

The Rapidly Changing Cryosphere



CliC Strategic Plan
2025–2034

WCRP 

© World Meteorological Organization (WMO), 2025

Copyright notice

The right of publication in print, electronic and any other form and in any language is reserved by CliC. Short extracts from this publication may be reproduced without authorization, provided that the complete source is clearly indicated. Editorial correspondence and requests to publish, reproduce or translate this publication in part or in whole should be addressed to info@climate-cryosphere.org.

Bibliographic information

The CliC Strategic Plan 2025–2034 should be cited as:

CliC, 2025. CliC Strategic Plan 2025–2034: The Changing Cryosphere. World Climate Research Programme (WCRP) Publication #/2025 [E. Hanna et al.]

Authorship notice

The CliC Strategic Plan 2025–2034 was prepared by:

- Edward Hanna, University of Lincoln, United Kingdom (Co-Chair)
- Amy Lauren Lovecraft, University of Alaska Fairbanks, USA (Co-Chair)
- Keith Alverson, CliC International Project Office
- Sandra Barreira, Argentine Navy Hydrographic Service, Buenos Aires, Argentina
- Raymond Bradley, University of Massachusetts, Amherst, USA
- Robert DeConto, University of Massachusetts, Amherst, USA
- Ben Galton-Fenzi, Australian Antarctic Program, Australia
- Sergi González-Herrero, Institute for Snow and Avalanche Research, Davos, Switzerland
- Miriam Jackson, International Cryosphere Climate Initiative, Norway
- Thamban Meloth, National Centre for Polar and Ocean Research, Goa, India
- Tim Naish, Victoria University Wellington, New Zealand
- Ramiro Saurral, University of Buenos Aires, Buenos Aires, Argentina
- Ted Scambos, University of Colorado, USA
- Chris Burn, Carleton University, Canada
- Meghan Taylor, CliC International Project Office
- Narelle van der Wel, WCRP Secretariat, Geneva, Switzerland

With additional valuable input from the CliC Scientific Steering Group (SSG) and the WCRP Secretariat.

Copy Editing

CliC International Project Office

Graphics and Layout

Katherine Quigley, CliC International Project Office

Cover image credit: Sebastian Olivos, Unsplash



Strategic Plan 2025–2034

The Rapidly Changing Cryosphere

CliC is a Core Project of the World Climate Research Programme (WCRP). WCRP is co-sponsored by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the International Science Council (ISC).



WORLD
METEOROLOGICAL
ORGANIZATION



International
Science Council

The CliC International Project Office is hosted by the University of Massachusetts, Amherst and supported by the U.S. National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA).



University of
Massachusetts
Amherst



Preface

The cryosphere, the naturally frozen parts of the Earth including glaciers, ice sheets, sea and lake ice, permafrost, and snow cover, are changing faster than any other component of the Earth system. The rates of loss of land and sea ice, permafrost, and snow cover have rapidly increased over the last few decades, representing the clearest planetary response to global warming. Changes in the cryosphere impose major consequences for local and global communities. Ecosystems, cultures and economies are being negatively affected across the world. For those living in mountain areas and regions downstream, the loss of glaciers has led to reduced water supply while enhancing hazardous hydrological conditions. In the Arctic, the change in sea ice has altered transportation patterns and reduced mobility for Indigenous communities. Permafrost thaw has led to land destabilization affecting infrastructure and planning. The loss of land ice has played a substantial role in rising sea levels, inundating low lying islands and coastal regions around the world. Significant uncertainties remain in predictions of future changes in the cryosphere, which makes it difficult for people to anticipate and adapt. The Climate and Cryosphere (CliC) Core Project of the World Climate Research Programme (WCRP) supports key research priorities pertaining to the Earth's changing cryosphere and assists in the coordination of international activities to address them. CliC fulfills its mission through its activities and other regular meetings, horizon scanning of cutting-edge research, and discussion with a wide variety of stakeholders and organizations. CliC highlights emerging issues, facilitates scientific exchanges, and helps to promote the activities of early career scientists. CliC also coordinates with stakeholders and communicates cryosphere-related science to policymakers, funding agencies, and the general public. This Strategic Plan builds on the achievements of the 2017–2021 CliC Action Plan, which strengthened international coordination and expanded model intercomparison activities and engagement with observing systems. The 2025–2034 Plan reflects the accelerating pace and increasing societal relevance of cryospheric change, with greater emphasis on predictability, extremes, uncertainties, impacts and actionable knowledge. The decade covered by this Strategic Plan coincides with the UN Decade of Action for Cryospheric Sciences (2025–2034) with major milestones, including the CliC Open Science Conference in 2026, the 5th International Polar Year (2032–33), and a planned major synthesis publication and conference at the end of the decade.

Background: The Cryosphere

The cryosphere is a fundamental component of the Earth system that affects global climate patterns, sea-level rise, freshwater availability, and ecosystem health, as well as human societies — particularly in polar and high-altitude regions. The cryosphere is made up of several components or features, each of which provide critical environmental and societal services. With warming, cryospheric changes result in diminished services as well as increased risk of physical hazards and their impacts (Figure 1).






Component	Snow	Sea Ice	Ice Sheets & Shelves	Mountain Glaciers	Permafrost
					
	High albedo Insulation Tourism & recreation Water Supply	Access & Mobility Coastal protection Food Supply High albedo	Healthy ecosystems High albedo Ocean heat transport	Food, water, & energy supply Healthy ecosystems High albedo Tourism	Access & Mobility Carbon storage & sequestration Structural support
Hazards & Impacts	Changing avalanche patterns Decreased tourism Drought Flooding	Changing Arctic shipping and transport Ecosystem & food chain disruption Increased storm intensity & coastal erosion	Changing atmospheric patterns Ecosystem & food chain disruption Flooding Sea level rise	Ecosystem & food chain disruption Drought Flooding Sea level rise	Coastal erosion Disrupted & unsafe transport Greenhouse gas emissions Landslides

Figure 1: Cryospheric components and selected examples of associated services, impacts, and hazards.

CliC's Mission and Strategic Plan

CliC's mission is to assess changes in the frozen parts of the planet, advance understanding of climate-cryosphere interactions, and support efforts to mitigate and

adapt to the impacts of changes in the cryosphere on ecosystems and human society.

The CliC Strategic Plan addresses cryospheric changes and their impacts across space and time. It focuses on improving cryospheric models and process studies, enhancing observational networks, fostering collaboration by means of synergistic work between cryosphere and climate research communities, and widely communicating the results of that research.

CliC Community and Leadership

CliC is a global community of scientists, researchers and other interested parties who focus on understanding the cryosphere and its interactions with the climate system. The range of activities represented within CliC includes modelling, process understanding, observations, cross-disciplinary work, and stakeholder engagement. CliC promotes cryosphere research in collaboration with numerous contributing scientists and researchers who target scientific and societal priorities in cryospheric and climate research through global and regional initiatives. These activities are carried out by a network of established specialized Working Groups (Figure 2) which focus on specific topics. Affiliated with the groups are CliC Early Career Researchers and Fellows that CliC has supported by offering opportunities for engagement and mentorship within the community of cryospheric scientists.













Arctic Sea Ice Working Group (ASIWG) 	Antarctic Sea Ice Processes & Climate (ASPeCt) 
Biogeochemical Exchange Processes at Sea-Ice Interfaces (BEPSII) 	Coordinated Regional Downscaling Experiment: Polar Domains (Polar CORDEX) 
Glacier Model Intercomparison Project (GlacierMIP) 	Ice Sheet Mass Balance & Sea Level (ISMAS) 
Ice Sheet Model Intercomparison Project for CMIP6/7 (ISMIP6/7) 	Impacts of Changes in the Mountain Cryosphere (IC-MontC) 
Linkage Between Arctic Climate Change & Mid-Latitude Weather Extremes (LINKAGES) 	Marine Ice Sheet Ocean Model Intercomparison Project (MISOMIP) 
Northern Oceans Region Panel (NORP) 	Permafrost Carbon Network (PCN)
Sea Ice Model Intercomparison Project (SIMIP) 	Southern Ocean Region Panel (SORP) 

Figure 2: An outline of active CliC Working Groups.



CLiC Scientific Steering Group members and guests gather for recent in-person meetings.

Photo A: 19th Meeting of the CLiC SSG in San Francisco, USA (December 2023)

Photo B: 20th Meeting of the CLiC SSG in Pucón, Chile (August 2024)

CliC has a Scientific Steering Group (SSG) that provides scientific guidance, oversight, and strategic leadership for CliC’s activities; they have overall responsibility for planning and guiding CliC’s work. The SSG includes experts from an array of fields, including glaciology, meteorology, oceanography, climate and paleoclimate science, and social sciences. The CliC International Project Office (IPO) is hosted by the University of Massachusetts Amherst and provides administrative and operational support. The CliC organigram (Figure 3) highlights the central coordinating roles of the SSG and IPO. It also illustrates the primary research interests and outward-facing nature of CliC Working Groups, which serve to engage with the broader community and drive collaborative science.

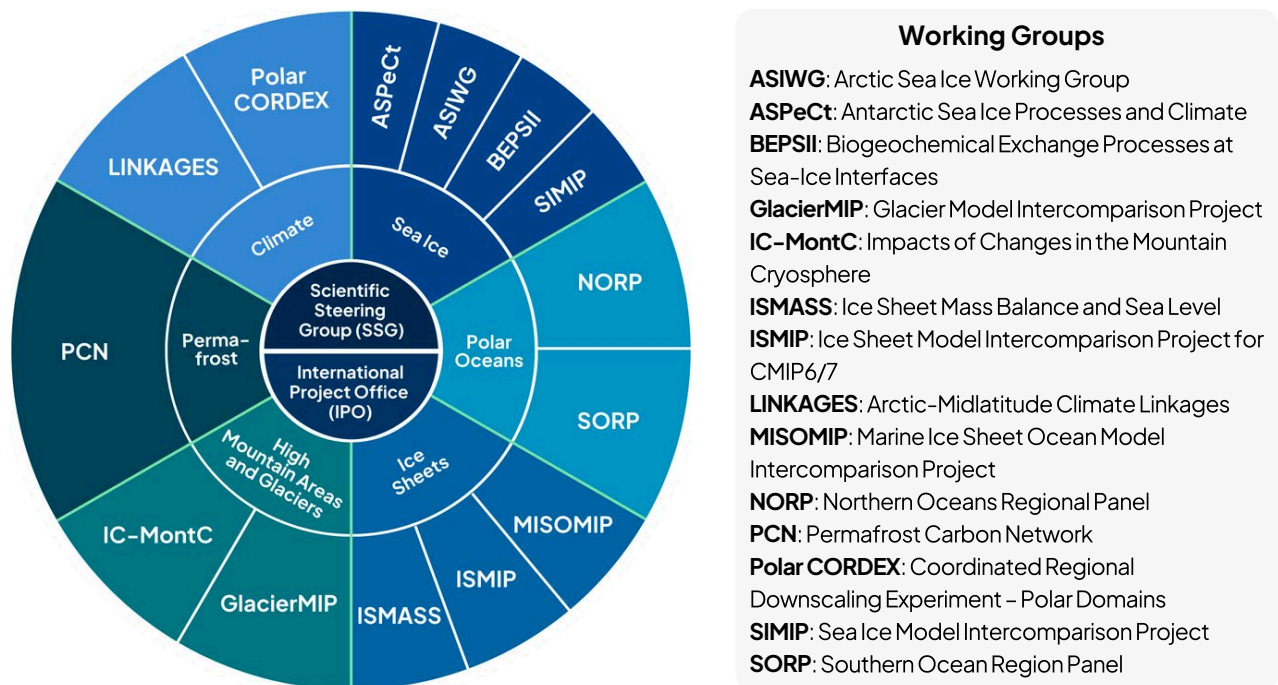


Figure 3: CliC organizational chart and Working Group titles for reference.

The Changing Cryosphere

As Earth continues to warm, the loss of ice, snow, and permafrost is leading to irreversible consequences on a planetary scale. Heat gained by the planet’s surface from increased greenhouse gases has resulted in the warming of the ocean, land, and atmosphere, the melting of ice and snow, and permafrost thaw. A substantial portion



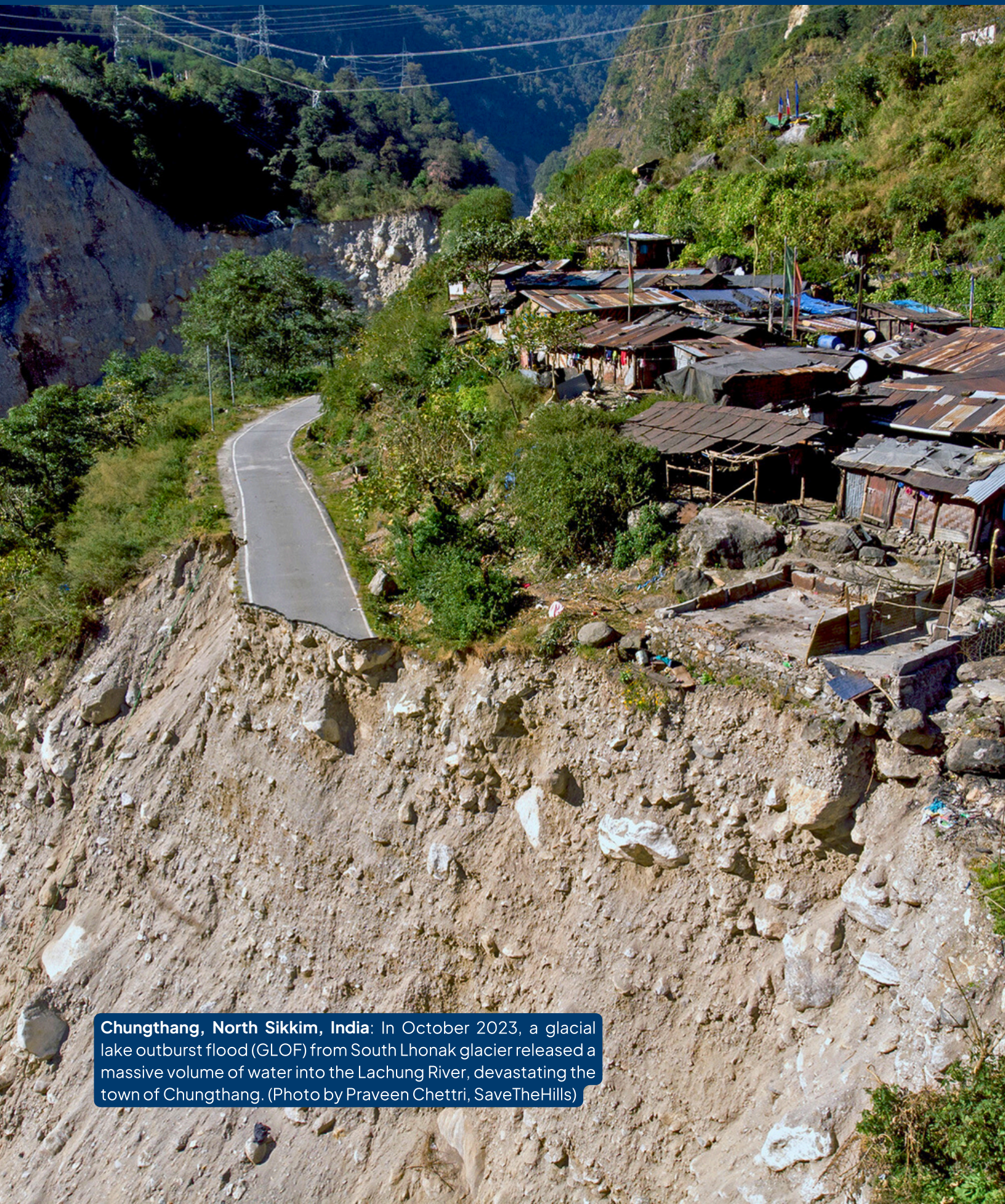
Humpback whale in Fournier Bay off of Anvers Island, Antarctic Peninsula: Rising temperatures and increased acidification in the Southern Ocean threaten the stability of native ecosystems. (Photo by Derek Oyen on Unsplash)

of the additional heat absorbed by the Earth in recent decades has been taken up by melting ice, with profound effects on sea-ice coverage, ice loss from the Greenland and Antarctic ice sheets, the seasonality of ice on lakes and rivers, and the reduction of glaciers worldwide.

Most of the excess heat has been absorbed by the oceans, mainly in the Southern Hemisphere, with implications for sea-ice loss and ice-sheet melting. These changes, in turn, affect global climate via a number of processes and feedbacks which have regional and global consequences. Sea-ice reduction leads to the increased absorption of solar radiation. Ocean and atmosphere warming results in positive feedbacks, and further sea-ice melt. Increased freshwater discharge into the ocean can affect ocean stratification and, by altering the exchange of heat between the atmosphere and the ocean, modify regional and large-scale ocean circulation.

The poles and high mountain ranges are changing more rapidly than any other locations and the loss of ice is alarming. Earth lost around 30 trillion tonnes of ice over the past three decades. These losses have been widespread, with substantial contributions from losses of sea ice in both hemispheres, continental ice sheets in Greenland and Antarctica, Antarctic ice shelves, and mountain glaciers. If this 28 trillion tonne mass of water were spread out over an area equivalent to the lower 48 states of the United States, it would be more than three and a half meters deep.

In short, humanity is faced with a relentlessly shrinking cryosphere which creates numerous and unexpected hazards around the globe due to the destabilizing effects of a warmer and wetter planet. Changes in snow, freezing rain, glacial ice, sea ice, and permafrost can be hazardous to infrastructure and dangerous to people and animals. Avalanches, areas of thin ice, glacial lake outburst flooding, and thawing permafrost account for costly damage to critical infrastructure for energy provision, communications, hunting and fishing, mobility, and everyday life activities. This affects not only communities but also research infrastructure and scientific projects, not to mention the loss of human life and destruction of ecosystems that are relied on for community security. There are also socio-economic benefits associated with cryospheric change, such as the opportunity for decreased shipping costs and times associated with opening of routes in the Arctic. CliC science informs actions both to avoid hazards and to benefit from opportunities.



Chungthang, North Sikkim, India: In October 2023, a glacial lake outburst flood (GLOF) from South Lhonak glacier released a massive volume of water into the Lachung River, devastating the town of Chungthang. (Photo by Praveen Chettri, SaveTheHills)

The 2023 One Planet-Polar Summit identified the need for a Decade of Action for Cryospheric Sciences (DACS) to demonstrate the crucial role of the cryosphere in governing planetary processes, providing livelihoods for humans, and supporting ecosystem services on Earth. This declaration and its subsequent adoption by a resolution of the United Nations General Assembly aligns with the timeframe of this CliC Strategic Plan, which begins with the UN International Year of Glaciers' Preservation in 2025 and includes the 5th International Polar Year (IPY-5) in 2032–2033.

How CliC works

CliC is the only cryosphere-focused organization defined by all three of the following characteristics:

- has an international membership
- has as its remit the entire cryosphere, including both polar and non-polar regions
- emphasizes interactions with the climate system

CliC serves a vital role in the global cryospheric community by identifying the highest priority scientific issues of policy and societal relevance; bringing together researchers of all career stages, stakeholders, and end-users to address these priorities; and using its convening power to facilitate the mobilization of resources.

CliC coordinates interdisciplinary collaboration and facilitates partnerships across national and institutional boundaries, enabling researchers to integrate field observations and remote sensing data, numerical modelling and process studies in order to better understand cryospheric dynamics and their interactions with—and influence on—climate, sea-level rise, hydrological systems, ecosystems, and human societies. This includes efforts to improve predictive capabilities for sea-ice concentration and thickness, ice-sheet and glacier mass loss, the thawing of permafrost, and loss of lake and river ice.

Through workshops, educational training events, and scientific conferences, CliC and its Working Groups create opportunities for knowledge exchange and skill development, helping to build a more scientifically diverse and globally representative research community by mentoring and training early-career scientists.



Patagonia, Argentina: South America's Patagonian icefields are melting away at some of the highest rates on the planet. This meltwater directly contributes to sea-level rise. (Photo by Adam Derewecki on Pixabay)

Communication and outreach are also fundamental components of CliC’s mission. CliC uses its platform to raise awareness about the far-reaching implications of cryospheric change, promote community engagement, and share the latest scientific findings with the broader scientific community, policymakers, other stakeholders, and the public. By synthesizing scientific findings and promoting their dissemination, CliC helps inform evidence-based decision-making at the national and international level.

CliC recognizes the importance of addressing emerging challenges at the nexus of climate and cryosphere that match cryosphere prediction and models to societal impacts. With this in mind, CliC works to bridge the natural and social sciences through co-production of knowledge and collaborative research focused on analyzing the impacts of future ice loss, evaluating the impacts of cryospheric changes on terrestrial and marine ecosystems, and supporting the development of mitigation strategies and adaptation plans for Arctic and High Mountain areas. CliC also drives research to explore the polar-tropical teleconnections impacting areas vulnerable to the effects of sea-level rise, such as small island developing states (SIDS). After implementing research activities through its Working Groups and collaborative partnerships with other international organizations, CliC synthesizes research findings and communicates with stakeholders to ensure that cryospheric research can inform decision-making and contribute to global climate resilience. CliC’s work contributes directly to the Intergovernmental Panel on Climate Change (IPCC)’s Assessment Reports and global initiatives such as the UN International Year of Glaciers’ Preservation and the upcoming IPY-5. With the start of the Decade of Action for Cryospheric Sciences (2025–2034), CliC is now playing a central role in coordinating and promoting international research activities that contribute to the decade.

To translate CliC’s research priorities (see following section) into action, CliC will pursue a small set of strategic objectives over 2025–2034. These include: advancing predictive capability of cryospheric change through co-ordinated intercomparison and synthesis activities; strengthening observing systems and process understanding; linking cryospheric science to societal risks and decision-making; and supporting a diverse and globally connected cryosphere research community. Deliverables include co-ordinated assessments, synthesis papers, contributions to IPCC and WCRP activities, and major community events such as the CliC Open Science Conference, IPY-5, and DACS-related activities.



Scoresby Sund (Kangertittivaq), Greenland: The Greenland ice sheet deposits fresh meltwater and sediment into the sea via fjord systems such as Scoresby Sund in East Greenland. According to the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC), the Greenland ice sheet is responsible for 20 percent of current sea-level rise. (Photo by Wietse Jongsma on Unsplash)



CliC Research Priorities

In coordination with the WCRP Strategic Plan and key partner organizations, CliC has identified the following research priorities for this strategic plan.

Ice sheets and sea-level rise

Ice sheets are the major cryospheric contributor to rising sea levels but experts still lack sufficient understanding about how they respond to climate change. The aims below will be addressed primarily through the ISMIP Working Group and in partnership with wider WMO/WCRP initiatives and SCAR INSTANT. Improved information and understanding will feed into various synthesis activities including a planned new interdisciplinary sea-level group within WCRP and the Intergovernmental Panel on Climate Change (IPCC) AR7 to be published in 2029.

Deliverables:

- Increase understanding of the rate-determining processes affecting the dynamic loss of Antarctic ice and incorporate those processes into models assessing the future, so that confidence in sea-level projections can be increased and deep uncertainty reduced.
- Improve knowledge of the processes of Greenland ice-mass loss and its relationship with North Atlantic regional climate variations through better understanding of atmospheric and oceanic circulation changes and their links with polar amplification.
- Through our Ice Sheet Model Intercomparison Project phase 7 (ISMIP7) activity, complete protocols for the standalone ice-sheet models and the coupled climate-ice sheet models and prepare atmosphere, ocean, and ice shelf fracture datasets for driving ice-sheet models using Coupled Model Intercomparison Project (CMIP) Earth System Models that will feed into the IPCC's AR7.
- Help determine what is a 'safe warming limit' for ice sheets and project the response of the ice sheets to the most ambitious emissions pathways.
- Constrain the uncertainty in projections of ice-sheet mass loss, and potential irreversibility and its contribution to sea-level rise. Contribute, in partnership with other WCRP and external entities, to new WCRP activity on global sea-level rise by contributing expert knowledge on ice-sheet and glacier elements of this change.



Sea ice in the Southern Ocean: According to the National Snow and Ice Data Center (NSIDC), the Antarctic sea ice maximum extent in 2025 was the third lowest in the 47-year satellite record, above 2023 and 2024. (Photo by Hector John Periquin on Unsplash)



Sea ice and polar oceans

Sea ice is critically important due to its role in many climate feedbacks, and is an incredibly sensitive marker of global climate change. There is currently a lack of clear understanding of extreme events, such as successive Antarctic sea ice extent minima since 2022, and their causes and implications. CliC is working to encourage closer connections between the existing four sea ice Working Groups in order to facilitate joint state-of-the-art assessments, white papers and project overview. CliC sea ice scientists have key leadership roles in upcoming relevant events such as the IGS Sea Ice Symposium in Hobart in 2027.

Deliverables:

- Explain the causes and effects of sea-ice variability and retreat in the Arctic and Antarctic to improve predictability of its coverage (extent and area), as well as understand the impact of sea ice on the wider Earth system.
- Improve observations and modelling of sea-ice thickness and volume changes, and especially of the Marginal Ice Zone.
- Increase understanding of the regulation of the climate system through sea-ice-mediated biogeochemical cycles and associated feedback processes, and the regulation of sea-ice-dependent ecosystems and food webs; both are relevant for ecosystem services.
- Through CliC's SIMIP activity in and beyond 2026 collect an exhaustive description of the sea ice model characteristics used by each modeling group for CMIP7. This description will be published in a key reference document that can be cited in all subsequent scientific studies that use this data.
- Through SIMIP produce 2–3 reference articles related to sea ice in CMIP7.
- Through CliC's SORP activity, reconcile observation- and model- based understanding of cross-shelf heat exchange in the Southern Ocean, and outline the observing system requirements for constraining cross-shelf heat flux variability. Through NORP and SORP, improve understanding of polar heat fluxes and seasonal freshwater variability and its relation to heat as well as connections to lower latitudes and fluxes.
- Foster work at the local and mesoscales to understand the hazards and opportunities of sea ice loss in different locations with a focus on the Arctic and the human populations dependent on sea ice for wellbeing.



Salvaging bricks from a washed-away home near Shariatpur, Bangladesh: While CliC's work focuses on polar and high mountain regions, cryospheric change has far-reaching consequences. As the cryosphere shrinks and meltwater contributes to sea-level rise, encroaching waters threaten to engulf coastal settlements and island communities across the globe. (Photo by Moniruzzaman Sazal / Climate Visuals Countdown)

Mountains, glaciers, lakes and rivers, and snow

Mountain glaciers are critical for drinking-water supply in many communities around the world. They also significantly affect global sea level, regional albedo, climate, and local tourism. One of the most pressing issues in high mountain areas is the formation and expansion of glacial lakes, which can lead to glacial lake outburst floods (GLOFs). Another concern is extreme weather events, such as cloudbursts, that add to the vulnerability of mountain hazards and increase the danger of GLOFs. CliC recently established an Impacts of Changes in the Mountain Cryosphere (IC-MontC) Working Group, which held its inaugural international workshop in 2025. The IC-MontC and Polar CORDEX activities focus on improving high-resolution climate models for mountainous and high-latitude regions. CliC's GlacierMIP project recently completed its third phase that focused on the long-term stabilisation of glaciers under a range of climatic conditions.

Deliverables:

- Improve understanding of the rates of snow and ice change in high mountain regions, and the implications for natural hazards, water resources, food production, tourism, sea-level rise and ecosystem services.
- Expand IC-MontC Working Group activity in coordination with GEWEX and other partners.
- Better understand how snowfall and atmospheric frozen cloud processes influence the Earth's hydrological cycle and albedo feedbacks.
- Standardise model output for future glacier modelling efforts (e.g. GlacierMIP4)
- Submit a formal analysis of GlacierMIP4 results during 2026/27, which is expected to feed into the IPCC's AR7.
- Gather and evaluate publications related to the value chains provided by glaciers in different regions for comparison.
- Support and sustain an integrated observing system to monitor cryospheric change at high altitudes.

Permafrost

Permafrost is the unseen cryosphere, and is the glue that holds the landscape together but is becoming unstuck. It is integral to many Arctic communities, but is also found in

the mountain cryosphere, pockets of the Southern Hemisphere, and beneath some high-latitude oceans. Its rapid demise is causing ground destabilisation and structural issues with building foundations, whilst affecting ecosystems and having the potential to release unquantified, potentially vast amounts of the very potent methane greenhouse gas. There is also a knowledge gap in how permafrost carbon responds to climate change. CliC continues to strive to improve understanding of permafrost changes and impacts through its Permafrost Carbon Network activity.

Deliverables:

- Improve understanding of the processes of permafrost thawing in the Arctic, Antarctic and mountain cryosphere for better predictability of spatial scale, rate and timing of methane and carbon dioxide release to the atmosphere and its influence on global warming and infrastructure and hazards, such as landslides.
- Develop adequate terrain-monitoring programs.
- Deal with failure of waste disposal sites that use permafrost as a containment medium.
- Determine the expected service life of structures founded on permafrost by utilising climate projections to 2100 CE and through application to thermal analysis of a range of foundation types.
- Under the remit of the Permafrost Carbon Network, which CliC sponsors, prepare a synthesis paper on this topic that will help to inform IPCC AR7.

Feedbacks and potential tipping points

CliC prioritizes the study of cryosphere-climate feedback mechanisms that could lead to abrupt and potentially irreversible changes to climatic and ecological systems with serious repercussions for society. CliC supports research focused on investigating how cryospheric changes—such as sea ice, ice sheet, glacier, snow and permafrost declines—influence atmospheric and oceanic circulation, carbon cycling and weather patterns. This is crucial for identifying potential tipping points, such as the collapse of ice shelves, that could trigger cascading effects on global climate dynamics. Paleoclimatic studies utilizing ice-core data and other historical records provide a unique record of changes in the Earth's climate system, enabling current conditions to be placed in a long-term perspective. Ice cores also offer insights into past climate and cryosphere-climate interactions, improving understanding of potential thresholds



Permafrost in the Ogilvie Mountains of the Yukon, Canada: Permafrost thaw contributes to infrastructure damage and erosion, forcing communities to adapt and/or relocate. It also exposes large quantities of previously frozen soil organic carbon to decomposition, releasing greenhouse gases into the atmosphere. (Photo by milehightraveler on Canva)



and feedback mechanisms that may occur in the future.

CliC collaborates within (e.g. APARC) and beyond WCRP (e.g. IASC) to improve understanding of cryosphere-related feedbacks, including by demarcating a safe operating space for the cryosphere based on the Planetary Boundaries Framework. By improving knowledge of the global climate system and feedbacks, CliC-sponsored work in this theme contributes to WCRP Scientific Objectives 1–3 (as outlined in the WCRP Strategic Plan 2019–2028).

Deliverables:

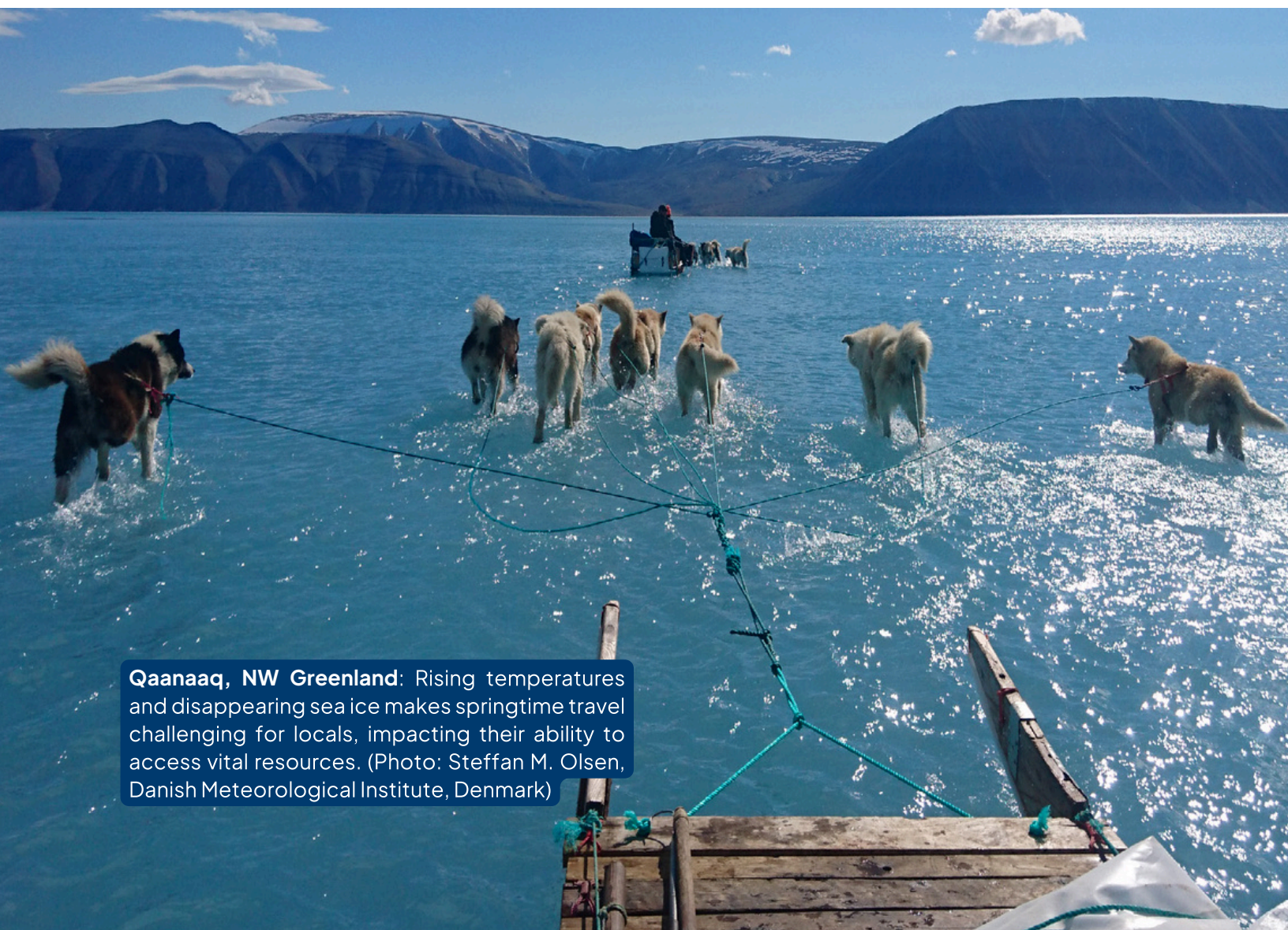
- Identify and understand key cryosphere-related extremes, feedbacks, thresholds and tipping points and advice on reducing related uncertainties in climate predictions and projections from a cryosphere perspective.
- Provide overview of how human communities perceive and operate in the uncertainty of their cryospheric resources.
- Reduce uncertainty of human adaptation related to the diminishing cryosphere through comparative analysis and a research overview synthesis paper.
- Establish the influences of high-latitude atmospheric blocking and stratospheric polar vortex changes on extreme weather – climate change connectivity between the Arctic and midlatitudes.
- Ascertain whether CliC’s Arctic-midlatitudes climate linkages activity, which focuses on the Northern Hemisphere, can be extended to provide a Southern Hemisphere perspective.

Observations and modelling

CliC Working Groups are continuing to lead this effort and will continue to do so, in particular in the context of IPY-5 and the UN Decade of Action for Cryospheric Sciences, in collaboration with other WCRP activities and external organizations. CliC will therefore provide key guidance and facilitate capacity building to strengthen observational networks and advancing modelling capabilities and process understanding of the cryosphere at all scales and from a transdisciplinary perspective, in co-operation and in accordance with but adding value to other inter/national projects.

Deliverables:

- Facilitate designing and testing an optimal observational network for AI analysis, to effectively extend human-based analysis, and support AI initiatives applied to modelling and prediction of cryospheric change and climatic interactions.
- Facilitate model improvement and next-generation model development and substantially reduce uncertainties regarding future cryospheric change through our activities including glacier and ice-sheet modelling (GlacierMIP and ISMIP) and sea-ice modelling (SIMIP).
- Through Polar CORDEX, engage more with the large international activities relevant for IPY-5 such as ‘Antarctic InSync’, Arctic Ocean 2050 and other large international programmes (e.g. the EU-funded Polar Snow, Permafrost, and Inland Ice in a Changing World [SnowPI] project). Results from PolarCORDEX will also be used for ISMIP7 (Ice Sheet Model Intercomparison Project for CMIP7).



Qaanaaq, NW Greenland: Rising temperatures and disappearing sea ice makes springtime travel challenging for locals, impacting their ability to access vital resources. (Photo: Steffan M. Olsen, Danish Meteorological Institute, Denmark)

CliC Partnerships

CliC contributes the cryosphere perspective to relevant WCRP Lighthouse Activities and Core Projects by providing expertise in observations, modelling, synthesis and community coordination. CliC will continue to strengthen collaboration through joint workshops, assessments and targeted science activities related to sea-level rise, high-mountain impacts, polar–tropical linkages and regional climate information, while maintaining coordination with stakeholders and end-users. Figure 4 shows partners that co-sponsor CliC Working Groups. In addition, CliC routinely works with numerous other WCRP and external groups. CliC encourages building relationships as further Working Groups, programs and research are identified.

CliC Partners	CLIVAR	ESMO Earth System Modelling and Observations CMIP	IASC	MOUNTAIN RESEARCH INITIATIVE	Rifs Regional Information for Society CORDEX Coordinated Regional Climate Downscaling Experiment	SCAR	SCOR	solas 20192
ASPeCT								
BEPSII								
IC-MontC								
ISMASS								
ISMIP6/7								
LINKAGES								
MISOMIP								
NORP								
Polar CORDEX								
SIMIP								
SORP								

Figure 4: An outline of CliC Partners and collaborative Working Groups.

CliC cooperates wherever feasible with other WCRP Core Projects and Lighthouse Activities, and aims to enhance these collaborations. CliC currently co-sponsors Working Groups with CLIVAR, ESMO-CMIP and Rifs-CORDEX. Additionally, CliC carries

out research activities with organizations outside of WCRP.

CliC's partnerships are in harmony with the WCRP Strategic Plan, which seeks to maintain excellent science while concurrently better serving societal needs. In particular, the Lighthouse Activities within WCRP all have strong relevance to the cryosphere. CliC also has an important educational role in cryospheric science and impacts, and works alongside the newly established WCRP Academy to fulfill this ambition.

The CliC Strategic Plan is aligned with complementary activities being carried out by the international research community, including but not limited to:

- **The Scientific Committee on Antarctic Research (SCAR)** which is charged with initiating, developing and coordinating high quality international scientific research in the Antarctic region including the Southern Ocean, and on the role of the Antarctic region in the Earth system.
- **The International Arctic Science Committee (IASC)**, which aims to facilitate Arctic research co-operation, promote engagement and ensure knowledge exchange.
- **The International Association of Cryospheric Sciences (IACS)**, which promotes cryospheric research and international discussion/meetings. In particular, CliC looks forward to working alongside the new IACS Working Group on Cryosphere Stewardship 2026–2030, co-chaired by Amy Lovecraft (CliC SSG co-chair).
- **The International Cryosphere Climate Initiative (ICCI)** which promotes integrated projects across regions and disciplines, bringing together a range of organizations and individuals not normally in contact.
- **The Mountain Research Initiative (MRI)**, which coordinates research on changing mountain environments in support of sustainable development in those regions.
- **The Scientific Committee on Oceanic Research (SCOR)** which focuses on promoting international cooperation in planning and conducting oceanographic research, and solving methodological and conceptual problems that hinder research.
- **The Surface Ocean – Lower Atmosphere Study (SOLAS)** which aims to understand the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere.

Looking Forward

This strategic plan outlines CliC's aims for the coming decade. CliC and partners will plan significant outcomes related to these research aims through assessments that enhance scientific understanding. Implementation of the Strategic Plan will be supported by dedicated Working Group implementation plans and a co-ordinated CliC Implementation Plan outlining measurable actions, responsibilities and timelines. CliC endorses the governance principles of WCRP as outlined in its Science and Implementation Plan:

- Transparency, consultation and effective communication, especially in sharing information and decision-making;
- The need for inclusion, diversity and equity (across career stage, gender, culture, discipline and geography) in its activities and leadership groups;
- Promoting and supporting cooperation, coordination and collaboration with partners, allied disciplines and stakeholders; and
- Clarity, i.e. that purpose, structure, roles and responsibilities, etc. are all publicly available and clearly explained (i.e., accessible).

In evaluating CliC's progress over the period covered by this Strategic Plan, CliC anticipates at the outset, the following outcomes:

- A successful 1st CliC Open Science Conference 2026 that helps to galvanize and steer the international cryosphere community, laying the groundwork for a second pan-CliC cryospheric event following IPY-5 to conclude the Decade of Action for Cryospheric Sciences.
- A successful Decade of Action for Cryospheric Sciences and IPY-5 including a major synthesis conference and publication at the end of the decade.
- Publication of influential CliC-related peer-reviewed papers, reports and assessments
- Improvements in the cryosphere observing system and modelling
- Enhanced engagement in WCRPs other Core Projects and Lighthouse Activities
- Expanded participation by the next generation of scientists from across the globe in CliC-sponsored workshops and events
- Strengthened relevance of CliC scientific endeavors to societal concerns



- Improved visibility of CliC amongst scientists and other stakeholders

The coming decade is critical for the diminishing cryosphere and all the services it provides. The research community is well-placed to address these changes, and CliC is ready to take the lead in this endeavour.

Continue reading to see Figure 5: CliC and cryosphere community timeline (1996–2036) and Figure 6: Climate and cryosphere timeline (1996–2026).

Figure 5: CliC and cryosphere community timeline (1996–2036)

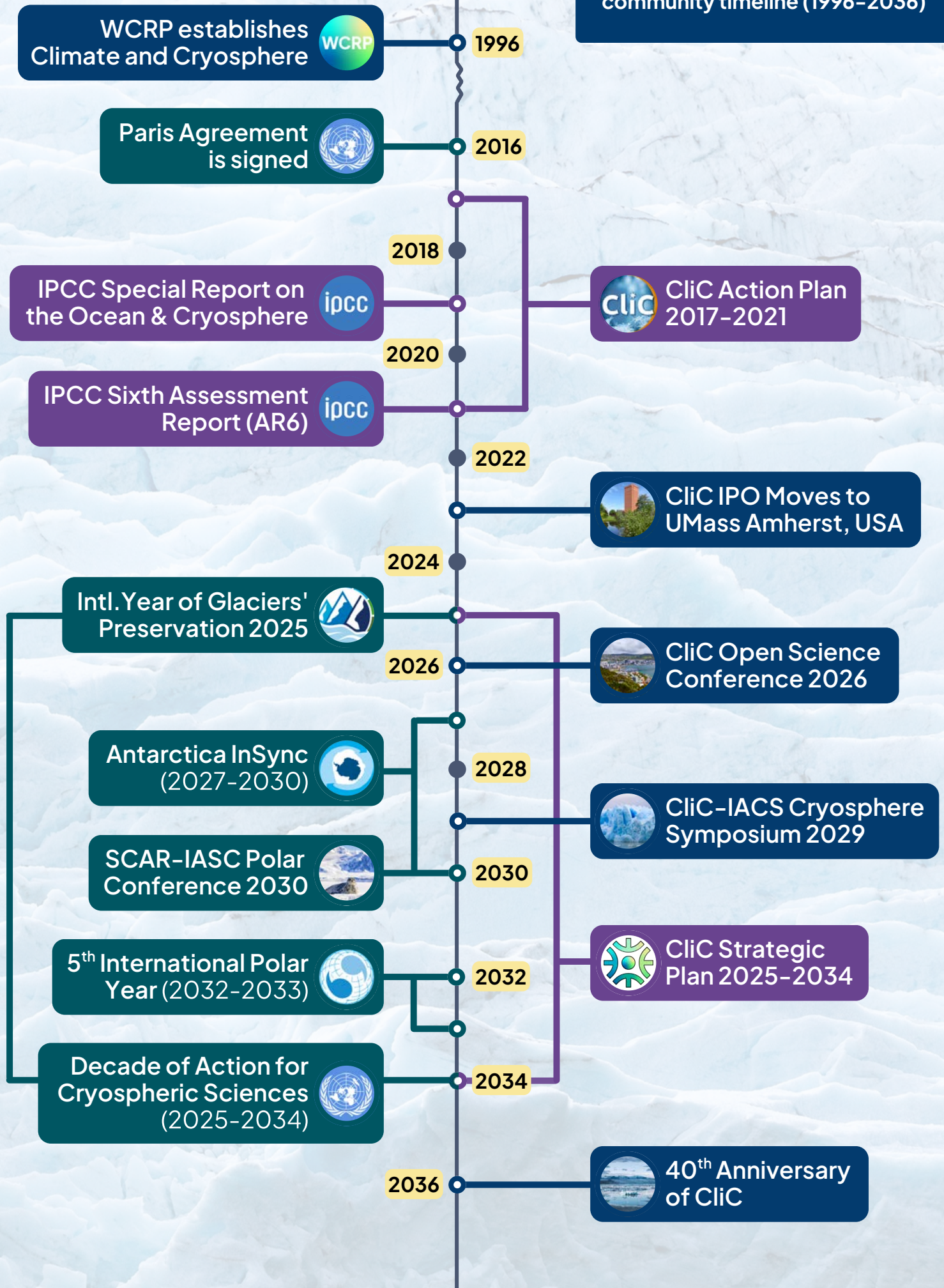
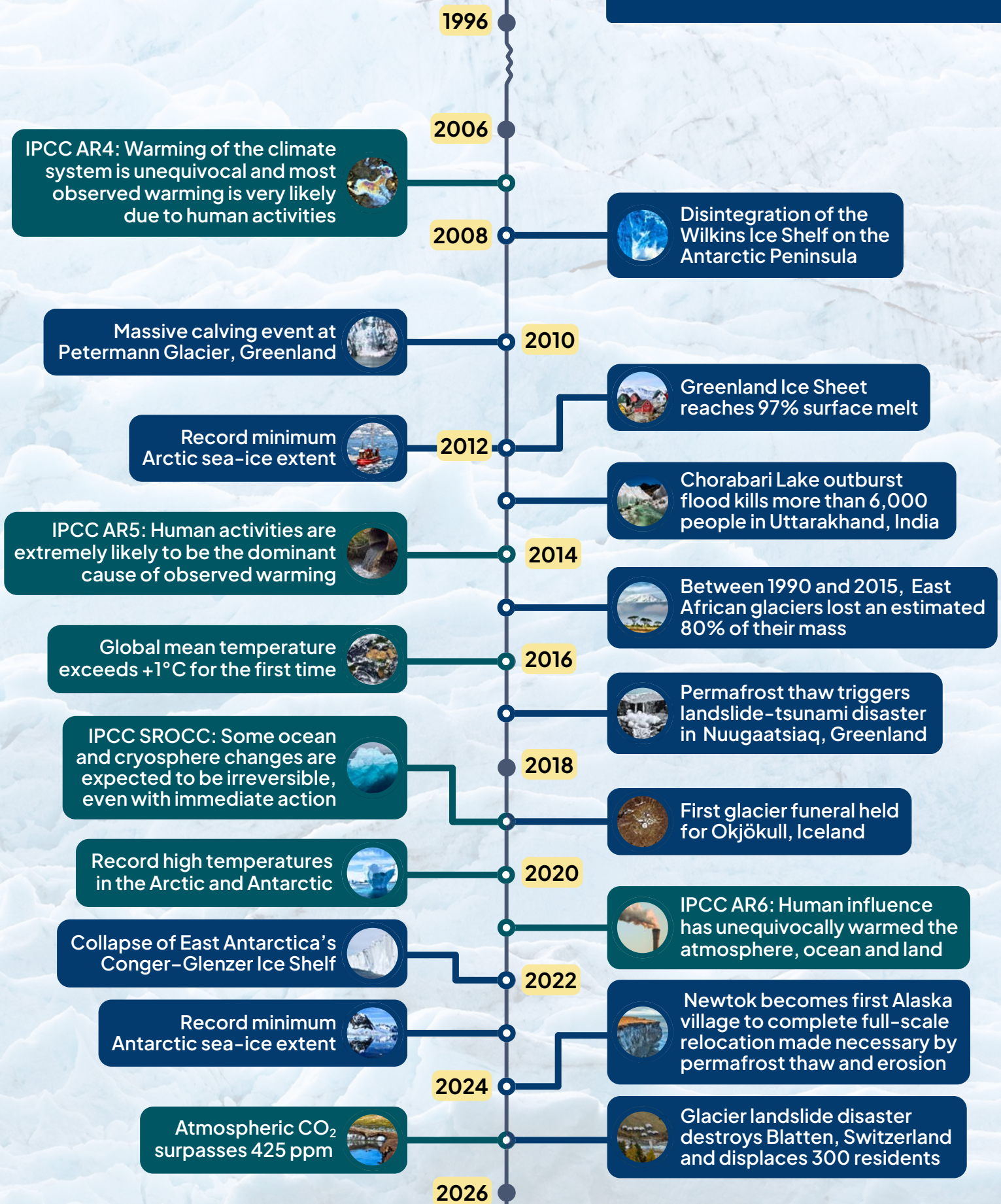


Figure 6: Climate and cryosphere timeline (1996–2026)



Index: Acronym Dictionary

AR7: Seventh Assessment Report of the Intergovernmental Panel on Climate Change

CliC: Climate and Cryosphere

CLIVAR: Climate and Ocean – Variability, Predictability, and Change

CMIP: Coupled Model Intercomparison Project

DACS: Decade of Action for Cryospheric Sciences (2025–2034)

ESMO: Earth System Modelling and Observations

IASC: The International Science Arctic Committee

IACS: The International Association of Cryospheric Sciences

ICCI: The International Cryosphere Climate Initiative

INSTANT: Instabilities & Thresholds in Antarctica (SCAR Scientific Research Programme)

IOC: Intergovernmental Oceanographic Commission

IPCC: Intergovernmental Panel on Climate Change

IPO: International Project Office

IPY-5: 5th International Polar Year (2032–2033)

ISC: International Science Council

MRI: The Mountain Research Initiative

RiFS: Regional Information for Society

SCAR: Scientific Committee on Antarctic Research

SCOR: The Scientific Committee on Oceanic Research

SIDS: Small Island Developing States

SOLAS: The Surface Ocean – Lower Atmosphere Study

SSG: Scientific Steering Group

UN: United Nations

UNESCO: United Nations Educational, Scientific, and Cultural Organization

WCRP: World Climate Research Programme