Climate and Cryosphere

CliC SSG Co-Chairs: Edward Hanna (University of Lincoln, UK) & Amy Lauren Lovecraft (University of Alaska Fairbanks, USA)

to JSC46

Paris, May 13th, 2025

CliC Climate and Cryosphere

WCRP World Climate Research Programme

CliC IPO supported by:

University of Massachusetts Amherst

NSF

NASA

CliC
Climate and Cryosphere

WCRP

Our Mission

To advance understanding of climate-driven changes in the frozen parts of our planet and to support efforts to mitigate and adapt to their impacts on ecosystems and human society.

What We Do

CliC identifies key research priorities pertaining to climate and the cryosphere and coordinates international activities to address them. We highlight emerging issues, facilitate scientific exchanges, cooperate with stakeholders, and promote early career researcher development. We also communicate cryosphere-related science to policymakers, funding agencies, and the general public.

Component	Snow	Sea Ice	Ice Sheets & Shelves	Mountain Glaciers	Permafrost
					
Services	High albedo Insulation Tourism & recreation	Coastal protection Hunting Transport	Healthy ecosystems High albedo Stable ocean currents	Drinking water & irrigation supply Hydropower	Carbon storage & sequestration Structural support Transport
Hazards	Changing avalanche patterns Decreased tourism Drought	Disrupted & unsafe transport Ecosystem & food chain disruption Increased storm intensity & impact	Disrupted & unsafe transport Ecosystem and food chain disruption Sea level rise	Drought Ecosystem & food chain disruption Flooding Sea level rise	Coastal erosion Disrupted & unsafe transport Greenhouse gas emissions Landslides

CliC
Climate and Cryosphere

WCRP

Amy Lovecraft
SSG Co-chair

Edward Hanna
SSG Co-chair

Keith Alverson
Executive Director

Meghan Taylor
Executive Officer

Katie Quigley
Communications & Outreach Manager

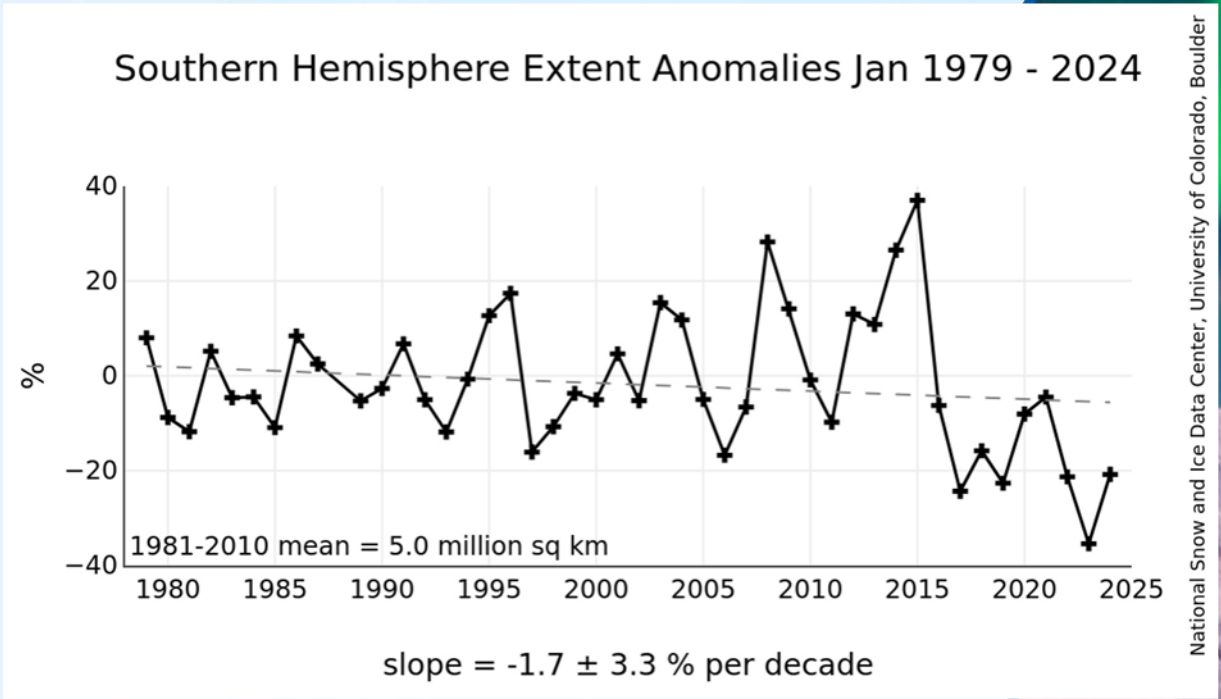
Assessments, impacts & projections of cryosphere loss

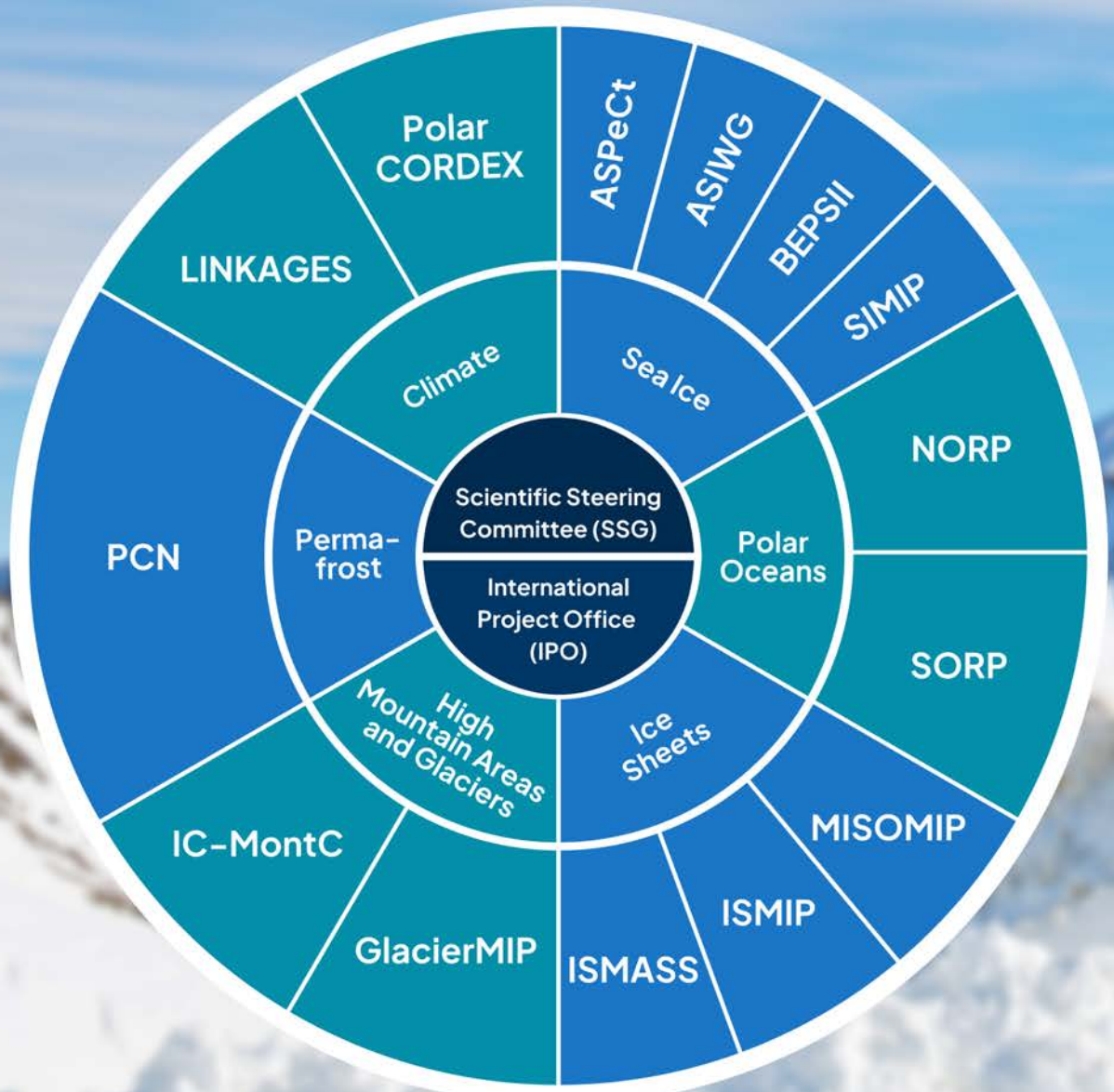
The cryosphere is changing rapidly.

CliC helps to support:

4 Model Intercomparison Projects (most CMIP6 endorsed) addressing knowledge gaps in ice sheets, sea ice and glaciers

10 further research projects/activities in collaboration with other groups including SCAR, IASC and CLIVAR related to sea ice processes and biogeochemistry, polar climate linkages, ice-sheet mass balance, permafrost carbon, and polar ocean responses





Working Groups

ASIWG: Arctic Sea Ice Working Group

ASPeCt: Antarctic Sea Ice Processes and Climate

BEPSII: Biogeochemical Exchange Processes at Sea-Ice Interfaces

GlacierMIP: Glacier Model Intercomparison Project

IC-MontC: Impacts of Changes in the Mountain Cryosphere

ISMASS: Ice Sheet Mass Balance and Sea Level

ISMIP: Ice Sheet Model Intercomparison Project for CMIP6 and CMIP7

LINKAGES: Arctic-Midlatitude Climate Linkages

MISOMIP: Marine Ice Sheet Ocean Model Intercomparison Project

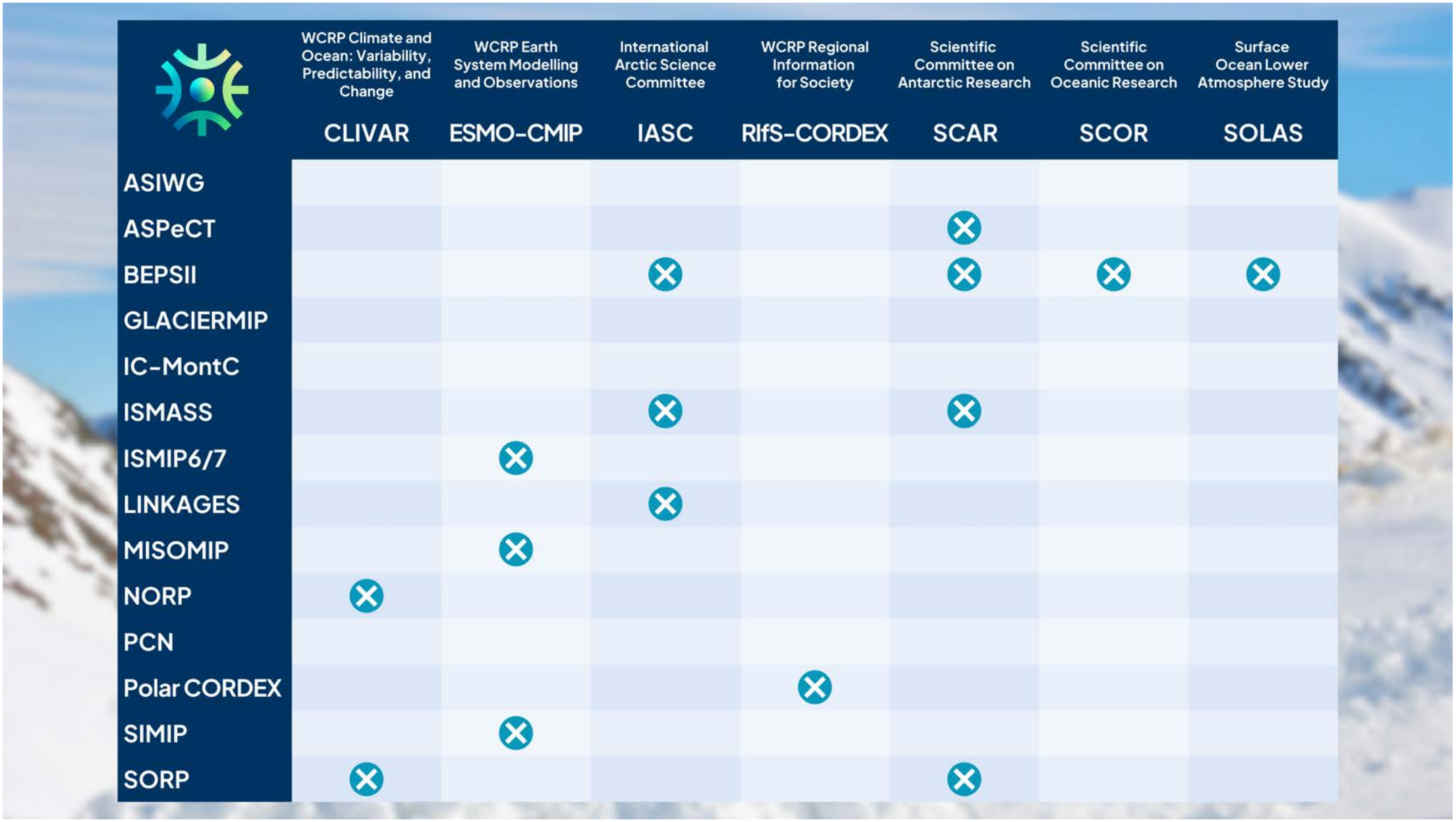
NORP: Northern Oceans Regional Panel

PCN: Permafrost Carbon Network

Polar CORDEX: Coordinated Regional Downscaling Experiment - Arctic and Antarctic Domains

SIMIP: Sea Ice Model Intercomparison Project

SORP: Southern Ocean Region Panel



	WCRP Climate and Ocean: Variability, Predictability, and Change	WCRP Earth System Modelling and Observations	International Arctic Science Committee	WCRP Regional Information for Society	Scientific Committee on Antarctic Research	Scientific Committee on Oceanic Research	Surface Ocean Lower Atmosphere Study
	CLIVAR	ESMO-CMIP	IASC	RIfS-CORDEX	SCAR	SCOR	SOLAS
ASIWG							
ASPeCT					✕		
BEPSII			✕		✕	✕	✕
GLACIERMIP							
IC-MontC							
ISMASS			✕		✕		
ISMIP6/7		✕					
LINKAGES			✕				
MISOMIP		✕					
NORP	✕						
PCN							
Polar CORDEX				✕			
SIMIP		✕					
SORP	✕				✕		

Impacts of Changes in the Mountain Cryosphere (IC-MontC)

Impacts of Changes in the Mountain Cryosphere

CliC and **Mountain Research Initiative (MRI)** will hold joint workshop on high-resolution climate modelling in areas of complex mountain topography, where seasonal snow and ice commonly cover land surface. This workshop is first activity of CliC's IC-MontC working group, which addresses scientific uncertainties associated with loss of mountain cryosphere as anthropogenic climate change continues.

Full Title
SE 3.105: High-resolution climate modeling in mountainous regions

Convener
Meghan Taylor

Co-Conveners
Carolina Adler, **Nikolina Ban**, **Raymond Bradley**, **Emily Collier**, **Lu Li**, **Paola Mercogliano**, **Kristen Rasmussen**, **James Thornton**,

IMC Innsbruck 2025
International Mountain Conference

CliC sea-ice group co-ordination and future plans

- Discussions between our Arctic (ASIWG) and Antarctic (ASPeCt) sea-ice working groups have recognized a need for a new edition of the Field Techniques for Sea Ice Research book to help support sea ice observations leading up to & during 5th IPY. Writing new edition may become future joint activity between ASIWG and ASPeCt as well as the broader sea-ice community.
- ASPeCt and BEPSII co-organised IPY-5 Planning Workshop on polar atmosphere and climate. Focus on identifying current state and gaps in polar atmosphere-ice-ocean research with respect to chemical, biogeochemical and physical processes in the Arctic and Antarctic and links to climate change. 21 ECRs helped run workshop. Identified priority research areas: water cycle; atmospheric composition; biogeochemistry and ecosystems; and energy budget. Detailed synthesis and overview concept to be published as white paper this year.
- E. Hanna discussing with Petra Heil how to better connect CliC's sea-ice groups and run overarching session at CliC Open Science Conference in February 2026.

Recent CliC-led papers in *Science*

Feb 7, 2025: The Polar Special Issue of *Science*, coordinated in part by CliC, is available now. Thank you and congratulations to all the authors who participated!

Reviews coordinated by CliC inside the Special Issue:

Antarctica in 2025: Drivers of deep uncertainty in projected ice loss

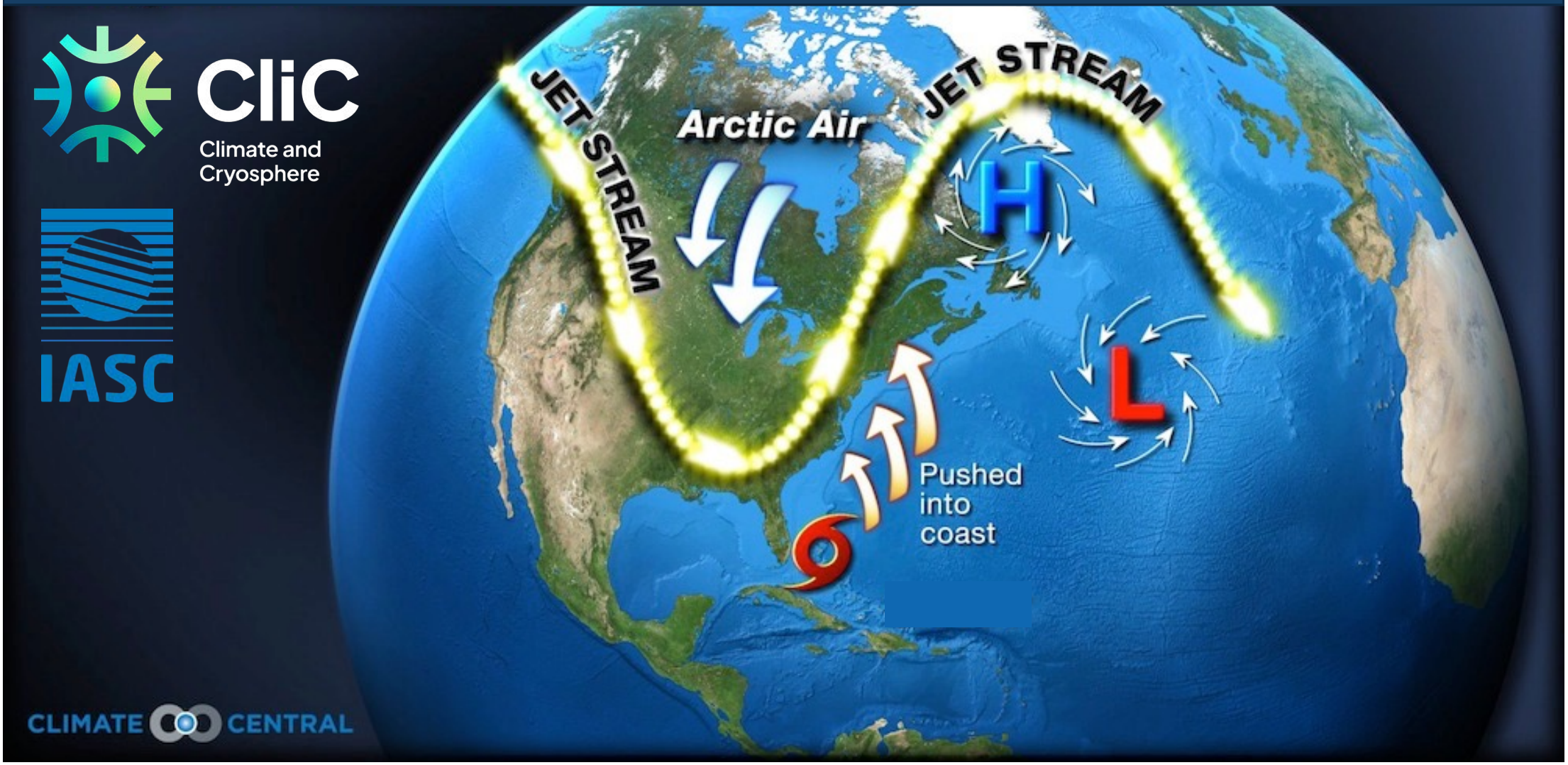
Authors: Helen Amanda Fricker, Benjamin K. Galton-Fenzi (CliC SSG), Catherine Colello Walker, Bryony Isabella Diana Freer, Laurie Padman, Robert DeConto (Ex Officio CliC SSG)

Disappearing landscapes: The Arctic at +2.7°C global warming

Authors: Julienne C. Stroeve, Dirk Notz (SIMIP), Jackie Dawson, Edward A. G. Schuur (Permafrost Carbon Network), Dorthe Dahl-Jensen, Céline Giesse

Arctic-Mid Latitude Linkages

"Warm Arctic-Cold Continents"



Dec. 2024 paper from Arctic-midlatitude climate Linkages CliC-IASC workshop

IOP Publishing Environ. Res.: Climate 3 (2024) 042004 https://doi.org/10.1088/2752-5295/ad93f3

ENVIRONMENTAL RESEARCH
CLIMATE

TOPICAL REVIEW

Influence of high-latitude blocking and the northern stratospheric polar vortex on cold-air outbreaks under Arctic amplification of global warming

Edward Hanna[1,*], Jennifer Francis[2], Muyin Wang[3], James E Overland[4], Judah Cohen[5], Dehai Luo[6], Timo Vihma[7], Qiang Fu[8], Richard J Hall[9], Ralf Jaiser[10], Seong-Joong Kim[11], Raphael Köhler[10], Linh Luu[1,15], Xiaocen Shen[12], Irene Erner[7], Jinro Ukita[13], Yao Yao[6], Kunhui Ye[14], Hyesun Choi[11] and Natasa Skific[2]

1 Department of Geography and Lincoln Climate Research Group, University of Lincoln, Lincoln, United Kingdom
2 Woodwell Climate Research Center, Falmouth, Massachusetts, United States of America
3 University of Washington & Pacific Marine Environmental Laboratory (PMEL), Seattle, United States of America
4 NOAA/PMEL, Seattle, United States of America
5 Atmospheric & Environmental Research/Massachusetts Institute of Technology, Lexington/Cambridge, MA, United States of America
6 Key Laboratory of Earth System Numerical Modelling and Application, and CAS Key Laboratory of Regional Climate-Environment for Temperate East Asia, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, People's Republic of China
7 Finnish Meteorological Institute, Helsinki, Finland
8 University of Washington, Seattle, United States of America
9 Department of Physics, Imperial College London, London, United Kingdom
10 Alfred Wegener Institute, Potsdam, Germany
11 Korea Polar Research Institute, Incheon, Republic of Korea
12 Department of Meteorology, University of Reading, Reading, United Kingdom
13 The University of Tokyo, Kashiwa, Japan
14 Atmospheric, Oceanic and Planetary Physics, University of Oxford, Oxford, United Kingdom
15 Vietnam Institute of Meteorology, Hydrology and Climate Change, Hanoi, Vietnam
* Author to whom any correspondence should be addressed.

E-mail: channa@lincoln.ac.uk

Keywords: blocking, Arctic amplification, polar vortex, global warming, cold air outbreaks

Supplementary material for this article is available online

OPEN ACCESS

RECEIVED 17 July 2024
REVISED 12 November 2024
ACCEPTED FOR PUBLICATION 18 November 2024
PUBLISHED 10 December 2024

UNIVERSITY OF LINCOLN

RESEARCH STUDY WITH US STUDENT LIFE BUS

Call for 'Bold and Rapid Action' as New Study Links Arctic Warming with Severe Cold Spells in UK and Europe

11 DECEMBER 2024

WRITTEN BY: HANNAH MCGOWAN

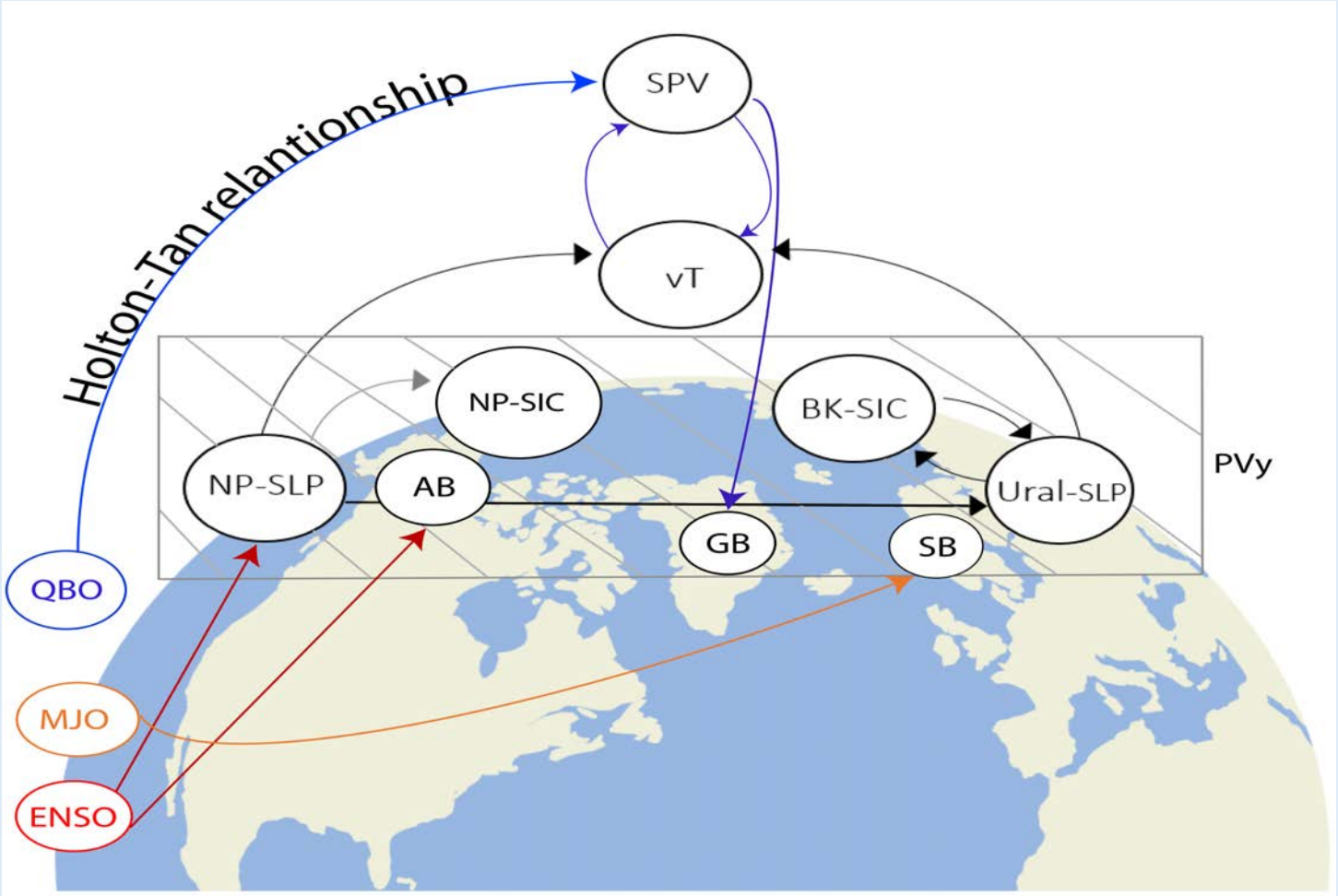
A team of scientists, led by a climate expert from the University of Lincoln, UK, says that continued rapid warming in the Arctic may be linked to severe cold-air outbreaks in the UK and nearby parts of Europe as well as North America and Asia.

Homepage > Research > **Call for 'Bold and Rapid Action' as ...**

The study finds that, paradoxically, despite abnormal warmth globally and especially in the Arctic, these outbreaks may continue and perhaps become more frequent across the Northern Hemisphere. The research suggests that the apparent paradox is in part

A global network for Arctic-midlatitude climate linkages

Hanna et al. 2024, adapted and extended from Kretschmer 2020



AB = Alaska blocking
BK = Barents-Kara Seas
GB = Greenland blocking
NP = North Pacific
PVy = meridional gradient of potential vorticity
SB = Scandinavia blocking
SIC = sea-ice concentration
SLP = sea-level pressure
SPV = stratospheric polar vortex
vT = eddy heat flux

Polar Early Career World Summit

- CliC co-sponsored the **Polar Early Career World Summit (PECWS)** held March 22-24, 2025, in Boulder, Colorado, USA, alongside the International Conference on Arctic Research Planning (ICARP) IV and the Arctic Science Summit Week (ASSW).

- **Objectives included:**

Shape polar research priorities and the next IPY

Provide input into ICARP IV and the development of the 5th International Polar Year (2032-33)

Strengthen polar early career networks and connections

Discuss the past, present and future of polar early career networks and strengthen them through in-depth discussions, relationship-building, and developing formats of collaboration

Amplify voices of the polar early career community

Conversations at the summit will be synthesized into multiple output formats to reach a broad audience and influence polar science policy and decision-making processes

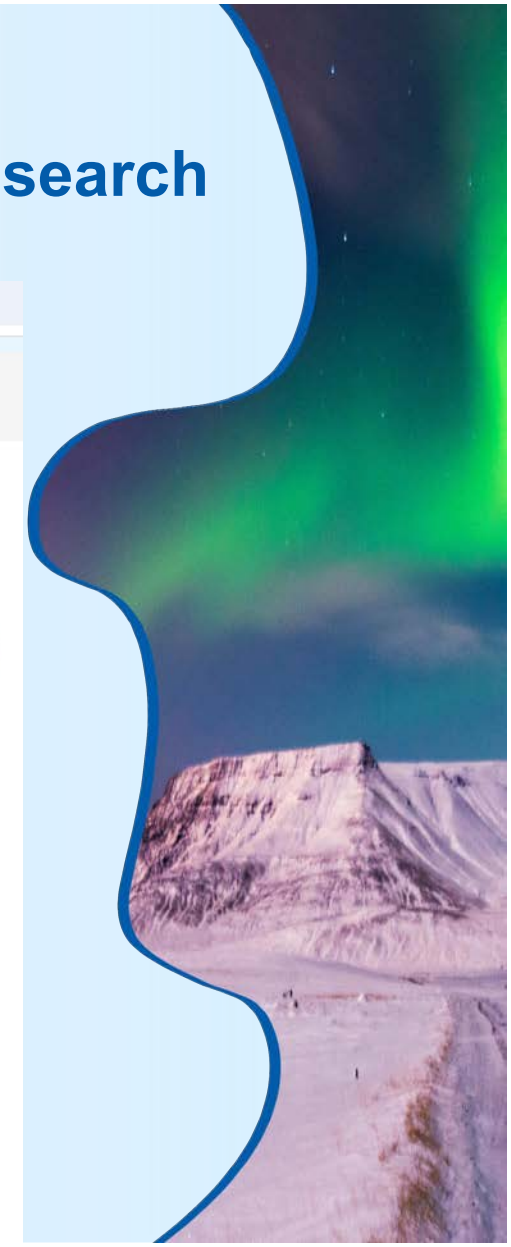
- **PECWS organized by:**

APECS Association of Polar Early Career Scientists

PSECCO Polar Science Early Career Community Office

ECOP Early Career Ocean Professionals

International Polar Year (IPY) & UNESCO Decade for Action on Cryospheric Research



climate-cryosphere.org/ipy/

International Years and Decades

Climate and Cryosphere is part of several international efforts to advance cryospheric science and research.

Choose a project below or scroll to learn more. If you have any questions, comments, or ideas regarding CliC's participation in any of the following initiatives, please reach out to us at info@climate-cryosphere.org.

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Decade of Ocean Science

UN Decade of Action for Cryospheric Sciences 2025–2034

Decade of Action for Cryospheric Sciences

2025 International Year of Glaciers' Preservation

International Year of Glaciers' Preservation

INTERNATIONAL POLAR YEAR 2032–2033

International Polar Year

Climate and Cryosphere

Open Science Conference

Wellington, New Zealand • 9–12 February 2026

clic2026.com

CliC
Climate and Cryosphere

CliC OSC 2026 Current Partners

Platinum Partners
$50,000 contribution

WCRP World Climate Research Programme

SCAR

INSTANT INSTABILITIES & THRESHOLDS IN ANTARCTICA

Te Puna Pātiotio Antarctic Research Centre
Victoria University of Wellington Te Herenga Waka

Gold Partners
$25,000 contribution

KOPRI Korea Polar Research Institute

Silver Partners
$10,000 contribution

NEW ZEALAND TOURISM

Business Events Wellington

IUGG

IAMAS International Association of Meteorology and Atmospheric Sciences

ICCL International Commission on Climate

SAEF Securing Antarctica's Environmental Future
Australian Research Council Special Research Initiative

unesco United Nations Educational, Scientific and Cultural Organization

Bronze Partners
$1,000 contribution

IASC

IACS International Association of Cryospheric Sciences

جامعة خليفة Khalifa University

Additional Partners

IGS

NASA

NSF

University of Massachusetts Amherst

CliC Climate and Cryosphere

CliC OSC 2026 Themes & Topics

The changing cryosphere and climate–cryosphere interactions

- Extreme events, trends and sensitivity to/effect on climate change
- Polar amplification, feedbacks and tipping points
- Bipolar and third pole (mountain glacier) dynamics
- Space and time scales of cryospheric change, drivers and impacts: from seconds through to millennia
- Biogeochemical cycling and changing ecosystems
- Extraterrestrial cryospheres & climates: what can we learn for our own Earth

Advances and knowledge gaps in cryospheric science

- Paleoclimate and future climate projections
- Cryospheric observations and community priorities: IPY-5, Decade of Action for Cryospheric Sciences, Antarctic InSync
- Climate model forcing improvements: what do we need to feed back to the climate science/modelling community
- Social science perspectives and priorities
- Cryospheric processes
- Emerging methods and technologies
- Facilitating the next generation of climate and cryosphere research

Human impacts, adaptations and mitigation

- Cryospheric services and impacts of change on communities
- Co-production and communication of cryospheric science
- Social, economic and policy implications of cryosphere change
- Cryospheric services and geoengineering
- Arts, history, and humanities
- Recreation and tourism
- Hazards and infrastructure
- Archeological insights

CliC
Climate and Cryosphere

Climate and Cryosphere

Open Science Conference

Abstract Submissions are open now!

Deadline: 31 July 2025

clic2026.com/abstracts

CliC
Climate and Cryosphere

Response to JSC's 2024 review of CliC

- We are currently finalising CliC's Strategic Plan for next decade.
- OSC2026 will play a major part in raising CliC's profile
- CliC directly involved in IPY 2032/33 and UNESCO's Decade of Action for Cryospheric Sciences 2025-2034 planning discussions and will showcase these as part of our OSC2026.
- JSC asked us to add sea ice and permafrost expertise to the SSG, and we have submitted proposal to add 2 experts in these area.
- We have started new IC-MONTC mountain cryosphere group and are thinking about potential new human impacts and cross-cutting sea-level activities in tandem with other WCRP and external groups.
- Ongoing review of our existing activities and how to better co-ordinate them.
- Recent (2024/2025) high-profile CliC-led publications in SCIENCE, NATURE REVIEWS and other leading journals, with significant media attention.
- Revitalised SSG and IPO beginning to bear fruit in terms of CliC's known presence and proactive planning at the cryosphere-climate nexus.

Challenges, opportunities & future directions

- We have completed an advanced draft of our new Strategic Plan for next decade, which is currently undergoing final checks & copy-editing.
- Ongoing funding of the US IPO (funded by NSF/NASA) is potential issue (alongside WCRP funding contributions).
- OSC2026 and IPY/Polar Decade will enable concerted focus on Antarctic ice sheet and sea ice dynamics, in collaboration with SCAR INSTANT, with aim to refocus and reframe future direction of Antarctic modelling community, as well as potentially social impacts of cryospheric change.
- We are discussing a potential new Working Group focused on human impacts, to complement existing activities.
- Another idea is for a cross-cutting sea-level activity, in co-ordination with other WCRP and outside groups, that can build on the work of ISMASS (Ice Sheet Mass Balance & Sea-level Expert Group).

CliC Climate and Cryosphere

Contact Us

WCRP

www.climate-cryosphere.org

info@climate-cryosphere.org

@clic_wcrp

@clicwcrp.bsky.social

Climate and Cryosphere International Project Office supported by:

University of Massachusetts Amherst

NSF

NASA