



# Climate and Cryosphere (CliC) and GC on Melting Ice & Global Consequences 40th Session of the WCRP Joint Scientific Committee

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*May 2019*

*Geneva, Switzerland*



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# Progress and achievements

## 2018 Overview

### 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

### Upcoming CliC Events

-  22 April 2019 - 26 April 2019  
 22 Arctic Sub-arctic Ocean Fluxes (ASOF)
-  13 May 2019 - 17 May 2019  
 13 2019 ESA Living Planet Symposium
-  13 May 2019 - 17 May 2019  
 13 BEPSII Workshop
-  17 June 2019 - 19 June 2019  
 17 9th International Workshop on Sea Ice Modelling, Data Assimilation and Verification
-  26 June 2019 - 28 June 2019  
 26 Workshop on CMIP6 21st century projections and predictions for Antarctica and the Southern Ocean
-  8 July 2019 - 18 July 2019  
 8 GlacierMIP Meeting at the 27th IUGG GA
-  8 July 2019 - 18 July 2019  
 8 Polar Modelling (Polar CORDEX) Session (M05) at the 27th IUGG GA
-  8 July 2019 - 18 July 2019  
 8 PCPI Meeting at the 27th IUGG GA

# Progress and achievements

## Melting Ice and Global Consequences Grand Challenge (3 Themes)

1. *Shrinking of mountain glaciers and large ice sheets with consequent sea-level rise and impacts on water resources;*

- **Ice Sheet Model Intercomparison Project for CMIP6 (ISMIP6)**
- **Marine Ice Sheet Ocean Model Intercomparison Project (MISOMIP)**
- **GlacierMIP – A model intercomparison of global-scale glacier models**
- **Ice Sheet Mass Balance and Sea Level (ISMASS)**

2. *Thawing permafrost and the potential for enhanced natural emissions of carbon dioxide and methane to the atmosphere;*

- **Permafrost Carbon Network (PCN)**
- **Permafrost Modeling Forum**

3. *Declining coverage of sea ice and snow, which will affect marine and ground transportation across the Arctic.*

- **Earth System Model-Snow Model Intercomparison Project (ESM-SnowMIP)**
- **Sea Ice Model Intercomparison Project (SIMIP)**
- **Arctic Sea Ice Working Group (ASIWG)**
- **Biogeochemical Exchange Processes at Sea Ice Interfaces (BEPSII)**
- **Antarctic Sea Ice Processes and Climate (ASPeCt)**



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# Progress and achievements

## GC –Theme 1, aligns with new SCAR strategic research programme “Antarctic Ice Sheet Dynamics and Global Sea-level”

### AIM

- Quantify the Antarctic ice sheet contribution to past and future sea-level change, from improved understanding of climate, ocean and solid Earth interactions and feedbacks
- so that decision-makers can better anticipate and assess the risk in order to manage and adapt to sea-level rise and evaluate mitigation pathways.*



XXXV SCAR Delegates Meeting

Davos, Switzerland, 25-26 June 2018

**SDM** 14c  
Agenda Item: 4.2.3  
Person Responsible: T Naish et al.

### Proposed Scientific Research Programme Planning Group: Antarctic ice sheet dynamics & global sea level

Report Authors  
Tim Naish (New Zealand) and Organising Group

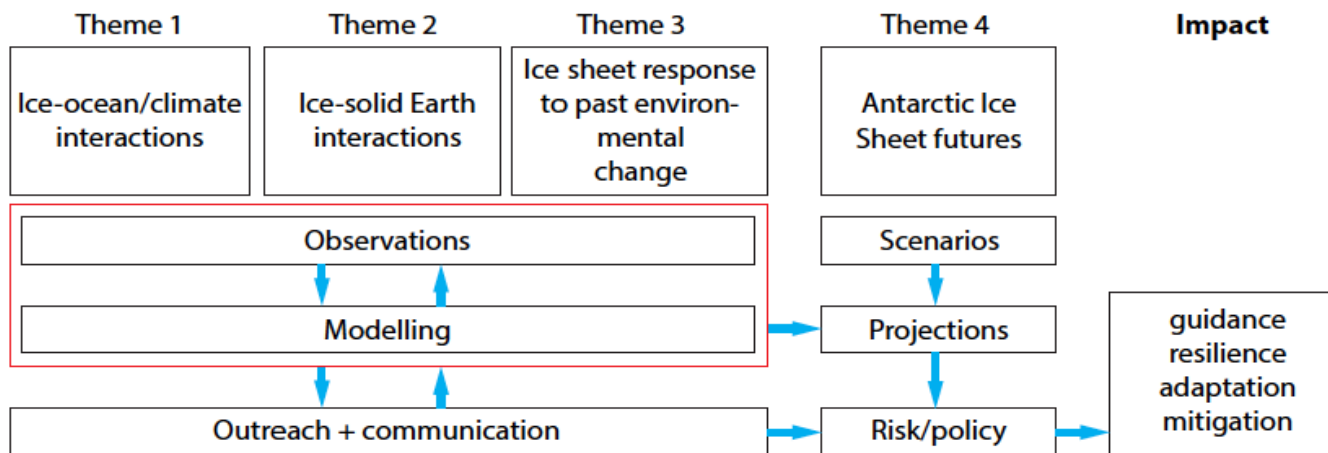


Figure 1. Proposed programme structure

# Progress and achievements

## Modeling work for CMIP6 and support for the GC on Melting Ice & Global Consequences

- **ESM-SnowMIP** - Earth System Model-Snow Model Intercomparison Project  
Site-scale simulations at snow measurement sites carried out and currently being published as part of an overview paper.
- **SIMIP** - Sea Ice Model Intercomparison Project  
Further worked on preparing the scientific analyses. Based on the resulting data call, upcoming CMIP6 simulations will provide unique insights into the evolution of the polar sea-ice cover.
- **ISMIP6** - Ice Sheet Model Intercomparison Project  
Analysis of the initMIP-Antarctica and ABUMIP model simulations. Developing process-based projections of the sheets' contribution to future sea level.
- **MISOMIP** - Marine Ice Sheet-Ocean Model Intercomparison Project  
Designing/testing the MISOMIP experiments. Experiments defined in a peer-reviewed document. Comparison of MISOMIP results between models that have completed the experiments. Coordinated idealized and regional realistic experiments. Upcoming papers intercomparing results from MISOMIP.
- **GlacierMIP** - Glacier Model Intercomparison Project  
Publication on Phase I of GlacierMIP being revised for Journal of Glaciology
- **PCN** – Permafrost Carbon Network  
Publication of the 2nd permafrost model intercomparison project led by core members of the PCN. Synthesis of an observational time series of ecosystem-atmosphere carbon exchange from the 1990s to the present day.



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# Progress and achievements

## CLIC Targeted Activities and Groups

- **Arctic Sea Ice Working Group (CASIWG)**  
Contribution to definition of observational protocols for sea ice measurements during the MOSAiC field campaign. Contribution to the Sea Ice Section of the Arctic Report Card and to the SIPN. Ship-based sea ice obs. made on science and tourist cruises using the ASSIST software package.
- **Biogeochemical Exchange Processes at Sea Ice Interfaces (BEPSII)**  
Meeting and Session at POLAR 2018. 5-year plan finalized. BEPSII Special feature in Elementa: Science of the Anthropocene finalized (18 accepted contributions).
- **Antarctic Sea ice Processes and Climate (ASPeCt)**  
ASPeCt's data acquisition strategy endorsed for inclusion in YOPP. Data collected by cruises into the ice zone in 2018-2019 to be contributed to the YOPP archives. ASPeCt session on Antarctic sea ice processes and ice shelves status at POLAR2018.
- **Polar Climate Predictability Initiative (PCPI)**  
Currently aiming at laying the ground for further activity, through further connections with WWRP's Polar Prediction Project, bringing in ECRs into the initiatives, and adding to the leadership
- **Ice Sheet Mass Balance and Sea Level (ISMASS)**  
Nature Climate Change article on how ice sheets and sea levels will change if global warming is limited to 1.5° C. Workshop and Steering Group meeting events at POLAR2018.



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# Progress and achievements

## CLiC Targeted Activities and Groups

- **SCAR/IASC/CLiC Southern Ocean Region Panel (SORP)**  
Meeting and session organized at POLAR 2018. Extensive participation in international research coordination and collaboration with several relevant programmes, including SOOS, OOCIP and the YOPP-SH.
- **CLIVAR /CLiC Northern Oceans Region Panel (NORP)**  
1<sup>st</sup> Session at POLAR2018. NORP organized into 6 task teams: Arctic ocean reanalyses, Arctic ocean in Arctic amplification, Arctic midlatitude linkages, Anthropogenic and natural forcing, Model errors in Arctic projections, and Greenland ice sheet – ocean interactions.
- **Polar CORDEX**  
Pre-MOSAIC model intercomparison study. Annual Meeting in Warsaw in October.



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# Future plans

## Coming in 2019 . . .

- ~18 CliC focussed workshops
  - Focussing on aims outlined in CliC 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



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# Future plans

## Modeling work for CMIP6 and support for the GC on Melting Ice & Global Consequences

- **ESM-SnowMIP** - LS3MIP global simulations will be run as a part of the CMIP6 exercise, followed by ESM-SnowMIP runs in the following year. In parallel, a more detailed paper on ESM-SnowMIP site simulations, and a paper describing the site data for future model developments are planned.
- **SIMIP** - Most CMIP6-SIMIP model results should be available. Close monitoring of the availability of the data and guide its analysis through the SIMIP sub groups. High-profile papers based on SIMIP output will be submitted for inclusion into the IPCC AR6.
- **ISMIP6** - Publications of the initMIP-Antarctica and ABUMIP results. Preparation of forcing dataset for ice sheet models and ice sheet model simulations targeting IPCC AR6. Workshops at EGU, IUGG, and AGU.
- **MISOMIP** - Modeling goal: Provide a set of reference simulations and solutions for model development for future researchers and models. Science goal: Focus regionally and on processes relating to coupling. Doing perturbations to explore uncertainties or processes.
- **GlacierMIP** - Publication on Phase I of GlacierMIP in Journal of Glaciology
- **PCN** - 9th PCN Annual Meeting at AGU Fall Meeting



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# Future plans

## CLiC Targeted Activities and Groups

- **CASIWG** - Continue efforts with MOSAiC, Arctic Report Card, Sea Ice Prediction Network, ASSIST software, citizen scientist outreach. ASIWG meeting planned for Aug 2019 at IGS Sea Ice Symposium.
- **BEPSII** - Currently designing future activities, e.g. analysis on Arctic sea-ice biogeochemical response to climate change. Expert contribution to ongoing discussions on the design of biogeochemistry and ecosystem components of MOSAiC. Model intercomparisons (CMIP6, FAMOS, ...).
- **ASPeCt** - Session and meeting at 2019 IGS Sea Ice Symposium. Workshop at SCAR 2020.
- **Polar Climate Predictability Initiative (PCPI)** - Develop plans for an Arctic Workshop on understanding past climate variations.
- **Ice Sheet Mass Balance and Sea Level (ISMASS)** - Submit a review paper to Earth Science Reviews based on the June 2018 Davos workshop.
- **SCAR/IASC/CLiC Southern Ocean Region Panel (SORP)** -SORP members at OceanObs'19 to highlight advances in understanding SO climate, promote coordinated SO research and synergies between observing and modeling communities: physical oceanography, cryosphere research, atmospheric science and biogeochemical oceanography. SORP-14 to be held at SCAR 2020 in Hobart.
- **CLIVAR /CLiC Northern Oceans Region Panel (NORP)** -Workshops and talks at upcoming conferences. White paper on sea-ice ocean metrics for lower-latitude-Arctic interactions for CMIP diagnostics.
- **Polar CORDEX** -Arctic: Pre-MOSAiC model intercomparison study and preparation for MOSAiC modeling participation. Polar region: Contribution to the IPCC AR6 Regional Atlas for future projections



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# Links to the WCRP Strategic and Implementation Plans

## 1. Fundamental understanding

- a. Strong need for underlying observations: Glacier mass balance, sea ice thickness, snow cover,...
- b. Understanding linkages between cryosphere components and between cryosphere and other climate system components (including biosphere)
- c. Modelling: interactive ice sheets in ESMs, sea ice prediction; MIPs

## 2. Near-term prediction

- a. Seasonal sea ice, snow cover, glacier mass balance...

## 3. Future evolution (longer term)

- a. Ice sheet behaviour and future sea level
- b. Cryospheric tipping points

## 4. Bridging climate science and society

- a. Regional variability & change - CORDEX
- b. Impacts & vulnerability: Glaciers and water availability, ice sheets and sea level rise
- c. Changing cryosphere and social impacts: traditional lifestyles, sense of place,...
- d. Strong links to regional policy needs e.g. Arctic Council and Antarctic Treaty requirements



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# Emerging issues

## Infrastructure issues

- Cryosphere community has expanded rapidly → CliC's network has expanded across
  - All cryosphere domains
  - Geographically throughout the Polar Regions and high mountain areas
- Important that CliC continues to partner and work with wider community
  - Many complimentary research activities led in other organisations
- CliC to stay focused on leading climate and cryosphere research
  - Find synergies with other related programs, both within and outside of WCRP
  - Avoid duplicating efforts of others

## Project Office

- Based at Norwegian Polar Institute until December 2018. Executive Officer hired as consultant by WMO to ensure continuity until CliC moves to a new office (provisionally September 2019; awaiting outcomes of grant applications)



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