Climate

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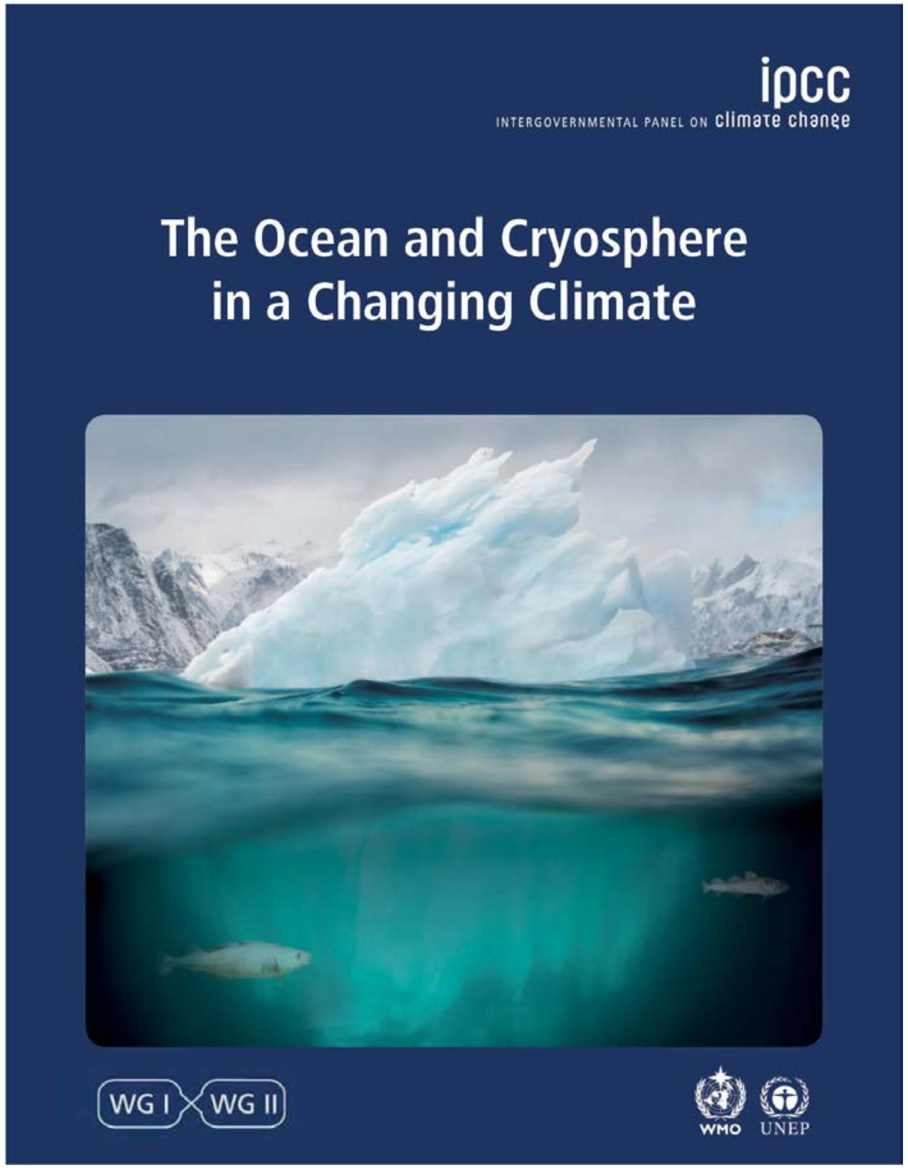

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SROCC Report by the numbers

104 authors

31% of authors are women

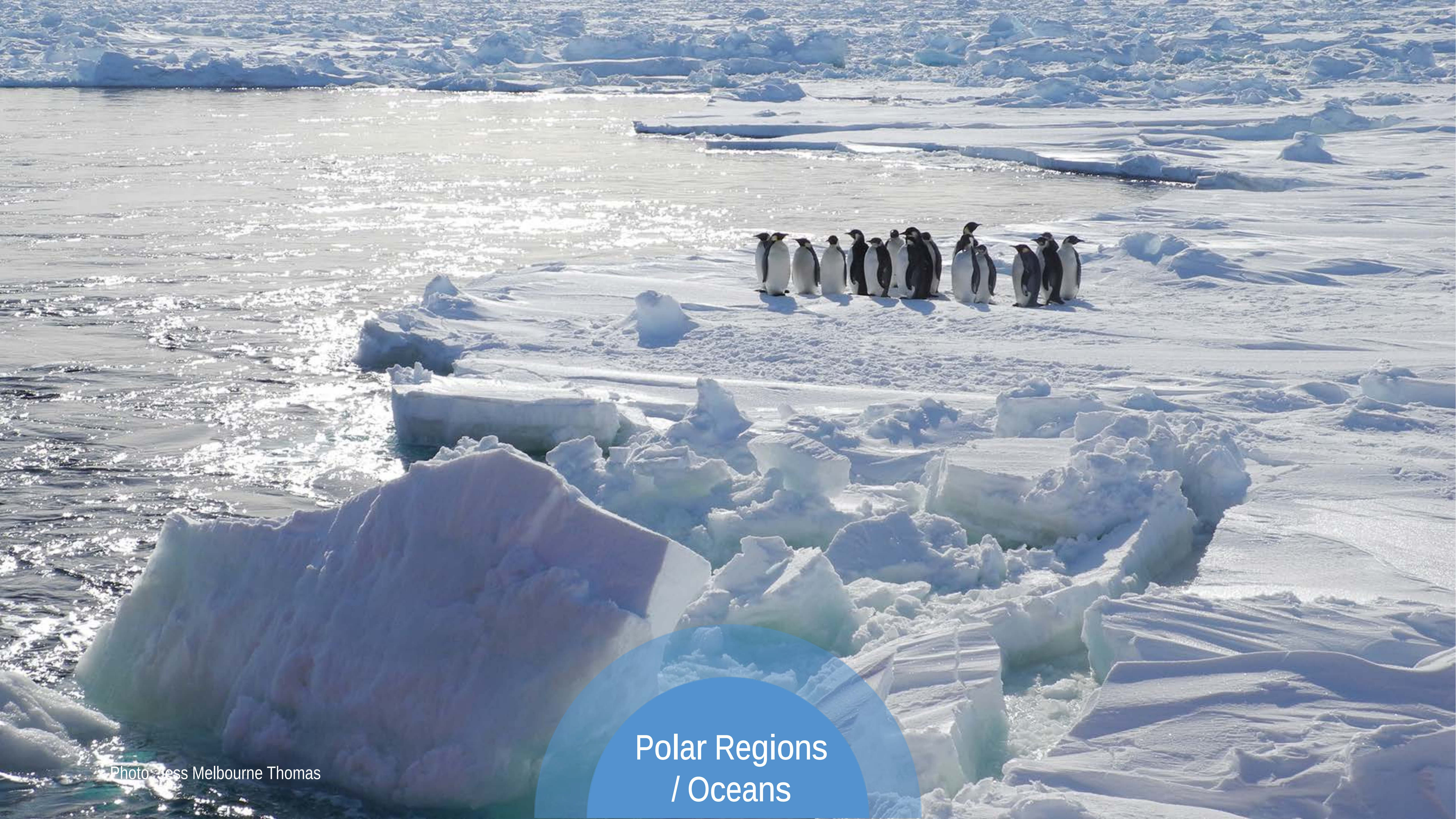
36 countries

6981 Studies

31,176 Comments

The world's ocean and cryosphere have been 'taking the heat' from climate change for decades.

Consequences for nature and humanity are sweeping and severe.



Polar Regions / Oceans

Photo: Jess Melbourne Thomas

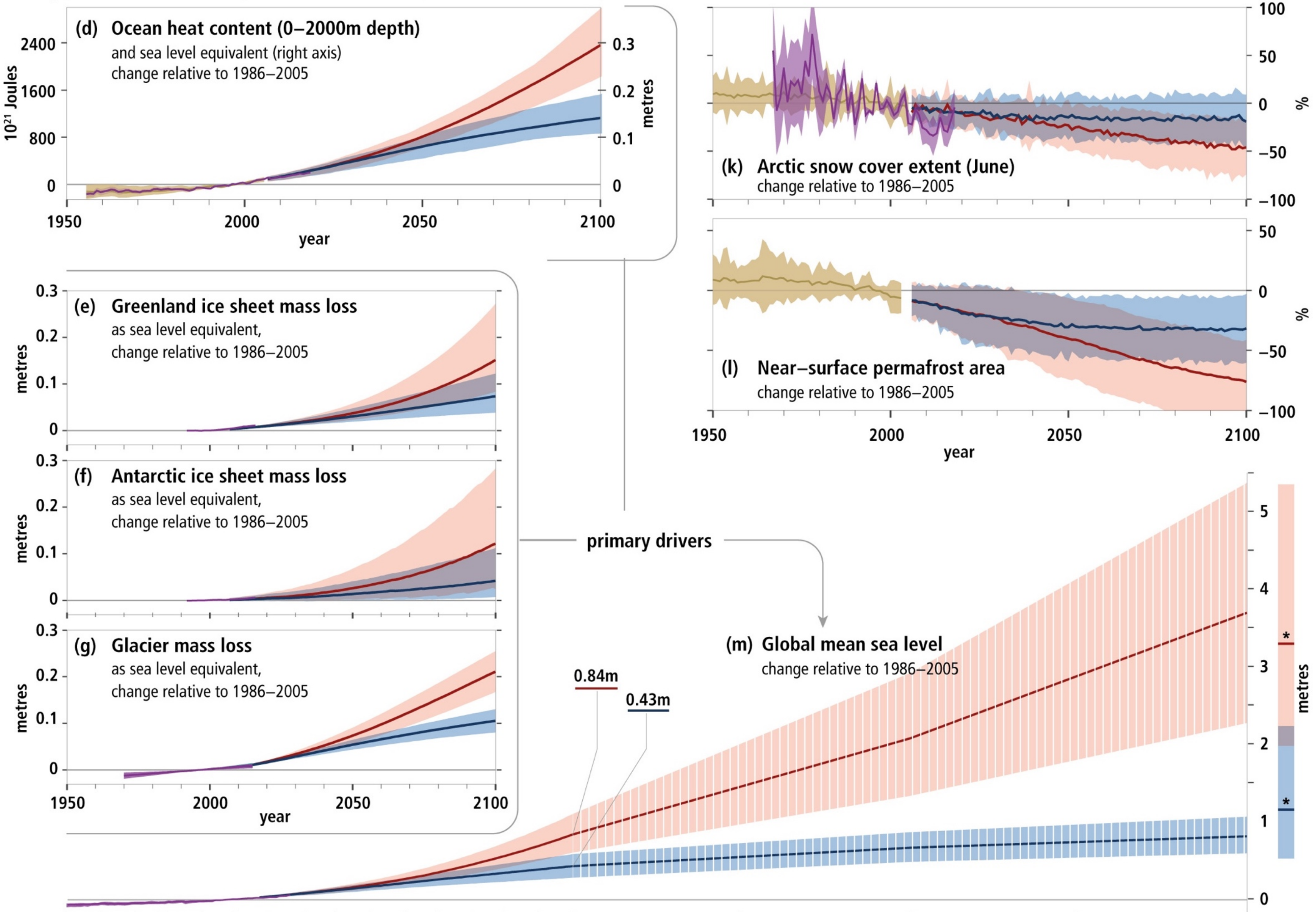
Changes in polar regions

- The Greenland and Antarctic ice sheets are losing mass, accelerating global sea level rise. They will continue to melt, committing the planet to **long-term** global sea level rise.
- **Arctic sea ice is declining in every month of the year**, and is getting thinner.
- At global warming of 1.5°C, the Arctic Ocean will **rarely be free of sea ice** in September. At 2°C warming, this will occur **up to one year in three**.


Sea Level Rise
Photo: Glenn R. Specht

Sea level rise and coastal extremes

- 680 Mio people live at low lying coasts, 65 Mio in Small Island States.
- During the 20th century, the global mean sea level rose by about **15cm**.
- Sea level is currently rising **more than twice as fast** and will further **accelerate** reaching up to 1.10m in 2100 and several metres in 2300 if emissions are not sharply reduced.
- Extreme sea level events which now occur rarely during high tides and intense storms will become more common.
- Many low-lying coastal cities and small islands will be exposed to risks of flooding and land loss annually by 2050, especially without strong adaptation.



Sea level: according to present knowledge... we have the choice between below 1 metre or several metres

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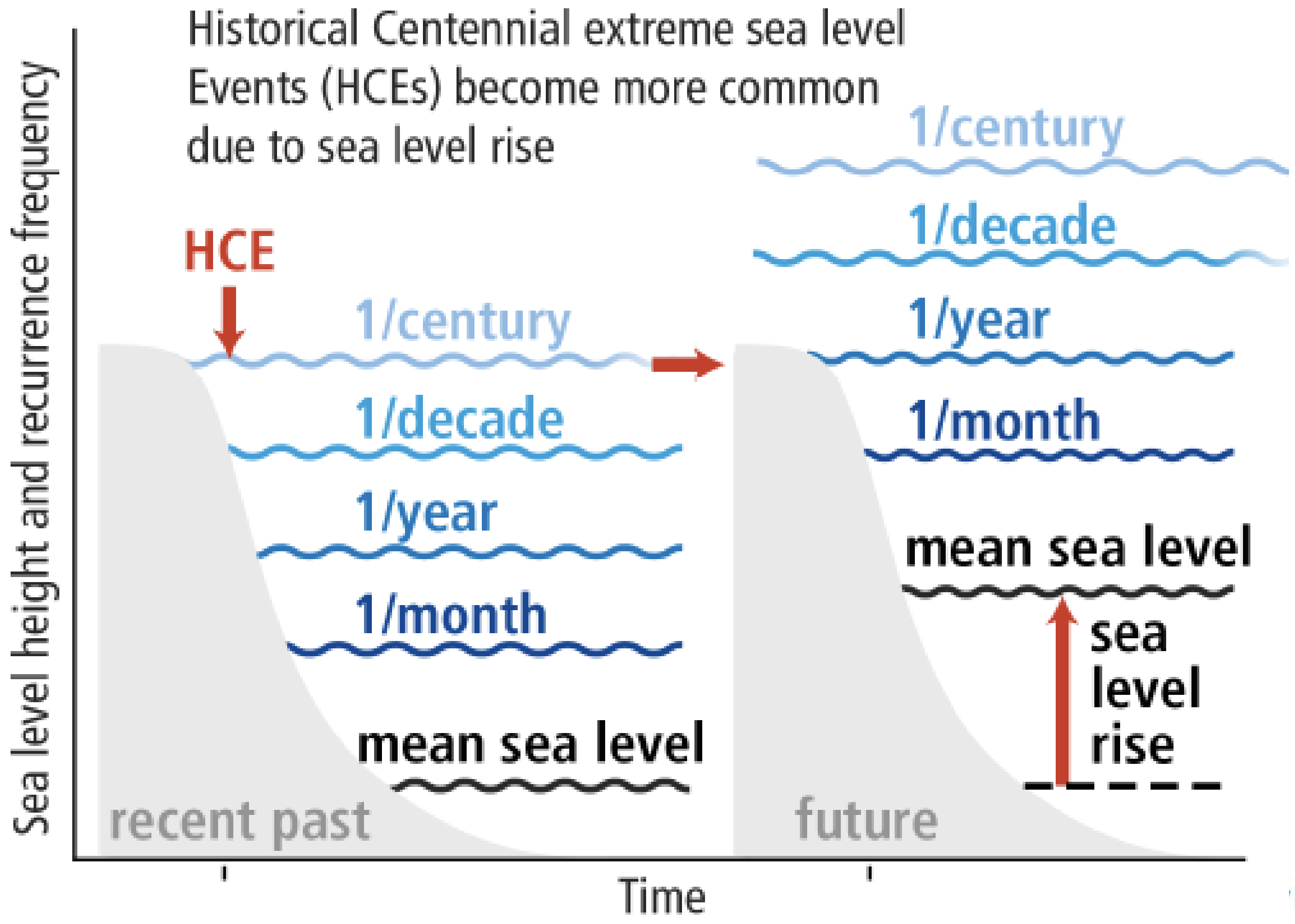
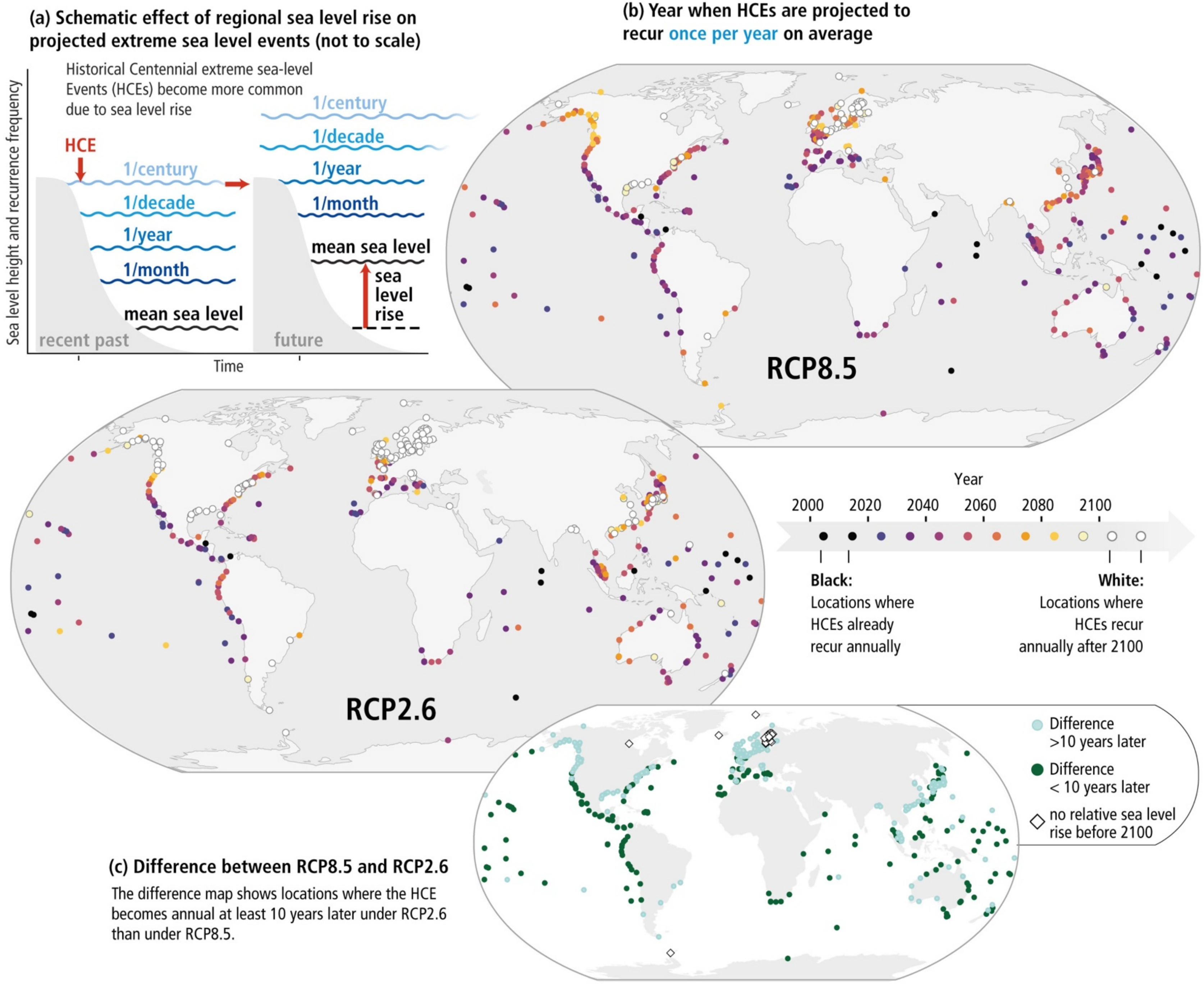
Extreme events on top of sea level rise

(a) Schematic effect of regional sea level rise on projected extreme sea level events (not to scale)



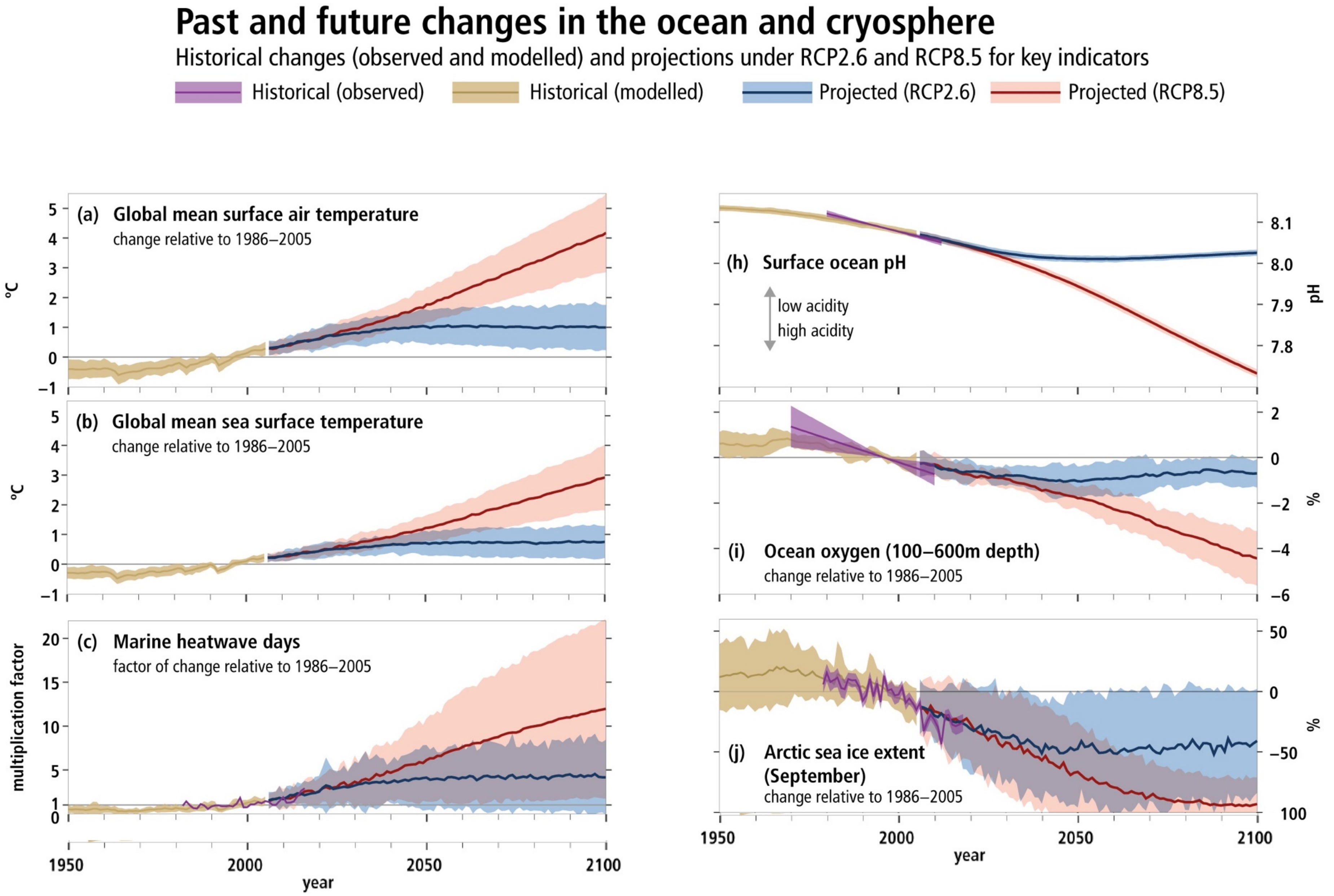
can continue to increase with rising frequency of HCEs.




Ocean and
Marine Life

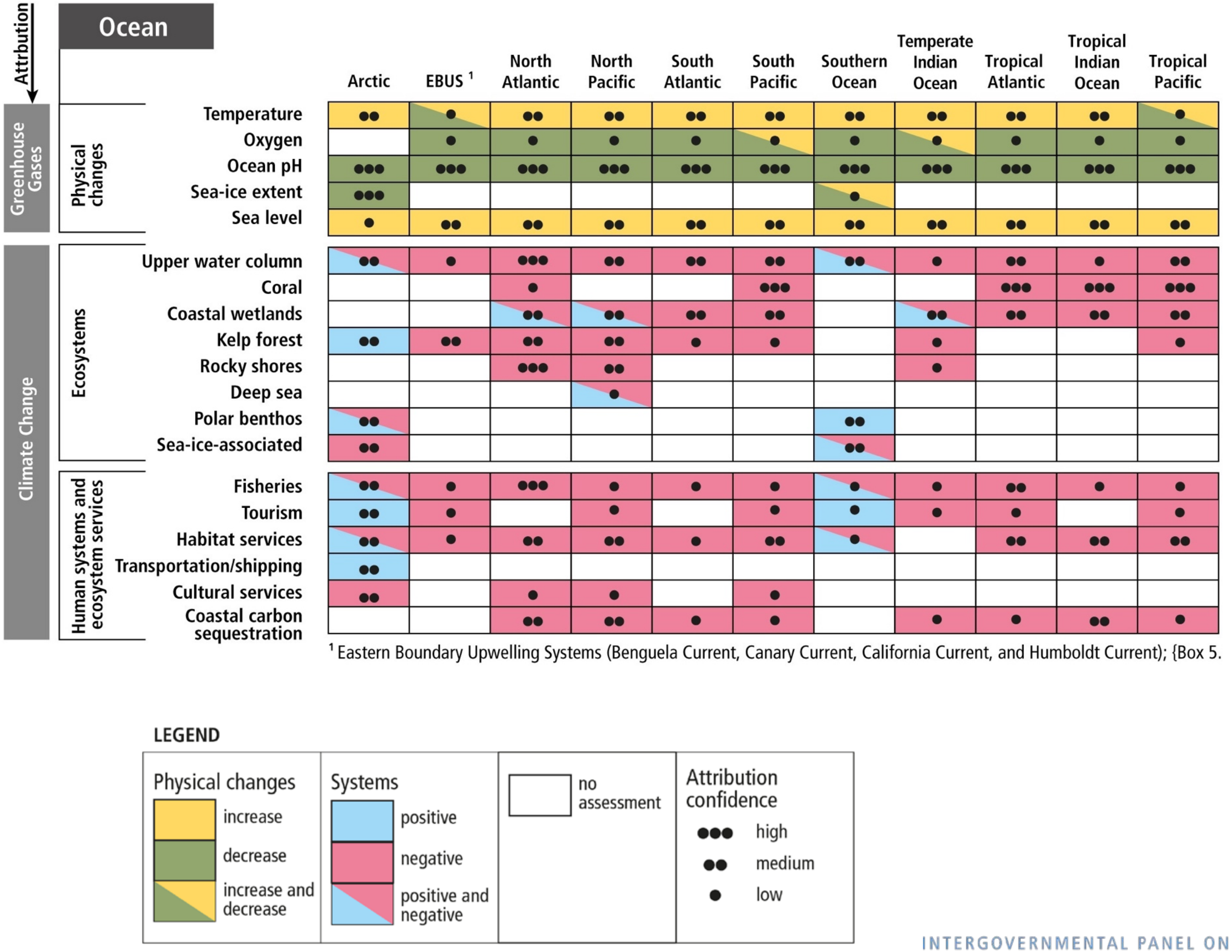
Changes in the ocean

- To date, the ocean has taken up **more than 90%** of the excess heat in the climate system. By 2100, the ocean will take up **2 to 4 times** more heat if global warming is limited to 2°C and **up to 5 to 7 times** at higher emissions.
- Ocean warming reduces mixing between water layers and therefore the supply of **oxygen and nutrients for marine life.**
- **Marine heatwaves** are becoming more frequent and severe, especially harming warm-water corals, kelp forests and the distribution of marine life.
- By absorbing human-induced carbon emissions, the ocean is becoming **acidified.** It has taken up 20 to 30% of these emissions and continued uptake will exacerbate this.



Ocean physics and chemistry are changing …. affecting marine life

Observed regional impacts from changes in the ocean and the cryosphere



Virtually all ocean regions are impacted by climate change

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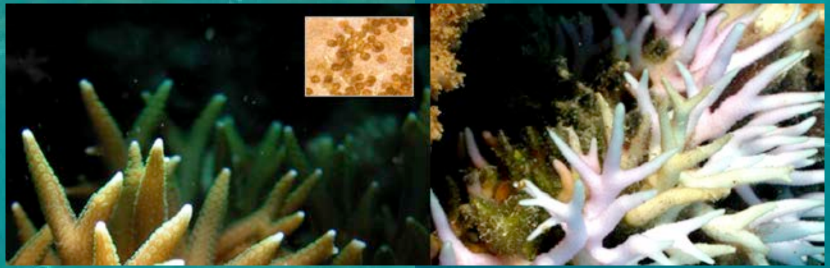
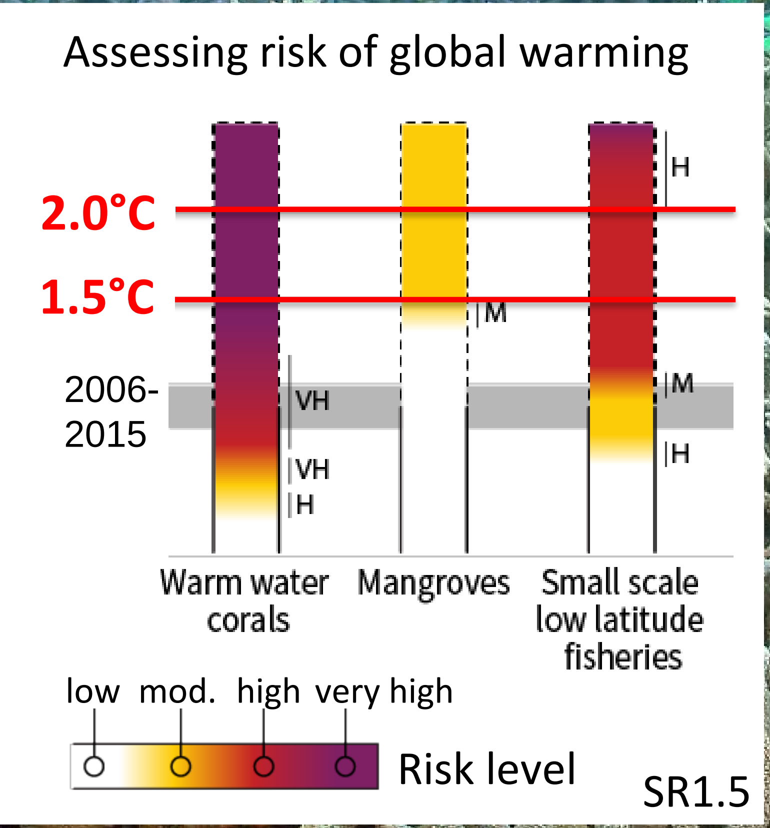
OBSERVATIONS **0.8 to 1.0°C**



Vulnerable Ecsystems identified in AR5, SR1.5, SROCC

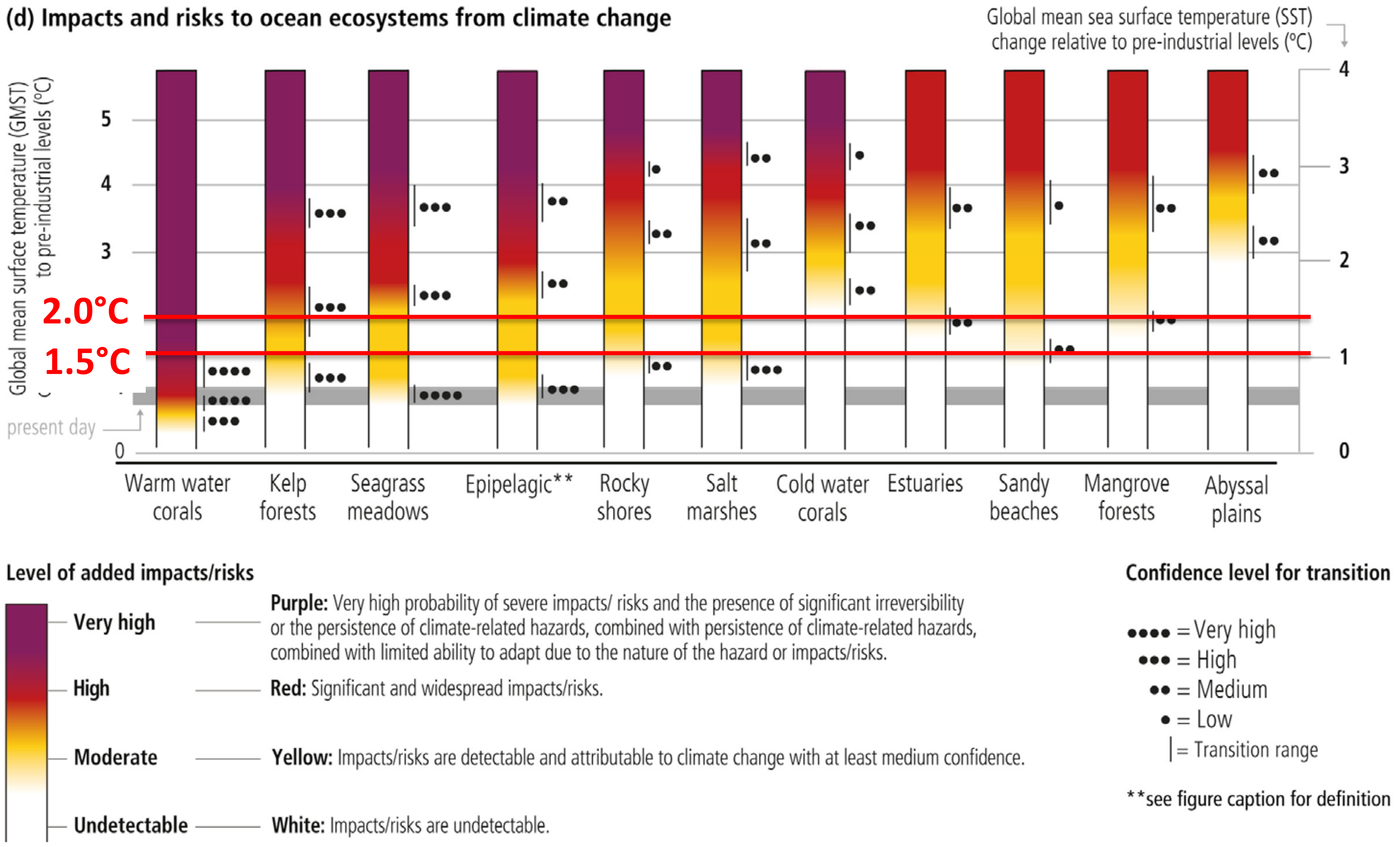
Warm water Coral Reefs



Even in a 1.5°C warmer world.... high risk of losing 70 to 90% of Coral Reefs and associated services for humankind; … even more at 2°C

Verons 2009

Ocean and coastal ecosystems: future risks



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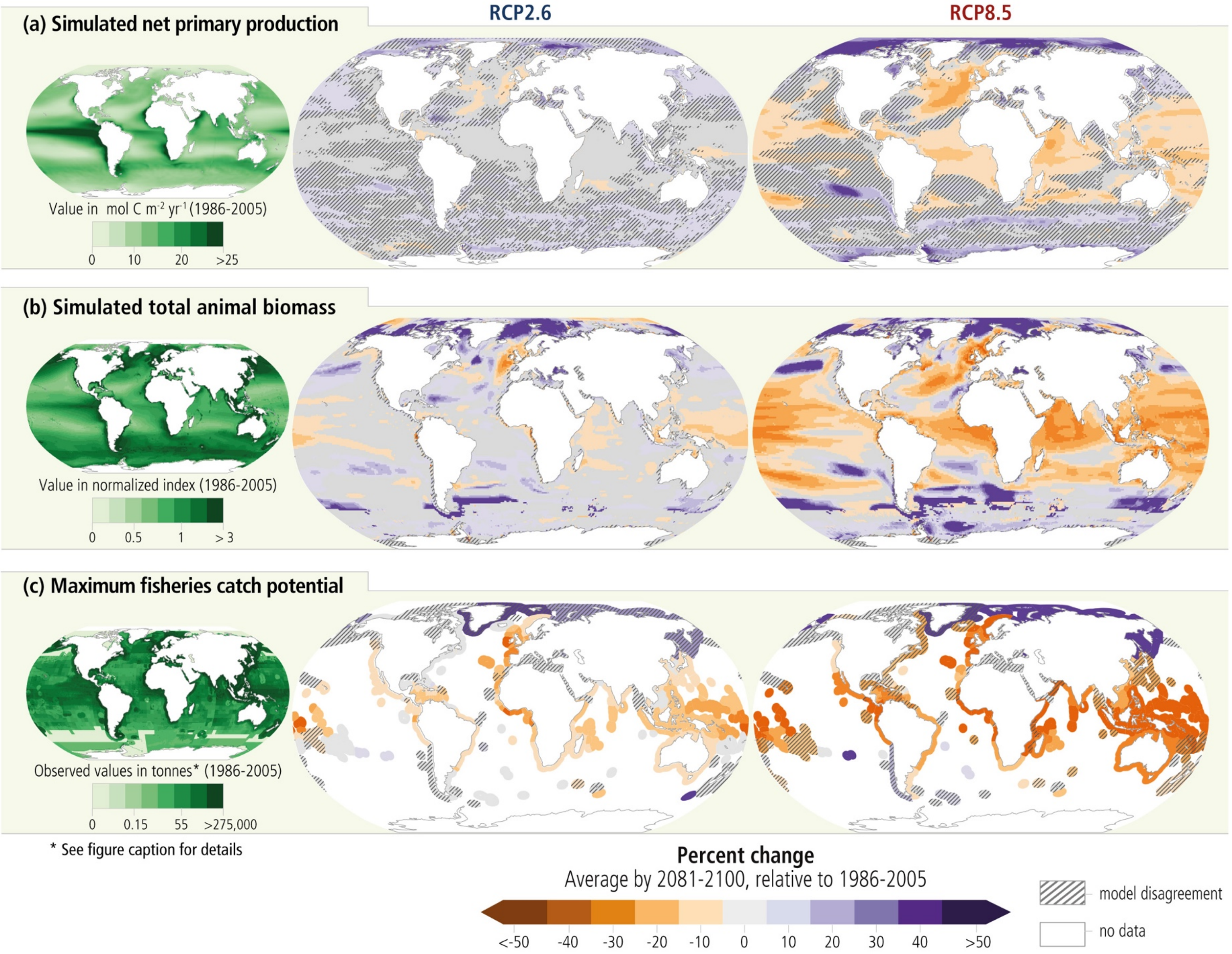
Ocean and coastal ecosystems: projections



Shifting primary production

Shifting and declining animal biomass production

Redistribution and loss of fisheries catch potential

Changes in marine life

- Changes in the ocean cause **shifts in fish populations**. This has reduced the global catch potential. In the future some regions will see further decreases but there will be increases in others.
- Communities that depend highly on seafood may face **risks to nutritional health and food security**.
- Reducing other pressures such as **pollution** will further help marine life deal with changes in their environment.
- Policy frameworks for **fisheries management** and **marine protected areas** offer opportunities for people to adapt.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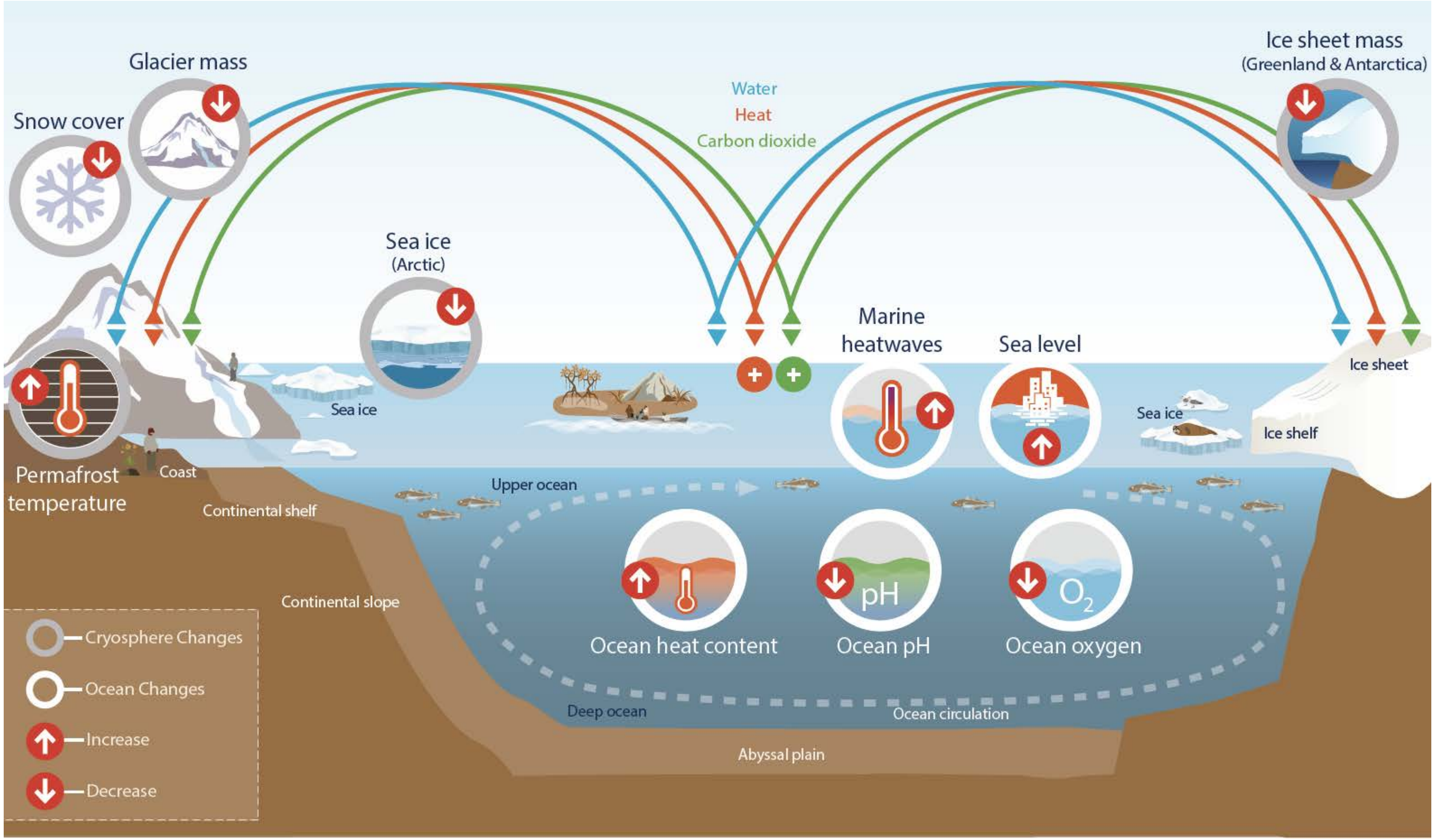
a summary

…on 80 % of the earth surface climate change affects the life sustaining systems - from the top of the mountains to the depth of oceans. These changes will continue for generations to come.



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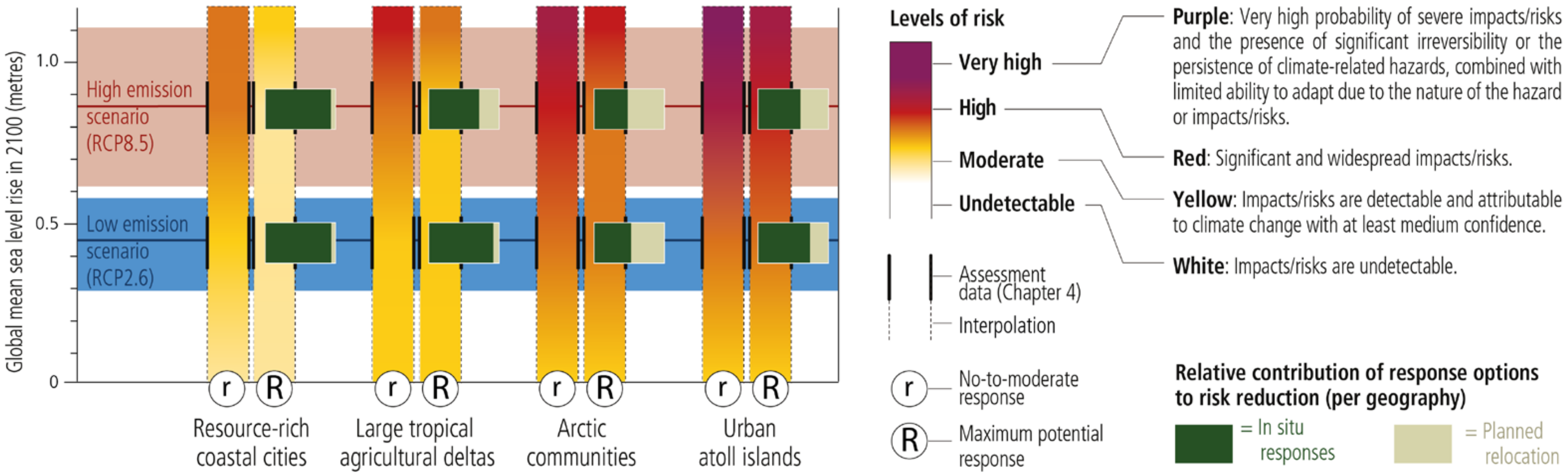
Sea level rise risk and responses

The term response is used here instead of adaptation because some responses, such as retreat, may or may not be considered to be adaptation.

(a) Risk in 2100 under different sea level rise and response scenarios

Risk for illustrative geographies based on mean sea level changes *(medium confidence)*



In this assessment, the term response refers to in situ responses to sea level rise (hard engineered coastal defenses, restoration of degraded ecosystems, subsidence limitation) and planned relocation. Planned relocation in this assessment refers to proactive managed retreat or resettlement only at a local scale, and according to the specificities of a particular context (e.g., in urban atoll islands: within the island, in a neighbouring island or in artificially raised islands). Forced displacement and international migration are not considered in this assessment.

The illustrative geographies are based on a limited number of case studies well covered by the peer reviewed literature. The realisation of risk will depend on context specifities.

Sea level rise scenarios: RCP4.5 and RCP6.0 are not considered in this risk assessment because the literature underpinning this assessment is only available for RCP2.6 and RCP8.5.

Sea level rise risk and responses

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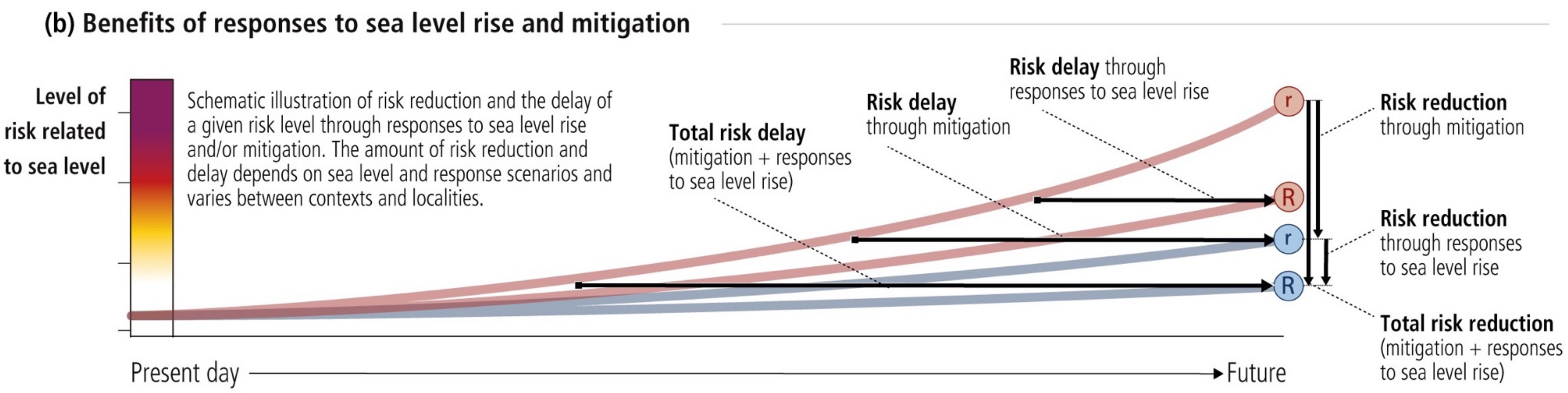

Exemplified by sea level rise, risk may continue to increase at different rates, depending on the capacity of responses, i.e. local adaptation and/or retreat, as well as depending on mitigation efforts;

…Further risk development may limit the time gained through adaptation….

Societal challenges

People with the **highest exposure and vulnerability** are often those with **lowest capacity to respond** (*high confidence*) (C1).

The temporal scales of climate change impacts and their societal consequences operate on **time horizons which are longer than those of governance arrangements** (e.g., planning cycles, public and corporate decision making cycles, and financial instruments) (C1.1).

Governance arrangements (e.g., marine protected areas, spatial plans and water management systems) are **too fragmented across administrative boundaries and sectors** to provide integrated responses to the increasing and cascading risks from climate-related changes (*high confidence*) (C1.2).

The capacity of governance systems in polar and ocean regions to respond to climate change impacts has strengthened recently, but this development is **not sufficiently rapid or robust** to adequately **address the scale of increasing projected risks** (*high confidence*) (C1.2).

Finding solutions

Networks of protected areas help maintain ecosystem services, including **carbon uptake and storage**, and enable future ecosystem-based adaptation options by facilitating the poleward movements of species, populations, and ecosystems (*medium confidence*) (C2.1).

… marine habitat restoration, and ecosystem management tools such as **assisted species relocation and coral gardening**, **can be locally effective** in enhancing ecosystem-based adaptation (high confidence). …coral reef restoration options may be **ineffective if global warming exceeds 1.5°C**, because corals are already at high risk (*very high confidence*). (C2.2)

Strengthening **precautionary approaches**, such as **rebuilding overexploited or depleted fisheries**, and responsiveness of existing fisheries management strategies reduces negative climate change impacts on fisheries, with benefits for regional economies and livelihoods (*medium confidence*) (C2.3).

Knowledge for action

The IPCC Special Report on the Ocean and Cryosphere in a Changing Climate

- highlights **the urgency** of prioritizing **timely, ambitious and coordinated action** to address **widespread and enduring changes** in the ocean and cryosphere;
- empowers people, communities and governments to tackle the **unprecedented transitions in all aspects of society;**
- provides **evidence of the benefits of combining scientific with local and indigenous knowledge;**
- focuses, for the first time, on the **importance of education and climate literacy**.

The more decisively and earlier we act, the more able we will be to address unavoidable changes, manage risks, improve our lives and achieve sustainability for ecosystems and people around the world – today and in the future.

More Information:

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