

Climate and Cryosphere Project (CliC) of the World Climate Research Programme (WCRP)

Understanding the changing cryosphere and its climate connections

Fiamma Straneo, James Renwick
Gwen Hamon, Mike Sparrow

GEWEX SSG
25 February – 1 March, 2019
Geneva



www.climate-cryosphere.org

Host

Tromsø
2003 – 2018



Sponsor

Geneva

WMO / UNESCO-IOC / ISC



CliC will have a new host in 2019
(awaiting funding confirmation).

Executive Officer hired as a
consultant to ensure continuity.



= Climate and Cryosphere project

Scientific Steering Group (SSG)

Co-chairs:

James Renwick (2017-2020)

Fiamma Straneo (2018-2020)

International Project Office

Executive Officer (consultant): Gwénaëlle Hamon

WCRP Grand Challenge – Melting Ice and Global Consequences, Lead: CliC, Chair: Tim Naish

- Earth System Model-Snow MIP (ESM-SnowMIP) (tightly linked to Land Surface, Snow and Soil Moisture MIP (LS3MIP))*
- Ice Sheet MIP for CMIP6 (ISMIP6)*
- Marine Ice Sheet-Ocean MIP (MISOMIP)*
- Diagnostic Sea Ice MIP (SIMIP)*
- GlacierMIP
- Permafrost Carbon Network (*part of the Study of Environmental Arctic Change (SEARCH) project*)

* Contributions to CMIP6, the 6th Phase of the Coupled Model Intercomparison Projects (MIP)

Groups, Panels, and Fora

- Polar Climate Predictability Initiative (PCPI) (*joint with SPARC*)
- Southern Ocean Region Panel (*joint with CLIVAR and SCAR*)
- Northern Oceans Region Panel (*joint with CLIVAR*)
- BEPSII - Biogeochemical exchange processes at Sea Ice Interfaces (*joint with SCOR and SOLAS*)
- Antarctic Sea Ice Processes & Climate (ASPeCt) (*joint with SCAR*)
- Technical Committee on Sea Ice Observations
- Arctic Sea Ice Working Group
- Sea Ice & Climate Modelling Forum
- Ice Sheet Mass Balance and Sea Level (ISMASS) (*joint with SCAR and IASC*)
- Permafrost & Climate Modelling Forum

Limited Lifetime Targeted Activities

- Polar Coordinated Regional Downscaling Experiment (Polar CORDEX)
- Earth Observations and Arctic Science Needs (with ESA)
- Linkage Between Arctic Climate Change and Mid-Latitude Weather Extremes

GlacierMIP

A model intercomparison of global-scale glacier models

- Focused on all glaciers in the world outside the ice sheets.
- Provides a framework for a coordinated intercomparison of global-scale glacier mass change models.
- Fosters model improvements and reduce uncertainties in global glacier projections
- Publication on Phase I of GlacierMIP being revised for Journal of Glaciology

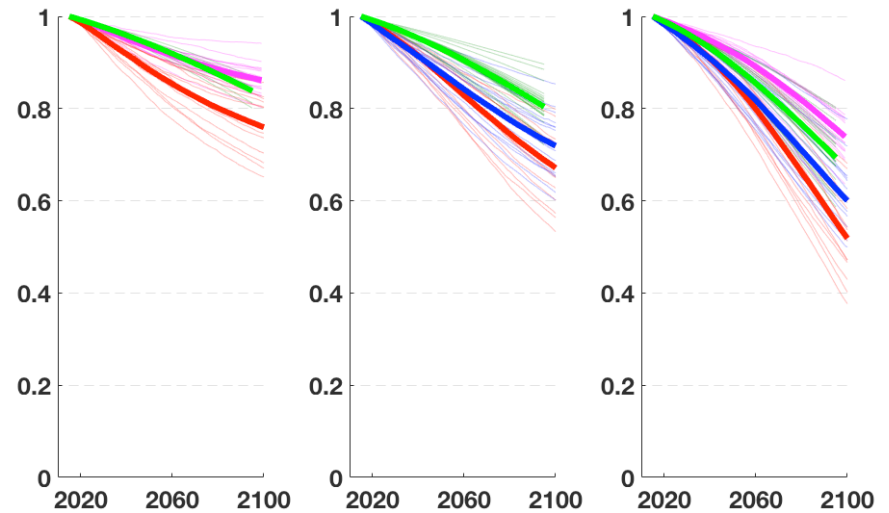


Figure 1: Normalized volume evolution of all glaciers outside the ice sheets for three emission scenarios (left: RCP2.6, middle: RCP4.5, right: RCP8.5) and six different glacier models (colors). Thick lines show multi-GCM means and thin lines individual GCM runs (unpublished).

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The Polar Climate Predictability Initiative (PCPI)

Aims to advance understanding of the sources of polar climate predictability on timescales ranging from seasonal to multi-decadal.

Theme 1 Understanding Past Polar Climate Variations

Theme 2 Reanalyses

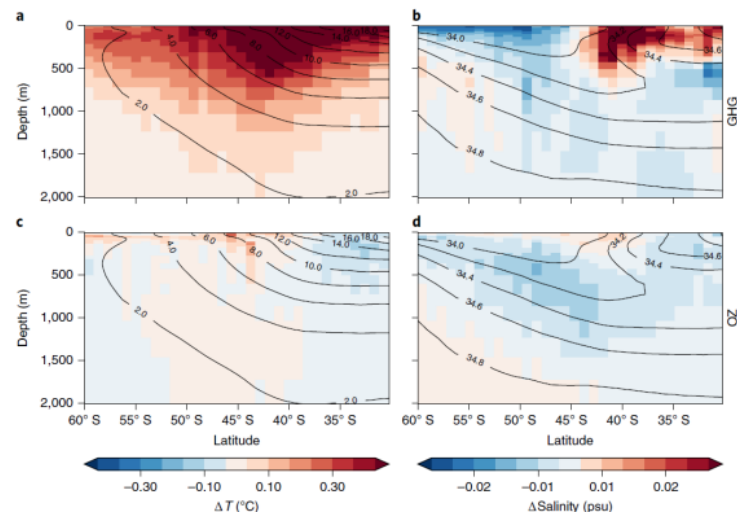
Theme 3 Improve understanding of polar predictability on seasonal to decadal timescales

Theme 4 Assessing Model Performance in Polar Regions

Theme 5 Model Error

Science Highlight.

In a paper co-authored by PCPI leads John Fyfe and Sarah Gille, detection and attribution analysis shows that the observed warming and freshening in the Southern Ocean has primarily been driven by anthropogenic greenhouse gas increases, with a secondary influence of stratospheric ozone depletion.



2018 Highlights

17 workshops

- 430+ participants
- 25+ countries


5 Conference presentations

- CliC presentations
- POLAR18, EGU, AGU+

GoToMeeting

80+ online project meetings

Social Media


 Facebook – ≈2000 likes


 Twitter – ≈3000 followers



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Upcoming CliC Events


 10 April 2019 10:45 am - 11:45 am
[ISMIP6 Workshop at EGU 2019](#)

 11 April 2019 10:45 am - 11:45 am
[ESM-SnowMIP Meeting at EGU2019](#)


 22 April 2019 - 26 April 2019
[Arctic Sub-arctic Ocean Fluxes \(ASOF\)](#)

 11 May 2019 - 15 May 2019
[MISOMIP Writing Workshop](#)

 13 May 2019 - 17 May 2019
[BEPSII Workshop](#)

 17 June 2019 - 19 June 2019
[9th International Workshop on Sea Ice Modelling, Data Assimilation and Verification](#)

 26 June 2019 - 28 June 2019
[Workshop on CMIP6 21st century projections and predictions for Antarctica and the Southern Ocean](#)

 8 July 2019 - 18 July 2019
[PCPI Meeting at the 27th IUGG General Assembly](#)

Coming in 2019...



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- ~18 CliC focussed workshops
 - Focussing on aims outlined in Action Plan
- Sponsor of major conferences:
 - ESA Living Planet Symposium, 13-17 May 2019, Milan, Italy
 - IGS Sea Ice Symposium, 18-23 August 2019, Winnipeg, Canada
- Sponsor of major school:
 - MOSAiC School, 15 September – 26 October 2019, onboard
- Input to other major conferences:
 - EGU General Assembly, 7-12 April 2019, Vienna, Austria
 - 27th IUGG General Assembly, 8-18 July 2019, Montreal, Canada
 - OceanObs'19, 16-20 September 2019, Hawaii, USA
 - AGU Fall Meeting, 9-13 December 2019, San Francisco, USA

Cross cutting with GEWEX...



Changes in the cryosphere

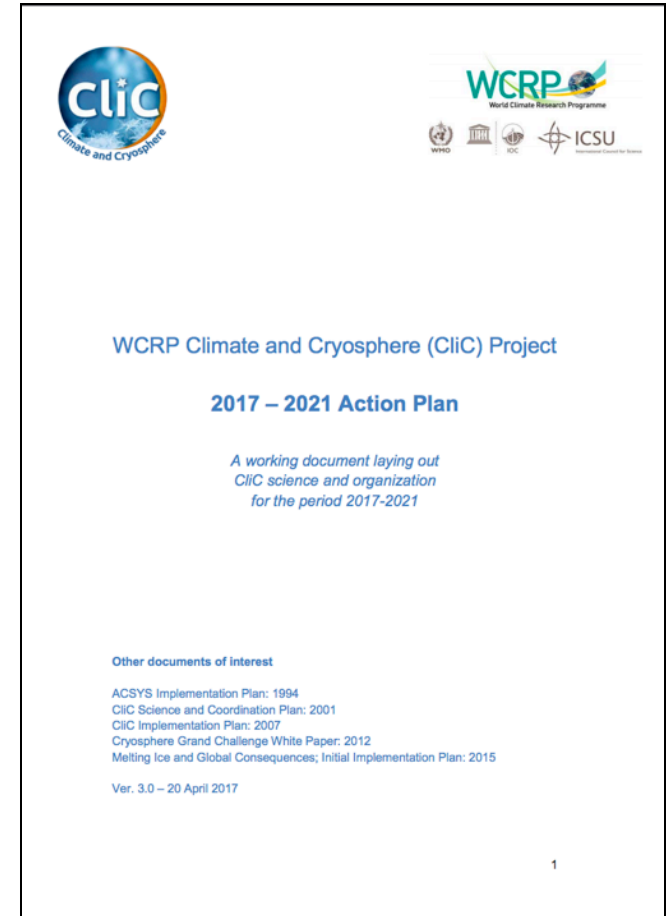


Changes in the water/energy cycle

CliC Science (Action) Plan

Four General Science Themes

- **Observing** the Cryosphere
- Physical **Processes** and Dynamical Understanding
- **Modelling** the Cryosphere
- Global and Regional **Prediction** and Predictability



15 pages 😊



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Cross cutting with GEWEX...



Observing the Cryosphere:

- What are the magnitudes, patterns and rates of change in terrestrial cryosphere regimes on seasonal-to-century time-scales? What are the associated changes in the *water cycle* and carbon cycles?

Physical Processes and Dynamical Understanding:

- What is the role of terrestrial cryospheric processes in the spatial and temporal variability of the *water, energy* and carbon cycles of cold climate regions?

Modelling the Cryosphere:

- How can interactions between terrestrial cryospheric processes and *water, energy* and carbon cycles of cold climate regions best be parameterized in models, over a range of time and space scales?



Areas of possible future cooperation ?



- **High Mountains**

e.g. WCRP input to WMO High Mountain Summit... *science* requirements in high mountains for example GEWEX/CliC to lead on a WCRP wide initiative on ***water availability in mountain regions*** ?

- **Polar Regions**

e.g. Relating changes in cryosphere in polar regions to changes in water/energy cycle... Build on GEWEX lead of Arctic Observation and Reanalysis Integrated System (ArORIS)

- **Others e.g. Earth's Energy Imbalance**

Building on from last workshop...GEWEX, CLIVAR lead...CliC and SPARC input.

- ...

CliC Communications

Web



Facebook



Newsletter



The Cryosphere and Atmospheric Chemistry (CATCH)

Coordinated by Thorsten Berke-Krauch (Switzerland), Annie Thomas (France), and Markus M. Frey (UK) (CATCH website)



Leadership team: Kent Pratt (USA), Jon Abbatt (Canada), Daisuke Nomura (Japan), Tom Douglas (USA), Paul Shepson (USA), V. Faye Michael (USA), Anna Jones (UK), Carl Ammann (USA), Kiseo Kim (Korea), Megan Wiles (Canada), Jennifer Murray (Canada), Franco Menni (USA), James Francis (UK), Manuel Delgado (Spain), Alvaro Sola (Spain), Cristina Frazer (Spain)

Earth's cold regions such as the Poles, the upper troposphere, and high mountain areas are an integral part of atmospheric chemistry. A new activity within the International Global Atmospheric Chemistry (IGAC) project co-sponsored by the Surface Ocean-Lower Atmosphere Study (SOLAS) focuses on natural processes specific to these cold regions.

Both IGAC and SOLAS provide networks to bring international scientific across disciplines together. IGAC focuses on enhancing fundamental research of atmospheric chemistry processes. SOLAS focuses on processes at the ocean-atmosphere interface. They are both a part of Future Earth and achieve their goals through sponsored activities. One recent activity is CATCH, the Cryosphere and Atmospheric Chemistry.

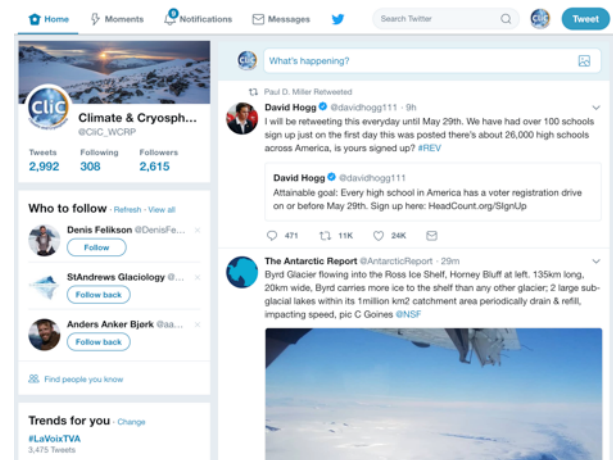
CATCH aims to build a scientific network to facilitate atmospheric chemistry research within the international community with a focus on the chemistry, biology, and physics of the natural environment in cold regions. CATCH held its first workshop in Paris in spring 2017. The key main objectives of the workshop were 1) to foster future collaborative work by highlighting cross-disciplinary research questions and 2) to identify future research needs and opportunities.



The cold and Polar regions are currently undergoing significant change with implications for regional and global climate, ecosystems, and society. CATCH involves focuses on the following underlying natural chemical, biological and physical processes, and feedbacks:

- How aerosols are formed and processed in cold regions;
- How cold region aerosols impact cloud properties;
- Feedbacks between climate change and atmospheric chemistry that are determined by changes in the cryosphere;
- How the ice core record can be used to understand global environmental change.

Twitter




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Thank you



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