#SROCC

The Ocean and Cryosphere in a Changing Climate: Polar Regions and High Mountains

Michael Meredith, British Antarctic Survey
Coordinating Lead Author, Polar Regions

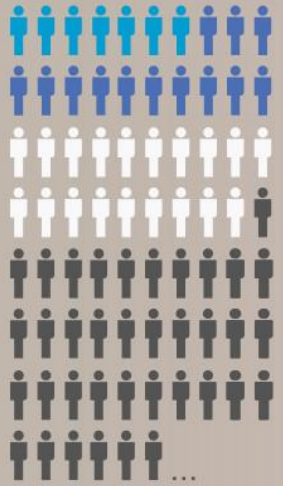
(Plus all authors from Chapters 2 and 3)

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

Why an SROCC?

OF THE WORLD'S 7.6 BILLION PEOPLE ...



Live in low-lying coastal zones

Live on coasts

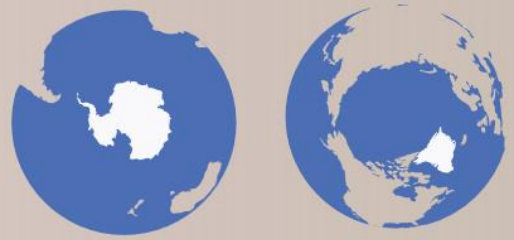
Rely on the the water that flows from the Hindu Kush Himalayan glaciers for drinking, agriculture, energy, or other purposes.

= 100 million

680 MILLION PEOPLE LIVE IN LOW-LYING COASTAL AREAS

66% OF HINDU KUSH HIMALAYAN GLACIERS MAY BE LOST BY 2100

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.



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

(John Lang, ECIU)

Why should the UK care…?

Sea level rise (29–115 cm in London by 2100, depending on choices).

Greatest contribution from ice sheets and glaciers; greatest uncertainty from Antarctica.

Polar region impacts on climate / weather

Influences predictability and planning.

Fisheries

Poleward migration of traditional stocks etc

Overseas territories, some adjacent to (or in) the polar regions

Governance, adaptation to climate change, fisheries policy, Marine Protected Areas etc

Photo: Yungdrung Tsewang

Changes in the mountain cryosphere

- **Smaller glaciers** (e.g. in Europe, eastern Africa, the tropical Andes) are projected to lose **more than 80%** of their current ice mass by 2100 if emissions continue to increase strongly.
- As glaciers melt and snow cover shrinks, **warm-adapted** plant and animal species **migrate upslope**. Cold- and snow-adapted species **decrease and risk extinction**, especially without conservation.
- The retreat of the cryosphere will continue to adversely affect recreational activites, tourism and cultural assets.

Changes in the mountain cryosphere

- Hazards for people, for example through **landslides, snow avalanches or floods** will increase as glaciers and permafrost decline.
- **Changing water availability and quality** affects households, agriculture, energy systems, and people both in the region and beyond.
- Limiting warming to 1.5°C would help people to adjust to changes in **water supplies** and **limit risks related to mountain hazards**.
- **Integrated water management and transboundary cooperation** provide opportunities to reduce the impacts of climate-related cryosphere changes on water resources.

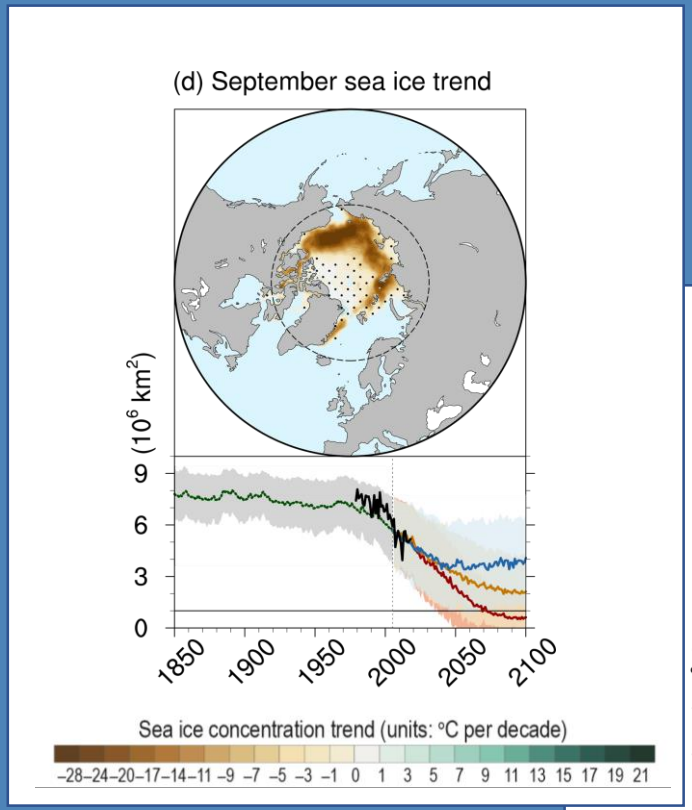
Polar Regions

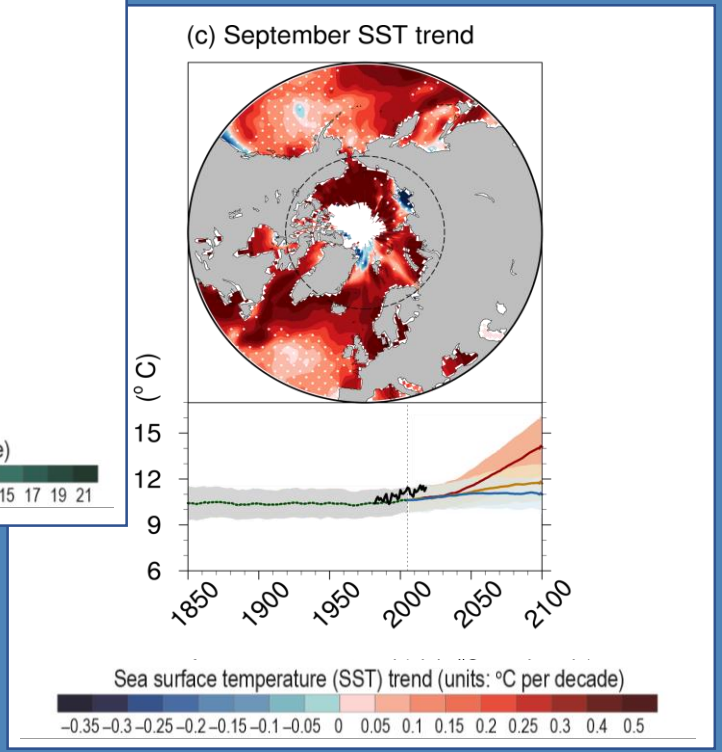
Photo: Mike Meredith

Polar changes

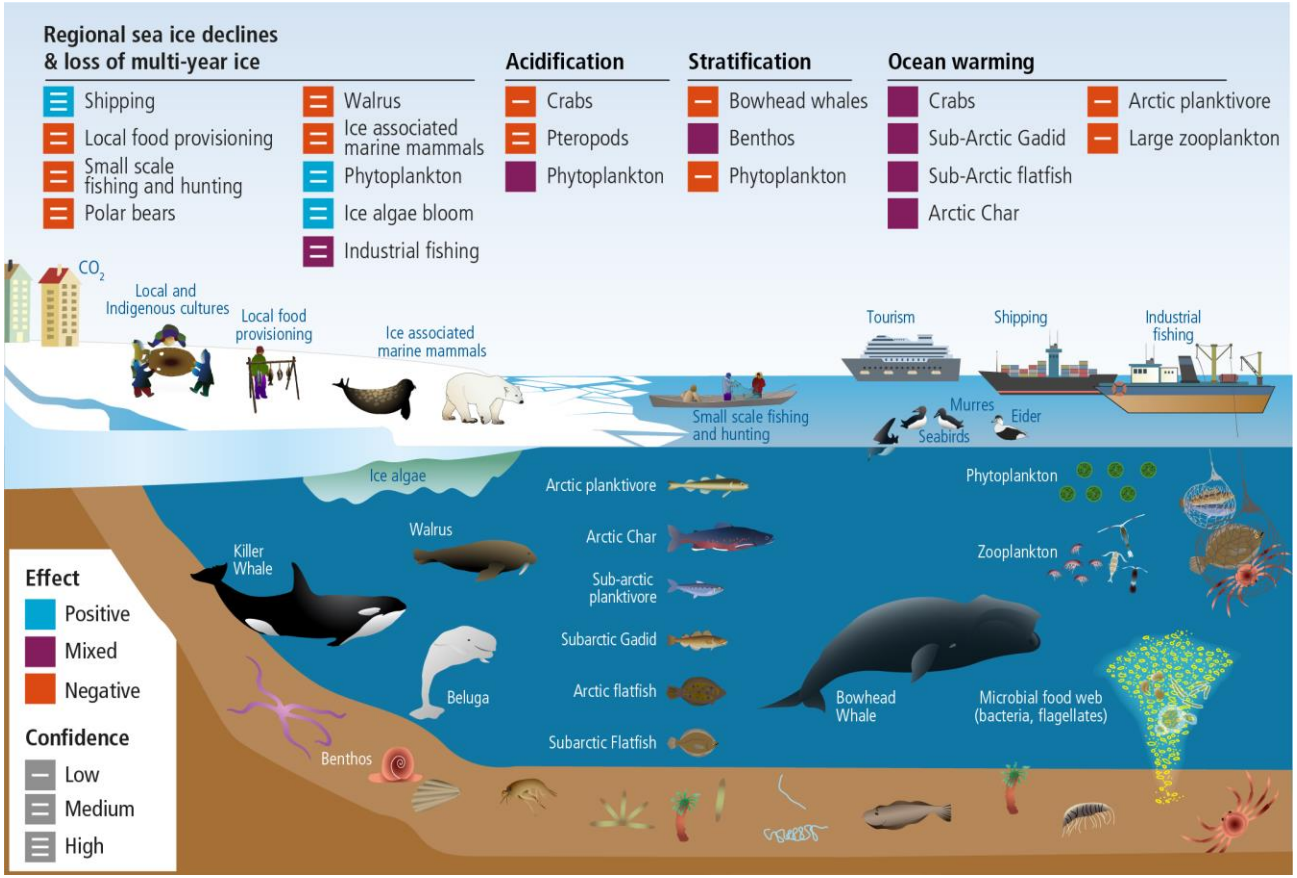
- Ice mass loss from Greenland **doubled** over 2007– 2016 relative to 1997–2006. For the same period, ice mass loss from Antarctica **tripled**.
- This is accelerating global sea level rise. Ice sheets will continue to melt, committing the planet to **long-term** global sea level rise.
- **Arctic sea 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**.

Arctic sea ice loss

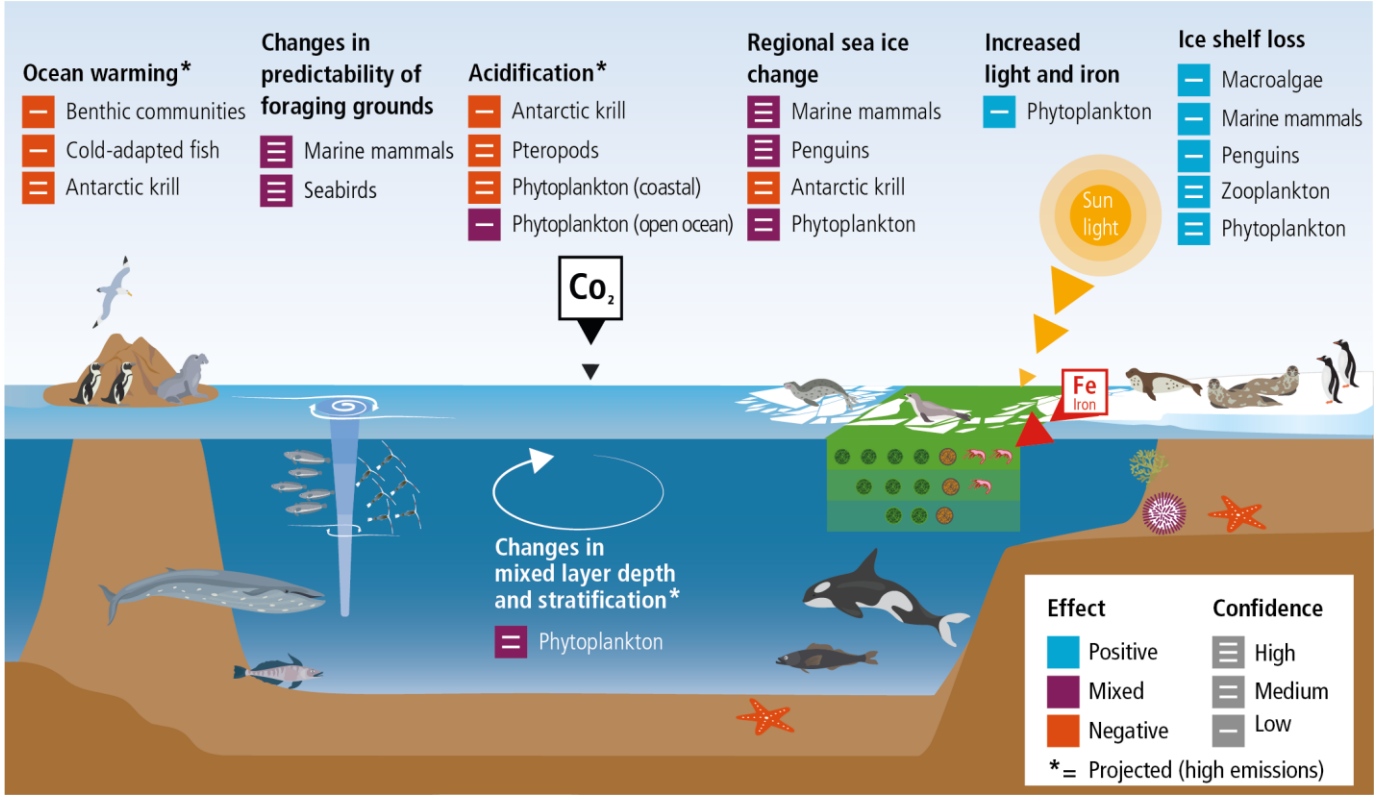




- Arctic sea ice has thinned and contracted; contemporaneous increase in ocean temperature.
- September sea ice reductions are 12.8 ± 2.3% per decade.
- This is likely unprecedented for at least 1000 years.
- Significant impact on albedo and climate; potential impacts on mid-latitude weather.

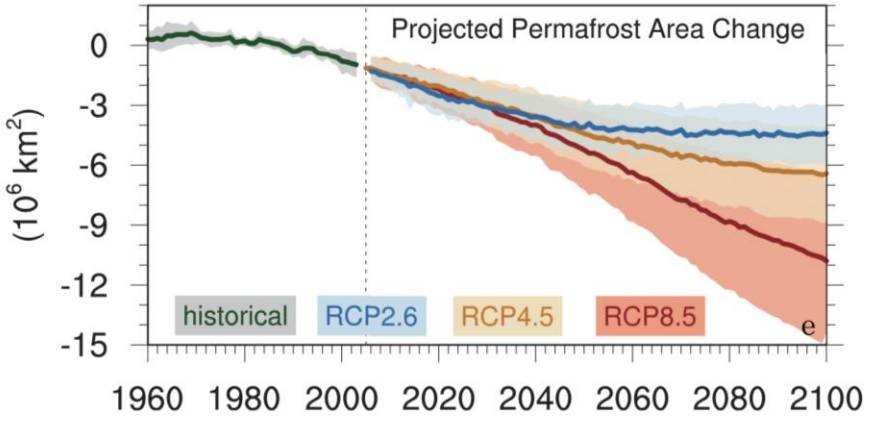


- Climate change impacts on **Arctic** ecosystems - not uniform, but more negative than positive.
- Traditional fishing / hunting places inaccessible.
- Income, livelihoods, and food security of marine-dependent communities threatened
- Resource conflicts at different scales (between communities, fishing fleets, regions, countries)



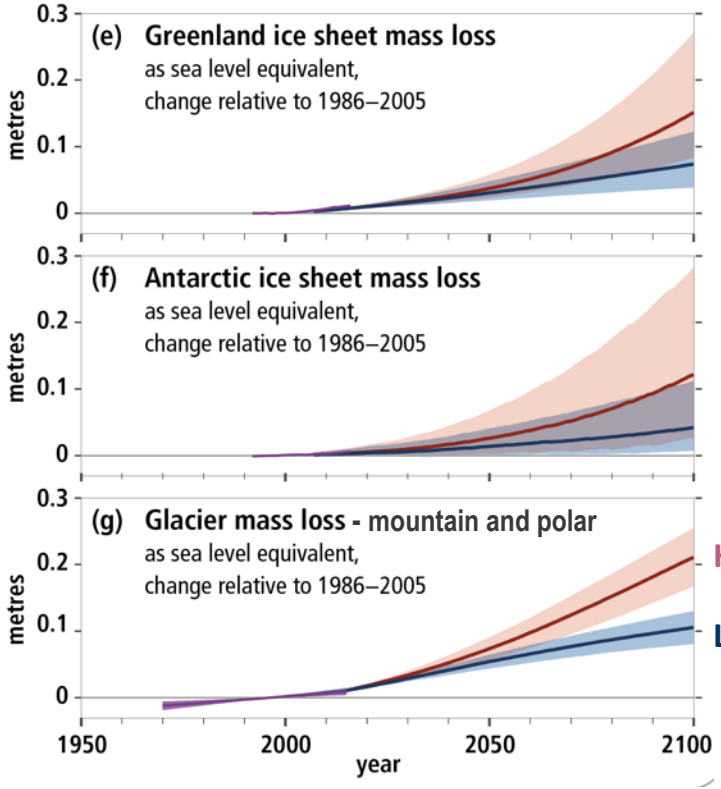
- Climate change impacts on **Antarctic** ecosystems
- Not uniform, but more negative than positive.
- Implications for fisheries, biodiversity, conservation, biological cycling of carbon, etc etc.

Polar changes



- Arctic permafrost is **thawing,** with the potential of **adding more greenhouse gases to the atmosphere**.
- With global warming limited to well below 2°C, **around one quarter** of near-surface permafrost will thaw by 2100. If emissions continue to increase strongly, **around 70% near-surface permafrost could be lost**.
- People living in the Arctic, especially Indigenous peoples, are already **adjusting their travel and hunting activities** to the seasonality and safety of land, ice and snow conditions. Their success in adapting depends on **funding, capacities and institutional support**.

Polar changes



- Loss of glacial ice from land will continue - sea level rise during the course of this century is inevitable.
- Major impacts also on ocean circulation, climate, marine productivity etc.
- Significant uncertainties remain, especially concerning Antarctica, but **choices made now** can strongly affect the level of sea level rise and other consequences that we will have to deal with.

Maybe three overarching messages …

- Climate-induced changes in the polar and high mountain regions are having significant impacts both **locally** and **globally** – everyone is affected.
- Across many aspects, the polar and high mountain regions of the future will appear **significantly different** from those of today.
- **Choices are available** that will influence the nature and magnitude of changes, potentially limiting their impacts and increasing the effectiveness of adaptation actions.

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.

Want to learn more? - https://www.ipcc.ch/srocc/home/

mmm@bas.ac.uk

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Priorities?

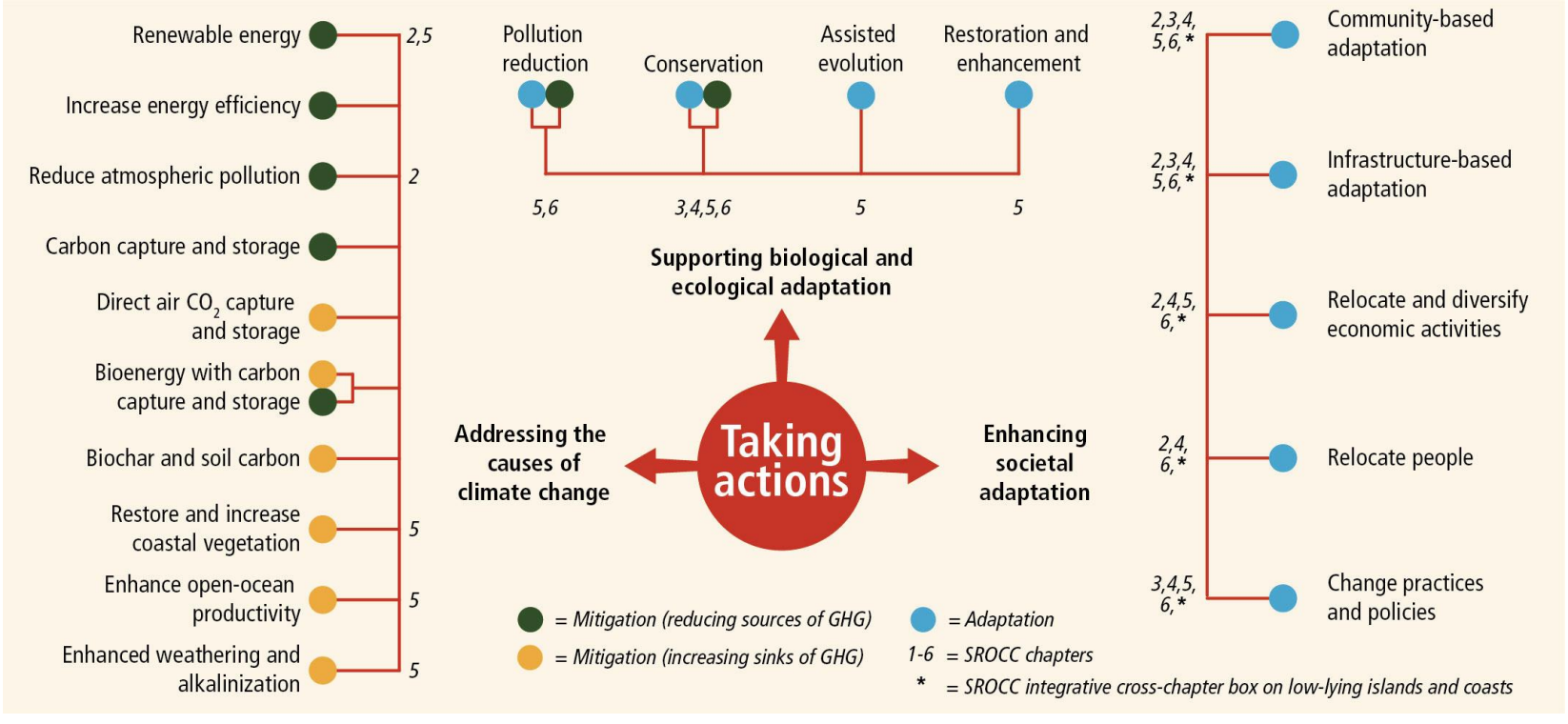
Important caveat: IPCC advises on science, it does not seek to prescribe policy.

But **if** the goal were to minimise the negative impacts of climate change and to prepare for the unavoidable:-

- Reducing emissions, of course. Net-zero nationally and globally will minimise negative climate impacts.
- Support international efforts for mitigation and adaptation via e.g. research, trade, aid.
- Planning for major impacts, e.g. significant sea level rise and much more frequent storm surges.
- Flexible adaptation policies to allow for diverse climate change scenarios.
- Short-term risk reduction (adaptation) concurrent with long-term planning to build resilience.
- Enhanced systems to monitor key processes and changes, to guide implementing flexible policies.

Specifics explored in detail in the report.

Summary of mitigation/adaptation options considered in SROCC



Key Knowledge Gaps

- **Ocean Overturning Circulation.** No direct measures and only indirect change indicators.
- **Polar ice sheets dynamics and sea level rise.** Improved quantification and attribution, and better understanding of Antarctic Ice Sheet instability /irreversibility mechanisms.
- **Snow depth on sea ice.** Essentially unmeasured, limiting sea ice model predictive skills.
- **Permafrost carbon**. Inadequate knowledge of stores and changes, both terrestrial and subsea.
- **Precipitation (incl. snow) observation and understanding.** Limiting understanding of water-related landscape processes, incl permafrost and ecosystem dynamics.
- **Ecosystems and biodiversity.** Regional gaps in observations, limited understanding of population dynamics and adaptation to habitat change limit ecosystem based management, spatial planning, and planning of conservation and human adaptation.
- **Strategies and tools for reducing risk and strengthening resilience.** Limited understanding of their efficacy and limits for ecosystems and people, their contribution to climate-resilient pathways, of resources needed, and of how institutions can support them. No understanding of how to pre-empt anticipated regime shifts.