

# CliC: Climate and Cryosphere

G. Flato & G. Krinner (co-Chairs)  
J. Baeseman (Director)

JSC-35 – Heidelberg, Germany 30/June-4/July



# Highlights

- New co-Chair: Gerhard Krinner (France)
- Several new targeted activities launched
- Draft 'CliC Action Plan' developed following discussion at SSG meeting
- Activity planning integrates Cryosphere Grand Challenge
  - Hosted grand challenge planning workshop in October
- Several productive meetings/workshops organized
- Ongoing effective collaboration with IASC and SCAR





# CliC Structure

## Scientific Steering Group

G. Flato and G. Krinner,  
Co-Chairs

## ICPO

J. Baeseman, Director  
*Hosted by Norwegian Polar Institute*

### Limited Lifetime Targeted Activities

(Core and Grand Challenge)

- Arctic Freshwater Synthesis
- Antarctic Ice Sheet / Ocean Interactions
- ESM Snow Model Intercomparison
- ESM Ice Sheet Model Intercomparison
- Polar CORDEX Analysis / Arctic Regional Climate Scenarios
- Polar Jet Stream Variability and Extremes
- Improved Greenland Mass Balance Estimation
- Carbon cycle feedbacks in a changing Arctic climate
- *Glacier volume change monitoring*
- *Interactions between cryospheric elements*

## ASPeCt

*Joint with  
SCAR*

## Arctic Sea Ice Working Group

## ISMASS\*

*Joint with SCAR  
and IASC*

## Permafrost Carbon Network

*Joint with IASC*

Sea Ice and  
Climate Modelling  
Forum

## Polar Climate Predictability Initiative (PCPI)

*Joint with SPARC*

Permafrost and  
Climate Modelling  
Forum

- Permafrost Research Priorities (with IPA)
- Southern Ocean Satellite Requirements



[www.climate-cryosphere.org](http://www.climate-cryosphere.org)

*\*ISMASS = Ice Sheet Mass Balance and Sea Level*

# Notes:

- the “*Climate and Cryosphere*” (CliC) core project, and the “*Cryosphere in a Changing Climate*” grand challenge, are obviously overlapping.
  - Many of the topics raised at the CliC SSG meeting in 2013 (which led to the development of some of the ‘targeted activities’), were reiterated at the Grand Challenge workshop (despite limited overlap in attendees).
  - Some of the targeted activities identified at the GC workshop have subsequently been integrated into CliC activity planning.
- In our view, such integration is vital to avoid duplication, and to minimize organizational overhead.
- There are also evident overlaps/connections/intersections between the cryosphere and the sea-level grand challenges, but also fairly clear lines of natural division that we will exploit to clarify responsibilities.
- PCPI should also be viewed as an integral component of the cryosphere grand challenge.





# Notes, cont' d:

- Connection to 'modelling' has been a central theme of past two CliC SSG meetings and resulting Action Plan.
- Targeted activity on polar CORDEX.
- New targeted activities on snow modelling, ice sheet modelling, and modelling Antarctic ice shelf / ocean interactions.
- Sea-ice and climate modelling forum established to promote communication and coordination amongst those involved in sea-ice component of Earth System models -- development and evaluation.
  - Producing a community-based CMIP6 output request
  - Developing recommendations for sea-ice model evaluation and observational data
  - Coordinating further analysis of CMIP5 output, aiming for a review paper



## 2013 meetings:

### [Amundsen Sea Low Workshop for PCPI Initiative](#)

5-6th December, University of California, Los Angeles ([UCLA](#))

### [Polar Jet Stream 2013](#)

13-15 November, Reykjavik, Island

### [PALSEA 2013 Workshop: Estimating rates and sources of sea-level change during past warm periods](#)

21-24 October, Rome, Italy

### [WCRP Cryosphere in a Changing Climate Grand Challenge](#)

16-18 October, Tromsø, Norway

### [ISMAS Steering Committee Meeting](#)

7 October, Sheffield, UK

### [Antarctic Ice Rises](#)

26 - 29 August....in....Tromsø, Norway

### [Sea Ice Modeling and Observing Workshop](#)

5 - 7 June....in....Tromsø, Norway





2014 meetings (so far):

**Workshop on Understanding Linkages Between Different Elements of the High-Latitude Cryosphere – How Important Are They?**

14 March 2014 (afternoon only)

IGS Sea Ice Symposium Venue, C3, Hobart

**2014 ASPeCt and Arctic Sea Ice Working Group Meetings**

10-16 March 2014 - Hobart, Australia

**THAW 2014 - THERMOKARST Aquatic ecosystems Workshop**

12-15th March 2014 - Quebec City, Quebec, Canada

**10th session of the CliC Scientific Steering Group (SSG)**

17-20th of February - Geneva, Switzerland

**DUE Permafrost**

11-13th of February Frascati, Italy

New database  
being developed...

Several more meetings to be held this summer and fall ...



## Polar CORDEX

- Antarctic
- Arctic
- Meetings
- Downloads

## Polar CORDEX

Polar-CORDEX (Coordinated Regional Downscaling Experiment - Arctic and Antarctic Domains) is part of the [international CORDEX initiative](#).

CORDEX is a WCRP-sponsored program to organize an international coordinated framework to produce an improved generation of regional climate change projections for input into impact and adaptation studies. The Polar CORDEX activities are coordinated through CliC.

Currently, the core of Polar-CORDEX consists of regional climate model simulations over the Arctic, with hindcast (ERA-Interim and GCM-driven historical simulations) and scenario (GCM-driven rcp4.5, rcp8.5 simulations) simulations are conducted. For an overview of Arctic CORDEX activities go to: [activities/targeted/polar-cordex/arctic](#). This effort is now expanding to include the Antarctic region as well. For an overview of Antarctic CORDEX activities go to: <http://www.climate-cryosphere.org/activities/targeted/polar-cordex/antarctic>.

Points of contact:

[John Cassano](#), University of Colorado, USA

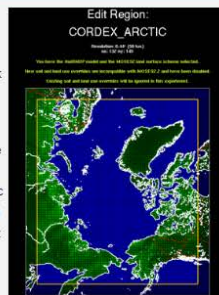
[Annette Rinke](#), Alfred Wegener Institute, Germany

## Mailing List

To help facilitate communication between people interested in regional downscaling of climate models in the Arctic and Antarctic, we have created an email list that anyone can join. It is meant to be a discussion platform to share ideas, progress updates, ask questions, and more.

If you are interested in joining the Polar CORDEX email list, or would like to change your settings, please contact the [CliC IPO](#), and refer to the Polar CORDEX list in the subject line.

To send an email to the group, use the email address: [polar-cordex@climate-cryosphere.org](mailto:polar-cordex@climate-cryosphere.org).



## CliC's contribution to CORDEX and the WGRC

## Next Polar CORDEX Meeting 17 June in Lund, Sweden

Published on Thursday, 08 May 2014 12:17

The Polar CORDEX meeting will be held on June 17, 2014, from 14:00 to 15:00 during the 3rd Lund Regional-scale Climate Modelling Workshop, 21st Century Challenges in Regional Climate Modelling, Lund, Sweden, 16 - 19 June 2014 (<http://www.baltex-research.eu/RCM2014/>)

For more information on the meeting, please contact [Annette Rinke](#)

For more information on Polar CORDEX visit: <http://www.climate-cryosphere.org/activities/targeted/polar-cordex>

For more information on the Century Challenges in Regional Climate Modelling: <http://www.baltex-research.eu/RCM2014/index.html>







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## News

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#### Cryosphere Community News

#### Cryosphere in the Media

#### CliC Newsletter Archive

## Workshop Announcement: CliC Sea ice and Climate Modeling Forum Workshop on large-scale sea-ice simulations

Published on Thursday, 12 June 2014 07:05

Sea ice and Climate Modeling Forum Workshop on large-scale sea-ice simulations September 26th, University of Reading, UK

This one-day workshop brings together users and developers of sea-ice models to start a joint effort for improving sea-ice models. We will discuss the analysis of sea-ice biases in CMIP5 models, determine the most pressing needs for model development, identify the most helpful observational data, and compile a list of the most useful sea ice variables to be saved for CMIP6. The workshop is the first in a series of planned activities from the Sea ice and Climate Modeling Forum, which is a WCRP-CliC initiative that aims at improving and better understanding large-scale sea-ice simulations by coordinating a joint effort of the international sea ice modeling community. Following a few short plenary talks, the workshop will consist of breakout group and discussion sessions. For further information about the workshop and to register for it (by June 30th 2014), please go to:

<http://www.climate-cryosphere.org/activities/groups/seaicemodelling>.



This workshop is the final one in a series of related sea ice workshops around that time in central Europe, including

16+17 Sep: 6th IICWG/ICE-ARC workshop on sea ice modeling and data assimilation Toulouse

<http://www.ice-arc.eu/2014/04/16/toulouse-modelling-workshop/>

18+19 Sep: International Sea ice concentration and thickness inter-comparison and evaluation workshop, Hamburg

<http://www.climate-cryosphere.org/meetings/seaice-conc-2014>

22+23 Sep: Arctic sea ice reduction: the evidence, models, and global impacts, Royal Society, London

<https://royalsociety.org/events/2014/arctic-sea-ice/>

24+25 Sep: Arctic sea ice reduction: the evidence, models, and global impacts - further discussion, The Royal Society at Chicheley Hall

<https://royalsociety.org/events/2014/sea-ice-reduction-satellite/>

Please email [Alexandra Jahn, NCAR](#) or [Dirk Notz, MPI for Meteorology](#), if you have any questions.



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## Targeted Activities

Arctic Freshwater Synthesis

Polar CORDEX

Permafrost Research  
Priorities

**ESM-SnowMIP**

Meetings

West Antarctica  
Glacier-Ocean Modelling

Where are they now?

Southern Ocean Satellite  
Data Requirements

## ESM-SnowMIP

Snow is an essential component of the Earth System. As both a permanent and an intermittent component of the cryosphere, it interacts with the atmosphere and the surfaces it covers (land, ice, sea ice) and it is one of the principal sources of feedbacks within the climate system. As an outcome of the [Tromsø 2013 Workshop](#) the WCRP/CliC Initiative for a ESM-SnowMIP intercomparison programme is a contribution to the WCRP Grand Challenge Cryosphere in a Changing Climate. The current strengths and weaknesses of snow models used in ESM and GCM must be assessed in order to provide guidelines for their improvement.

For more information, please contact the steering committee leads [Gerhard Krinner](#) or [Eric Brun](#), or any member of the group: Chris Derksen, Richard Essery, Alex Hall, Helmut Rott, and Matthew Sturm.

## Why a large-scale integrated study of snow in the climate system is timely?

The most well-known positive feedback stems from the albedo contrast between snow-covered and snow-free surfaces. It can lead to a local warming and critically determine the conditions for persistence or decay of permafrost. Undergoing quick changes, snow is also a prominent and powerful indicator of climate change. Relative changes in seasonal snow can be as large as or even stronger than those in sea-ice extent. Last but not least, snow is a critical determinant for water resources in many regions of the Earth.

In spite of this, there are still fundamental knowledge gaps concerning the physical properties of snow and their evolution in time in both seasonal and permanent snow packs, past, present and future trends in snow mass and distribution, and the effects of snow in the Earth System.

There is a clear need to better tie together observational data, remote sensing, and modelling using novel approaches available through WCRP. This is something that has not been tackled before within a large international framework such as under CliC. Field experiments, dataset generation, model development, and process studies need to be done together at a meaningful range of time and spatial scales, and could be complemented by a multi-scale observing and modelling experiment.

Within the Cryosphere in a Changing Climate Grand Challenge, the following targeted actions arising from identified scientific knowledge gaps could prepare and initiate this Snow in the Earth System study.

*Col de Porte snow and  
meteorology field site,  
French Alps.*

- Y. Lejeune / Météo-France -  
CNRS

[http://www.cnrm-game.fr/  
spip.php?rubrique218&lang=en](http://www.cnrm-game.fr/spip.php?rubrique218&lang=en)







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## Meetings and Events

- Cryosphere Community Calendar
- 2014 SOOS SSC
- **Ice Sheet Modeling for CMIP6 Meeting**
- Sea Ice Concentration and Thickness 2014
- Rising Coastal Seas On A Warming Earth
- Large-Scale Sea-Ice Simulations Workshop
- Past cliC Meetings

## Ice Sheet Modeling for CMIP6 Meeting



Ice Sheet MIP for CMIP6 Meeting

Venue: NASA GSFC, Greenbelt, MD, USA

Dates: 16-18th July, 2014

Meeting Organizers: [Sophie Nowicki](#) (GSFC), [Tony Payne](#) (University of Bristol), and [Eric Larour](#) (JPL).

The sea-level projections made by the glaciological community as part of the IPCC process have often been out of phase with the projections considered by the wider CMIP community. For instance in AR5, the ice2sea and SeaRISE ice sheet projects predominantly worked with AR4 scenarios, while the CMIP5 community used new RCP scenarios. A primary focus of this meeting is therefore to develop a plan that will allow ice sheet and glacier models to be better integrated in the CMIP6 initiative, in order to improve both sea level projections due to changes in the cryosphere and our understanding of the cryosphere in a changing climate. These goals map into the Cryosphere Grand Challenge and the Sea-Level Rise Grand Challenge relevant to cliC and the WCRP. Participation is by invitation only, and will primarily include ice sheet and Earth system model development and analysis leaders, representatives of MIPs that are relevant to the cryosphere and observation data set providers. If you would like to be invited to the meeting, please email [Sophie Nowicki](#).

The meeting goal is to develop an Ice Sheet MIP proposal for participation in the CMIP6 initiative.

➤ [Meeting Objectives](#)

➤ [Agenda](#)

➤ [Participants](#)

➤ [Local information](#)



# Climate and Cryosphere

Understanding the changing cryosphere and its climate connections



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## Arctic Freshwater Synthesis

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## Arctic Freshwater Synthesis

### *Sources, Fluxes, Storage and Effects*

Over approximately the next two years, the World Climate Research Programme's (WCRP) Climate and the Cryosphere Project (CLIC), the International Arctic Science Committee (IASC), and the Arctic Council's Arctic Monitoring and Assessment Program (AMAP) have decided jointly to promote and support the production of an internationally authored **Arctic Freshwater Synthesis (AFS)** as a contribution to the 3rd International Conference on Arctic Research Planning (ICARP III), the WCRP's Grand Challenges, and AMAP's Adaptation Actions for a Changing Arctic. The overall goal of the AFS is to synthesize our current scientific understanding of Arctic freshwater **sources, fluxes, storage and effects**, with the project structured around 5 major components: **atmosphere, ocean, terrestrial hydrology, terrestrial ecology and resources**. The web page outlines the current goals of the project and features a diagram identifying some of the key issues that are likely to be the foci for the 5 components.



## News and Updates

Check here for the latest information on how the project is progressing: <http://www.climate-cryosphere.org/activities/targeted/afs/downloads>

Norwegian Ministry of Environment recently committed 660,000NOK (~US \$110,000) to support this.



[www.climate-cryosphere.org](http://www.climate-cryosphere.org)



## Ice-sheet mass balance and climate change

Edward Hanna<sup>1</sup>, Francisco J. Navarro<sup>2</sup>, Frank Pattyn<sup>3</sup>, Catia M. Domingues<sup>4</sup>, Xavier Fettweis<sup>5</sup>, Erik R. Ivins<sup>6</sup>, Robert J. Nicholls<sup>7</sup>, Catherine Ritz<sup>8</sup>, Ben Smith<sup>9</sup>, Sławek Tulaczyk<sup>10</sup>, Pippa L. Whitehouse<sup>11</sup> & H. Jay Zwally<sup>12</sup>

Since the 2007 Intergovernmental Panel on Climate Change Fourth Assessment Report, new observations of ice-sheet mass balance and improved computer simulations of ice-sheet response to continuing climate change have been published. Whereas Greenland is losing ice mass at an increasing pace, current Antarctic ice loss is likely to be less than some recently published estimates. It remains unclear whether East Antarctica has been gaining or losing ice mass over the past 20 years, and uncertainties in ice-mass change for West Antarctica and the Antarctic Peninsula remain large. We discuss the past six years of progress and examine the key problems that remain.

This Review aims to synthesize the main advances in monitoring and modelling of ice-sheet mass balance since the publication of the 2007 Intergovernmental Panel on Climate Change Fourth Assessment Report<sup>1</sup> (IPCC AR4). Mass balance is defined as the net result of mass gains (primarily snow accumulation) and mass losses (primarily meltwater runoff and solid ice dynamical discharge across the grounding line). Surface mass balance (SMB) is the net balance of mass gains and losses at the ice-sheet surface and does not include dynamical mass loss. Efforts to determine ice-sheet mass balance using the three satellite geodetic techniques of altimetry, interferometry and gravimetry (see next section) have recently been sharpened by carefully defining common spatial and temporal domains for inter-comparison<sup>2</sup>. Here we review the latest mass-balance estimates for the Antarctic Ice Sheet (AIS) and the Greenland Ice Sheet (GIS). New glacial isostatic adjustment (GIA) models, tested and evaluated against Global Positioning System (GPS) data, have recently led to significant downwards revision in GIA, and hence downwards revisions of gravimetric and altimetric satellite estimates of Antarctic mass loss<sup>3</sup> (Box 1).

Since the publication of IPCC AR4<sup>1</sup>, ice-sheet models are no longer constrained to use overly simplified physics, allowing them to simulate more accurately the important coupling between ice sheets, ice streams and ice shelves. This major advance has been accompanied by improved model representation of the complex interactions of the ice sheet with its bed, the atmosphere and the ocean. For completeness, we also discuss briefly the contributions to sea-level rise (SLR) from other sources, namely glaciers and ice caps, thermal expansion of the oceans and terrestrial water storage changes. Despite recent advances, improved observations and predictions of ice-sheet response to climate change are as urgently needed to feed into mitigation and adaptation models of ensuing SLR as they were at the time of ref. 1.

### Recent changes in ice-sheet mass balance Comparison of mass-balance estimates

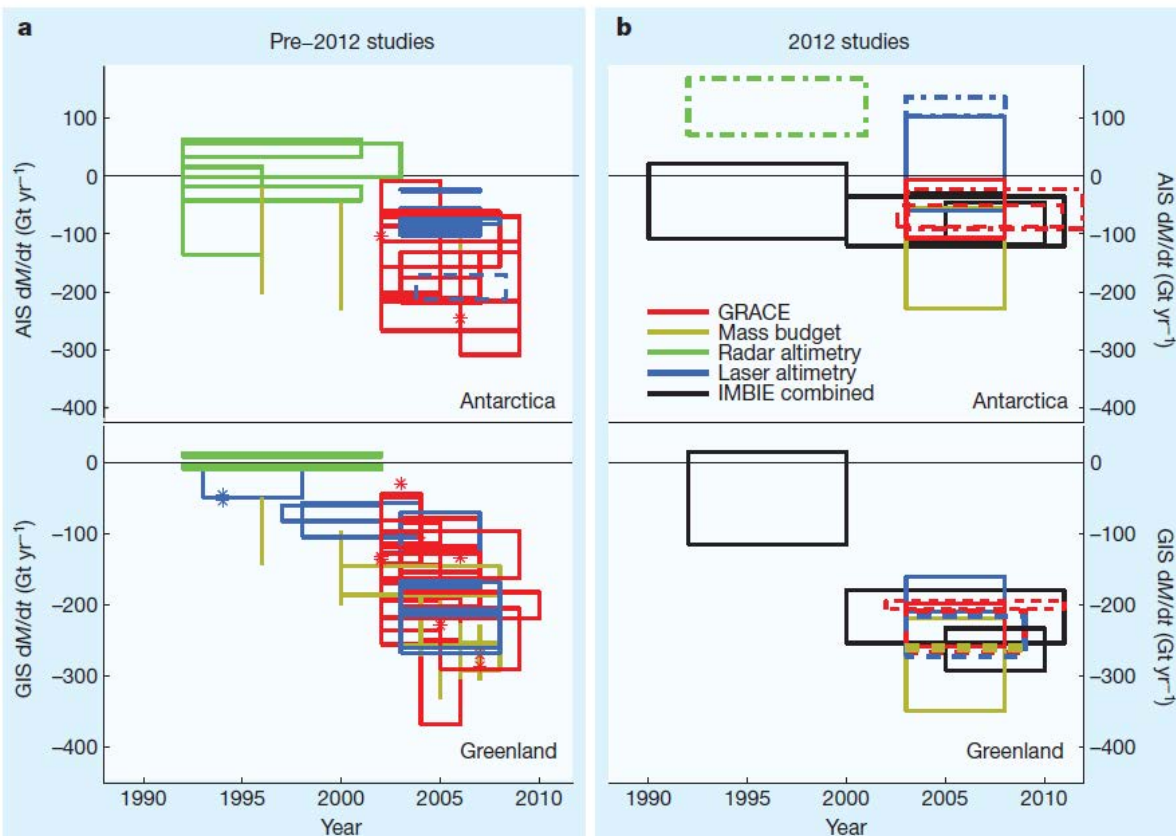
One of the most sought after but elusive goals in contemporary Earth science is to date the mass-balance state of the great ice sheets to observed SLR. A measure of this state provides an unambiguous quantification of

the ice-sheet system response estimates have been derived. **Volumetric techniques.** Ice sheet via measurement are based on radar altimetry. **Space gravimetric technique.** via repeated and very accurate Gravity Recovery system<sup>4</sup>.

### BOX 1 Recent developments models

Glacial isostatic adjustment including associated changes in ice and effect of GIA is regional variation of GIA are necessary for mass change<sup>5</sup> and for glacial geological constraints on rebound uncertainty associated with ice change<sup>1,10,19</sup>. However, in ice extent and thickness known, and typically not they can dominate the regions of low mantle viscosity, as detected by signal, but are not yet in the data used to tune GIA are now being adopted in

NATURE Review article by ISMASS group



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Abrupt thaw, as seen here in Alaska's Noatak National Preserve, causes the land to collapse, accelerating permafrost degradation and carbon release.

# High risk of permafrost thaw

Northern soils will release huge amounts of carbon in a warmer world, say Edward A. G. Schuur, Benjamin Abbott and the Permafrost Carbon Network.

Arctic temperatures are rising fast, and permafrost is thawing. Carbon released into the atmosphere from permafrost soils will accelerate climate change, but the magnitude of this effect remains highly uncertain. Our collective estimate is that carbon will be released more quickly than models suggest, and at levels that are cause for serious concern.

We calculate that permafrost thaw will release the same order of magnitude of carbon as deforestation if current rates of deforestation continue. But because these emissions include significant quantities of methane, the overall effect on climate could be 2.5 times larger.

Recent years have brought reports from the far north of tundra fires<sup>1</sup>, the release of ancient carbon<sup>2</sup>, CH<sub>4</sub> bubbling out of lakes<sup>3</sup> and gigantic stores of frozen soil carbon<sup>4</sup>. The latest estimate is that some 18.8 million square kilometres of northern soils hold about 1,700 billion tonnes of organic carbon<sup>5</sup> — the remains of plants and animals that have been accumulating in the soil over thousands of years. That is about four times more than all the carbon emitted by human activity in modern times and twice as much as is present in the atmosphere now.

This soil carbon amount is more than three times higher than previous estimates,

largely because of the realization that organic carbon is stored much deeper in frozen soils than was thought. Inventories typically measure carbon in the top metre of soil. But the physical mixing during freeze–thaw cycles, in combination with sediment deposition over hundreds and thousands of years, has buried permafrost carbon many metres deep.

The answers to three key questions will determine the extent to which the emission of this carbon will affect climate change: How much is vulnerable to release into the atmosphere? In what form it will be released? And how fast will it be released? These questions are easily framed, but challenging to answer.

## KNOWN UNKNOWN

As soils defrost, microbes decompose the ancient carbon and release CH<sub>4</sub> and carbon dioxide. Not all carbon is equally vulnerable to release: some soil carbon is easily metabolized and transformed to gas, but more complex molecules are harder to break down. The bulk of permafrost carbon will be released slowly over decades after thaw, but a smaller fraction could remain within the soil for centuries or longer. The type of gas released also affects the heat-trapping potential of the emissions. Waterlogged, low-oxygen environments are likely to contain microbes that produce CH<sub>4</sub> — a potent

greenhouse gas with about 25 times more warming potential than CO<sub>2</sub> over a 100-year period. However, waterlogged environments also tend to retain more carbon within the soil. It is not yet understood how these factors will act together to affect future climate.

The ability to project how much carbon will be released is hampered both by the fact that models do not account for some important processes, and by a lack of data to inform the models. For example, most large-scale models project that permafrost warming depends on how much the air is warming above them. This warming then boosts microbial activity and carbon release. But this is a simplification. Abrupt thaw processes can cause ice wedges to melt and the ground surface to collapse, accelerating the thaw of frozen ground<sup>6</sup>. Evidence of rapid thaw is widespread: you can see it in the 'drunken' trees that tip dangerously as a result of ground subsidence, and in collapsed hill slopes marked by scars from landslides. These are just some of the complex processes that models don't include.

At the same time, few data are available to support these models because of the difficulties of gathering data in extreme environments. Only a handful of remote field stations around the world are collecting data to support this research, even though the permafrost zone covers about almost one-quarter

E. A. SCHUUR

## NATURE Comment article by the Permafrost Carbon Network

**Permafrost Carbon Network**

Background: Soil carbon is estimated to be stored in soils and permafrost of the Northern Hemisphere (Fig. 1 and Fig. 2) which is twice as much carbon as is currently in the atmosphere. In a warmer world permafrost thawing and decomposition of previously frozen organic carbon is one of the more likely positive feedbacks from terrestrial ecosystems to the atmosphere. Although ground temperature increases in permafrost regions are well documented there is a knowledge gap in the response of permafrost carbon to climate change.

The Vulnerability of Permafrost Carbon Research Coordination Network (VPCRN) is a NSF-funded synthesis project that builds on several previous synthesis efforts. These former activities include:

1. National Center for Biological Analysis and Synthesis (NCBAS) [workshop](#) on the Vulnerability of carbon in permafrost: Pool size and potential effects on the climate system (see also [Schuur et al., 2008](#)).
2. International Permafrost Association (IPA) sponsored Carbon Pools in Cryosphere Region (CAMP) project which specifically focused on permafrost carbon pools including total below-ground organic matter quantity and quality in the presence of permafrost (see also [Kuhry et al., 2009](#)).

**Objectives**

The main objectives of the VPCRN are to synthesize and link existing research about permafrost carbon and climate in a format that can be assimilated by biophysical and climate models, and that will contribute to future assessments of the Intergovernmental Panel on Climate Change (IPCC).

Our activities include a series of [meetings](#) and working groups designed to synthesize ongoing permafrost carbon research which will produce new knowledge to quantify the role of permafrost carbon in living climate change in the 21st century and beyond.

**Fig. 1. Latitudinal zonation of permafrost.** (Source: Brown and colleagues 1998)

**Fig. 2. Spatial extent of the Northern Circumpolar Soil Carbon Database (NCSD) and the estimated soil organic carbon content to a depth of 1m.** (Source: Hugelius et al. 2012)

**News and Updates:**

**Data visualization**

Click on the map to view multiple maps that illustrate data used in synthesis products from the Permafrost Carbon Network on maps.

**Job Opportunities**

Click [here](#) for job opportunities of interest to the Permafrost Carbon Research Community.

**New Publications:**

Machuga M & Riley WJ (2014) Active-layer thickness across Alaska: Comparing Observation-Based Estimates with CMIP5 Earth System Model Projections. *Soil Sci. Soc. Am.* [doi:10.2136/sss11.1.1404](#)

Wild B, Schneider J, Jores RJD et al. (2014) Input of easily available organic C and its stimulus to microbial decomposition of soil organic matter in arctic permafrost soil. *Soil Biology and Biochemistry*, 79, 143–151. doi: [http://dx.doi.org/10.1016/j.soilbio.2014.04.014](#)

Hayes, D.J. Kiddigher DW, McGuire AD

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CLIC



# Cross-Project issues:

- Need to work more on coordination of PCPI and Cryosphere GC with SPARC.
  - Both activities are progressing well, just need to make sure information is flowing.
- Have had active GEWEX participation at GC workshop and SSG
  - Topics of mutual interest identified; Arctic Freshwater Synthesis is one (participants are from both GEWEX and CliC 'communities').
- CliVar/CliC/SCAR Southern Ocean Panel
  - Not really a 'joint' activity (CliC asked to identify a member); discussion initiated with CliVar to address this. Open question about Arctic Ocean panel.
- Discussion with CliVar regarding CliC role in sea-level GC.
  - Clear and agreed-upon strategy in place.
- Cross-attendance at SSG meetings is desirable but challenging.



# CliC Resources

- Cryosphere in the Media/News
- Recent Cryosphere Literature Publications
- Community Calendar and Planning Resource
- Cryosphere Community News
- Polar and Cryosphere Job Opportunities (APECS)
- Videos, Photos, Reports and Other Useful Stuff
- Cryosphere Specialist Directory
- **WCRP** Community Calendar & RSS

## New

- Frostbytes
- Cryosphere Projects Catalogue





# www.climate-cryosphere.org

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Password:

☐ Remember Me



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### Latest CliC News

- Call for Papers: 9th Arctic Frontiers Conference: Climate and Energy
- Workshop Announcement: CliC Sea Ice and Climate Modeling Forum Workshop on large-scale sea-ice simulations
- European Space Agency's call for proposals: Data User Element INNOVATOR
- Nominations to the IUGG Early Career Scientist Award (Deadline: 22 June 2014)
- Updates from the Permafrost Carbon Network
- Marine Ice Sheet Model Intercomparison Projects (MISMIP) EGU 2014 Meeting Notes Available
- Group on Earth Observations Launches Worldwide App Competition
- Cryosphere in A Changing Climate Report in Eos
- David Carlson Appointed New Director WCRP
- Next Polar CORDEX Meeting 17 June in Lund, Sweden

### Upcoming CliC Events

-  17 Permafrost Young Researchers Workshop
-  18 Submarine Permafrost Steering Committee Meeting
-  21 1st International Satellite Snow Products Intercomparison workshop (ISSPI)
-  26 Sea Ice and Climate Modeling Forum Workshop
-  10 PFF/PCPI Workshop: Polar-Lower Latitude Linkages and Their Role in Weather and Climate Prediction

## Sponsors



CliC Project Office hosted by the Norwegian Polar Institute

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## FrostBytes

If you are looking for interesting soundbytes of cool research, FrostBytes is the category for you to search. CLiC has teamed up with the Association of Permafrost Researchers (APR) to create FrostBytes project. FrostBytes are short (often 30-60 seconds) audio clips that highlight recent discoveries. Erik Steffen, an APECS member, has attended recent CLiC sponsored workshops.

Available as  
iTunes  
podcasts!

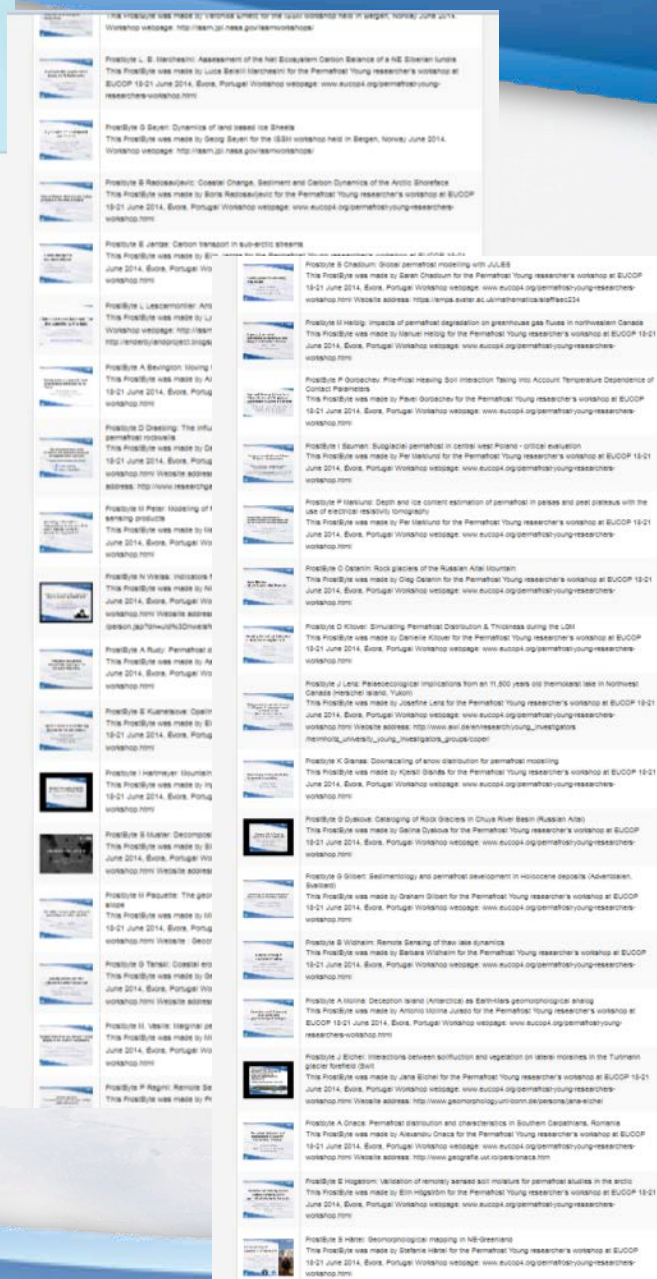
Media Display # 100

The... pre-disposition at the pan-arctic scale  
... by David Olefeldt for the 3rd Carbon Pools in Permafrost Regions, 12 - 14 May, 2014, Stockholm University, Sweden.

**FrostByte J Ely: Flowstripes and Longitudinal Foliations of the Antarctic Ice Sheet**  
This FrostByte was made by Jeremy Ely for the Ice Sheet System Model Workshop, 2 - 4 June 2014 Bergen, Norway. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

**FrostByte I. Vankova: Glacier-Ocean Interactions: Calving**  
This FrostByte was made by Irena Vankova for the Ice Sheet System Model Workshop, 2 - 4 June 2014 Bergen, Norway. Website: <http://caos.cims.nyu.edu/page/home> Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

**FrostByte V Emetc: Antarctic Mass Balance: Integration of modeling and observation**  
This FrostByte was made by Veronika Emetc for the ISSM workshop held in Bergen, Norway June 2014. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>



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# Cryosphere Projects Catalog

The Cryosphere Projects Catalog is meant to give an overview of the current research happening within the various fields of cryospheric science. This is a living resource and we encourage people to add their own projects and let us know if any of the information provided here needs updating. Entries are from individual PIs, national funding databases, international organizations and other sources. We hope this will help people find new collaborators, share resources, and more. Suggestions on improving the catalog are always welcome.

To search the directory, click on the binoculars  below.

To add a new project, click on the green plus  below.

-  Add
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	Title of Project	Lead Institution	Country	Category	Map Location	Project Location
 View	Development of EM ice thickness systems	Norwegian Geotechnical Institute	Norway	Observations Sea Ice		
 View	DYNAWARM: Dynamics of Warm Climates	University of Bergen/ SKD - Centre for Climate Dynamics at the Bjerknes Centre	Norway	Sea Ice		
 View	Barents Sea Review Paper	Geophysical Institute / University of Bergen	Norway	Sea Ice		
 View	The role of Sea Ice processes on Co2 exchange and Calcium Carbonate saturation levels SICCA (FS OA Flagship)	Norwegian Polar Institute	Norway	Sea Ice		
 View	ICE-Fluxes	Norwegian Polar Institute	Norway	Sea Ice		
 View	Cryoclim	Norwegian Computing Center (NR)	Norway	Remote Sensing	53.2224 -4.2007	53.2224 -4.2007
 View	SIOS	NFR - Research Council of Norway	Norway	Observations Sea Ice	53.2224 -4.2007	53.2224 -4.2007
 View	CISAR - CryoSat land and sea ice studies in the Arctic	Nansen Environmental & Remote Sensing Center	Norway	Observations Remote Sensing Sea Ice		
 View	SIDARUS	Nansen Environmental & Remote Sensing Center	Norway	Remote Sensing Sea Ice		
 View	Arctic sea ice variability: a comprehensive study using satellite and in-situ observations - ArcticSIV	Nansen Environmental & Remote Sensing Center	Norway	Remote Sensing Sea Ice		

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## Recent Cryosphere Literature

Combined RSS feeds of recent journal articles from major cryosphere journals: The Cryosphere, Polar Research, Polar Science, Polar Record, Antarctic Science Brought to you by the Climate and Cryosphere Project (CLIC).

1. [Enthalpy benchmark experiments for numerical ice sheet models](#)
2. [Independent evaluation of the SNODAS snow depth product using regional scale LIDAR-derived measurements](#)
3. [A novel integrated method to describe dust and fine supraglacial debris and their effects on ice albedo: the case study of Forni Glacier, Italian Alps](#)
4. [The sub-ice platelet layer and its influence on freeboard to thickness conversion of Antarctic sea ice](#)
5. [Surface kinematics of periglacial sorted circles using structure-from-motion technology](#)
6. [Quantifying mass balance processes on the Southern Patagonia Icefield](#)
7. [Writing with light: a photographer's vision: Frank Hurley and the 1911–1914 Australasian Antarctic Expedition](#)  
The Polar Journal, Ahead of Print.
8. [Arctic opening: insecurity and opportunity](#)  
The Polar Journal, Ahead of Print.
9. [Antarctica: a biography](#)  
The Polar Journal, Ahead of Print.
10. [Antarctica in fiction: imaginative narratives of the far south](#)  
The Polar Journal, Ahead of Print.
11. [Glacier area and length changes in Norway from repeat inventories](#)
12. [Brief Communication: Trends in sea ice extent north of Svalbard and its impact on cold air outbreaks as observed in spring 2013](#)
13. [Arctic sea ice melt onset from passive microwave satellite data: 1979–2012](#)
14. [Simultaneous solution for mass trends on the West Antarctic Ice Sheet](#)
15. [Seasonal cycle of solar energy fluxes through Arctic sea ice](#)
16. [Processes governing the mass balance of Chhota Shigri Glacier \(Western Himalaya, India\) assessed by point-scale surface energy balance measurements](#)
17. [Glacier-like forms on Mars](#)
18. [Thermal characteristics of permafrost in the steep alpine rock walls of the Aiguille du Midi \(Mont Blanc Massif, 3842 m a.s.l.\)](#)
19. [The GAMDAM Glacier Inventory: a quality controlled inventory of Asian glaciers](#)
20. [Physical controls on the storage of methane in landfast sea ice](#)
21. [Conference reports, notes and announcements](#)  
The Polar Journal, Ahead of Print.
22. [Blowing snow at D17, Adélie Land, Antarctica: atmospheric moisture issues](#)
23. [SMOS-derived thin sea ice thickness: algorithm baseline, product specifications and initial verification](#)
24. [Comparing C- and L-band SAR images for sea ice motion estimation](#)
25. [Brief communication: Light-absorbing impurities can reduce the density of melting snow](#)
26. [On the interest of positive degree day models for mass balance modeling in the inner tropics](#)
27. [Glacier changes in the Karakoram region mapped by multitemporal satellite imagery](#)
28. [Destabilisation of an Arctic ice cap triggered by a hydro-thermodynamic feedback to summer-melt](#)
29. [Oscillatory subglacial drainage in the absence of surface melt](#)
30. [Climate change implications for the glaciers of the Hindu Kush, Karakoram and Himalayan region](#)
31. [Winter speed-up of quiescent surge-type glaciers in Yukon, Canada](#)
32. [Elevation changes of Inylchek Glacier during 1974–2007, Central Tian Shan, Kyrgyzstan derived from remote sensing data](#)
33. [Representativeness and seasonality of major ion records derived from NEEEM firn cores](#)
34. [Spatial-temporal dynamics of chemical composition of surface snow in East Antarctica along the Progress station–Vostok station transect](#)
35. [Weekly gridded Aquarius L-band radiometer/scatterometer observations and salinity retrievals over the polar regions – Part 2: Initial product analysis](#)





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Thumbnail	Title
	Supporting-Docs SOOS-SSC2014 3RD SCIENTIFIC STEERING COMMITTEE MEETING 18–20 June 2014, Tromsø, Norway
	SOOS-SSC2014-Agenda 3RD SCIENTIFIC STEERING COMMITTEE MEETING 18–20 June 2014, Tromsø, Norway
	Permafrost Research Priorities Business Cards Business cards used to promote the Permafrost Research Priorities process.
	2014-04-22 Permafrost Research Priorities Core Group Meeting 2nd meeting of the ICARP III Core Group Adobe connect conference 22nd of April 2014 (17:00-18:00 UTC+1) Minutes and Action Items Participants: • Hugues Lantuit [AWI, Germany, Chair] (HL) • Gerhard Kinner [LGGE Grenoble, France] (GK) • Karina Scholän [IPA - Executive Director of the IPA] (KS) • Michel Allard [Université Laval, Canada] (MA) • Ylva Sjöberg [Stockholm University, Sweden] (YS)
	International Council for Science bulb for different teksts in here from july 2010 to 2006
	2012_12-06-CryoOrgs-meeting-final Cryosphere Organizations meeting 6 December 2012, San Francisco (AGU) Participants Anne Nolin (AGU—Cryosphere) Ragline Hock (ICSIH) Hilmar Gudmundsson (EGU—Cryosphere) Kristina Creek (ARCUS) Howie Epstein (University of Virginia) Vladimir Ryabinin (WCRP/CliC) Inga May (IPA) Gary Wilson (NZ Antarctic Research Institute) Chuck Kennicutt (SCAR) Allen Pope (APECS) Charles Fierz (IACS) — skype Volker Raichold (IASC) Apologies from: Jenny Baeseman (CliC)(III) Main Issues The only agenda item...
	2011_03_Sat-derived-sea-ice-products Satellite-derived Sea Ice Products Community Workshop Report Sponsored by WCRP Climate and Cryosphere (CliC) Project Office NASA Goddard Space Flight Center, Greenbelt, MD Workshop Summary On 15-16 March 2011, twenty-six people attended the WCRP CliC "Satellite-derived Sea Ice Products Community Workshop" at NASA Goddard Space Flight Center, in Greenbelt, Maryland, USA. The focus of the meeting was to bring together people who produce various passive microwave sea ice concentration products...
	2010_Kattsov_etal_Meier_JGlaciol_published_2012_10199[1] Antarctic ice changes a good challenge of climate science ABSTRACT Over the period of modern satellite



## Capacity Development:

- Strong link to APECS
- Support meeting attendance and engage young scientists in CliC activities. Require them to contribute a 'FrostByte'.
- Implementing 'CliC Fellows' program where a young scientist is funded to help coordinate some activity (currently have one assigned to Permafrost Research Priorities activity).



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# Action Items from JSC-34:

- Action 8 – liason with WGRC
  - Annette Rinke is CliC contact; coordinating CORDEX polar activities and contribute future climate scenario information to AMAP assessments that are just starting.
- Action 14 – contribution to interannual/decadal predictability research and regional GC white paper.
  - CliC connection primarily via PCPI which has several relevant activities; were not contacted regarding regional GC white paper. See above re AMAP.
- Action 15 – identify optimal choice of leadership for work on skilful/ action-oriented regional climate information ...
  - ???
- Action 17 – Cryosphere grand challenge input
  - Several core projects and working groups were represented at GC workshop; also participation at CliC SSG. Connection to, and role in, sea-level GC being actively discussed.



- Action 18 – seek opportunities to contribute to international research on role of declining Arctic sea-ice and snow in climate predictability ... atmos. Circulation. CliC/WGSIP to discuss ...
  - Being pursued within PCPI; will be a topic for sea-ice and climate modelling forum; note work underway in ISMASS on polar jet stream variability. ESMSnowMIP will contribute. Discussion initiated with ESA on funded Arctic research activity.
- Action 19 – strengthen sea-ice and ice-sheet modelling in support of WGSIP, WGCM and WGNE
  - Initiated 'sea-ice and climate modelling forum' to foster improved communication/collaboration. Will work with CMIP panel on sea-ice data request. New Antarctic ice-ocean modelling and ESMIceSheetMIP activities. Potential Greenland ice-ocean activity (GRISO). Some aspects of PCPI.



- Action 20 – update JSC Chair on Cryo GC workshop
  - Meeting agenda and description sent to Chair 9/Sept/2013; meeting report available on CliC web site
- Action 24 – establish communication between GC leads.
  - Invited GC leads to CliC SSG meeting in Geneva in March (devoted more than half a day to this topic); would be nice if JPS coordinated more regular communication.
- Action 25 – consider benefits of US Climate Process Team approach
  - Noted
- Action 26 – develop/articulate implementation of GC
  - Template not provided by JPS (to our knowledge). Implementation of cryosphere GC integrated with CliC Action Plan.



- Action 34 – guidelines/datasets for ESGF
  - CliC does not generate a lot of ‘data’. ASPeCt and ASIWG may have some. Sea-ice and climate modelling forum, ESMSnowMIP and ESMIceSheetMIP will certainly have interest in ‘Obs4MIPs’ type activities using ESGF. Not clear what (if anything) needs to be done here.
- Action 43 – ‘gap’ in WCRP structure in the area of atmospheric dynamics.
  - CliC was involved in e-mail discussion of this; not at all clear to us that there really is a ‘gap’, or if there is, that we need a structure for it.
- Action 45 – better define role of CliC in involving Arctic Ocean research communities in WCRP priorities ... involve IASC.
  - CliC has MOU with IASC and co-sponsors several activities (though not specific to Arctic Ocean). Ocean research not central to CliC mandate. Some discussion initiated re GRISO. Some discussion with CliVar.





- Action 46 – CliC, WGSIP and WGCM to develop proposals on facilitating their interactions.
  - Is a ‘proposal’ really needed? Interactions are already developing naturally via PCPI, new MIP activities (snow and ice sheets). Sea-ice and climate modelling forum will further improve connections. CliC co-chair (Flato) hosted WGCM meeting in Victoria in Fall 2013.
- Action 47 – CliC Chair to develop plan for sea-ice and ice sheet modelling to present to JSC-35
  - Connection between CliC and WCRP modelling activities has been a central theme at two recent CliC SSG meetings. New targetted activities specifically address snow in earth system models, ice sheets in earth system models, and modelling ice-shelf ocean interactions. Sea-ice and climate modelling forum established. Co-sponsor of ISMASS which is very active.
  - These activities are now ‘mainstreamed’ into CliC.



- Action 52 – inform CMIP6 of questions/research requirements
  - ESMSnowMIP, ESMIceSheetMIP, and Sea-Ice and Climate Modelling Forum will all be interacting directly with WGCM CMIP panel, specifically on CMIP6 planning.
- Action 58 – synthesis papers in advance of IPCC assessments
  - Noted. E.g. Arctic Freshwater Synthesis is aimed specifically at this. Sea-ice and climate modelling forum planning a paper on in-depth evaluation of sea-ice in CMIP5 results.
- Action 59 – update project web sites
  - CliC IPC Director (Jenny) has been VERY active in developing/expanding the CliC website and regularly updating content. She has also been very active in fostering communication through social media, web-casting, meeting/project web hosting, tele-conf and video-conf support, etc

