

CliC: Climate and Cryosphere

Big Picture Achievements

Co-chairs: G. Flato, G. Krinner

Project Office: L. Hislop, G. Hamon

Our project office host ...



www.climate-cryosphere.org

CliC Structure

Scientific Steering Group

G. Flato and G. Krinner,
Co-Chairs

ICPO

L. Hislop, Director
G. Hamon, Executive Officer
Hosted by Norwegian Polar Institute

Limited Lifetime Targeted Activities

Core

- Arctic Freshwater Synthesis (*Done*)
- Marine Ice Sheet/Ocean Model Intercomparison (MISOMIP)
- Polar CORDEX Analysis / Arctic Regional Climate Scenarios
- Polar Jet Stream Variability and Extremes
- Improved Greenland Mass Balance Estimation

Cryosphere GC: Melting Ice – Global Consequences

- Carbon cycle feedbacks in a changing Arctic
- Sea-ice, Snow, and Ice Sheets in CMIP6
- Global Glacier Mass Balance

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

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

Achievements ...

2015 CliC Activity Report summarizes the following:

- Arctic Freshwater Synthesis (AFS)
- Arctic Sea Ice Working Group (ASIWG)
- Antarctic Sea Ice Processes and Climate (ASPeCt)
- Technical Committee on Sea Ice Observations
- Interactions Between High-latitude Cryosphere Elements
- ESM Snow Model Intercomparison (ESM-SnowMIP)
- SCAR/IASC/CliC Ice Sheet Mass Balance and Sea Level (ISMASS)
- Ice Sheet Modelling Intercomparison Project 6 (ISMIP6)
- Polar Coordinated Regional Downscaling Experiment (Polar CORDEX)
- Linkage Between Arctic Climate Change and Mid-Latitude Weather Extremes
- Permafrost Carbon Network
- Permafrost Research Priorities
- Sea Ice and Climate Modelling Forum
- CLIVAR/CliC/SCAR Southern Ocean Regional Panel
- Southern Ocean Satellite Data Requirements
- Submarine Permafrost Mapping Action Group
- Marine Ice Sheet Ocean Model Intercomparison Project (MISOMIP)
- Where Are They Now
- CliC's Contribution to the Year Of Polar Prediction (YOPP)



2015 WCRP CliC Annual Report



Photo courtesy of Lawrence Hickey

See Activity Report for full details



Arctic Freshwater Synthesis

Synthesis of Arctic freshwater sources, fluxes, storage and effects, covering atmosphere, ocean, terrestrial hydrology, terrestrial ecology and resources, with modeling as a sixth cross-cutting component.

Latest Achievements

- **8 component journal manuscripts** accepted for a special issue of **JGR Biogeosciences**
- **Layman's report**
- **Freshwater chapter** in the update to the **SWIPA** report

Future Plans

- AFS provides input to the **Adaptation Actions for a Changing Arctic (AACCA)** process
- Both **US and Finnish Arctic Council chairmanships** are prioritizing freshwater and may also carry AFS legacy forward
- Key messages from AFS, AFS input to SWIPA, and outreach products will be available for the **Arctic Council Ministerial Meeting** in April 2017



Modeling - CMIP6 et al.

- Strategic aim: engage more strongly with the climate modelling community
- Coupled Model Intercomparison Project (CMIP6) planning well underway, with CliC-led efforts well organized.
- Ice sheet/ocean interaction and global glacier mass balance modelling activities are closely aligned.



CMIP6 Endorsed MIPS (* indicates diagnostic MIP)

	Short name of MIP	Long name of MIP
1	AerChemMIP	Aerosols and Chemistry Model Intercomparison Project
2	C4MIP	Coupled Climate Carbon Cycle Model Intercomparison Project
3	CFMIP	Cloud Feedback Model Intercomparison Project
4	DAMIP	Detection and Attribution Model Intercomparison Project
5	DCPP	Decadal Climate Prediction Project
6	FAFMIP	Flux-Anomaly-Forced Model Intercomparison Project
7	GeoMIP	Geoengineering Model Intercomparison Project
8	GMMIP	Global Monsoons Model Intercomparison Project
9	HighResMIP	High Resolution Model Intercomparison Project
10	ISMIP6	Ice Sheet Model Intercomparison Project for CMIP6
11	LS3MIP	Land Surface, Snow and Soil Moisture
12	LUMIP	Land-Use Model Intercomparison Project
13	OMIP	Ocean Model Intercomparison Project
14	PMIP	Palaeoclimate Modelling Intercomparison Project
15	RFMIP	Radiative Forcing Model Intercomparison Project
16	ScenarioMIP	Scenario Model Intercomparison Project
17	VolMIP	Volcanic Forcings Model Intercomparison Project
18	CORDEX*	Coordinated Regional Climate Downscaling Experiment
19	DynVar*	Dynamics and Variability of the Stratosphere-Troposphere System
20	SIMIP*	Sea-Ice Model Intercomparison Project
21	VIACS AB*	VIACS Advisory Board for CMIP6

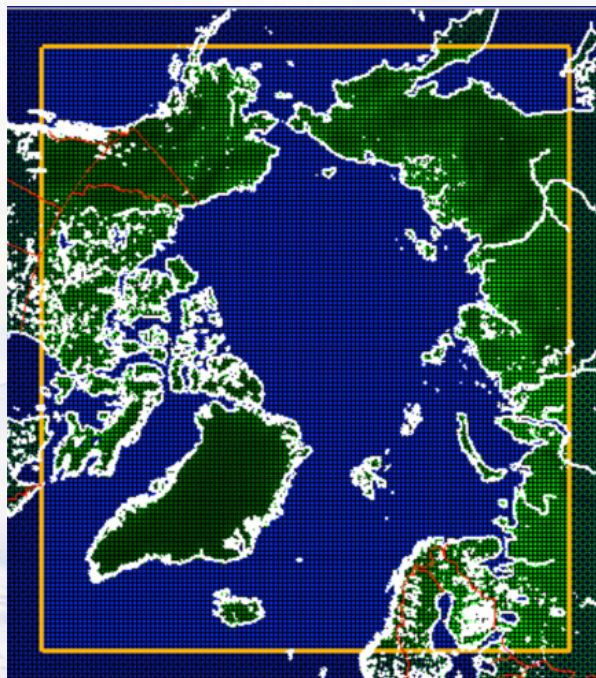


Arctic Cordex

John Cassano and Annette Rinke

Meetings

- Workshop in Potsdam – October 2015
- At CORDEX meeting in Stockholm – May 2016
- Workshop in Bergen – November 2016



Circum-Arctic domain

0.44° (ca. 50 km x 50 km)

13 Participating Institutes (alphabetically) which run circum-Arctic RCMs

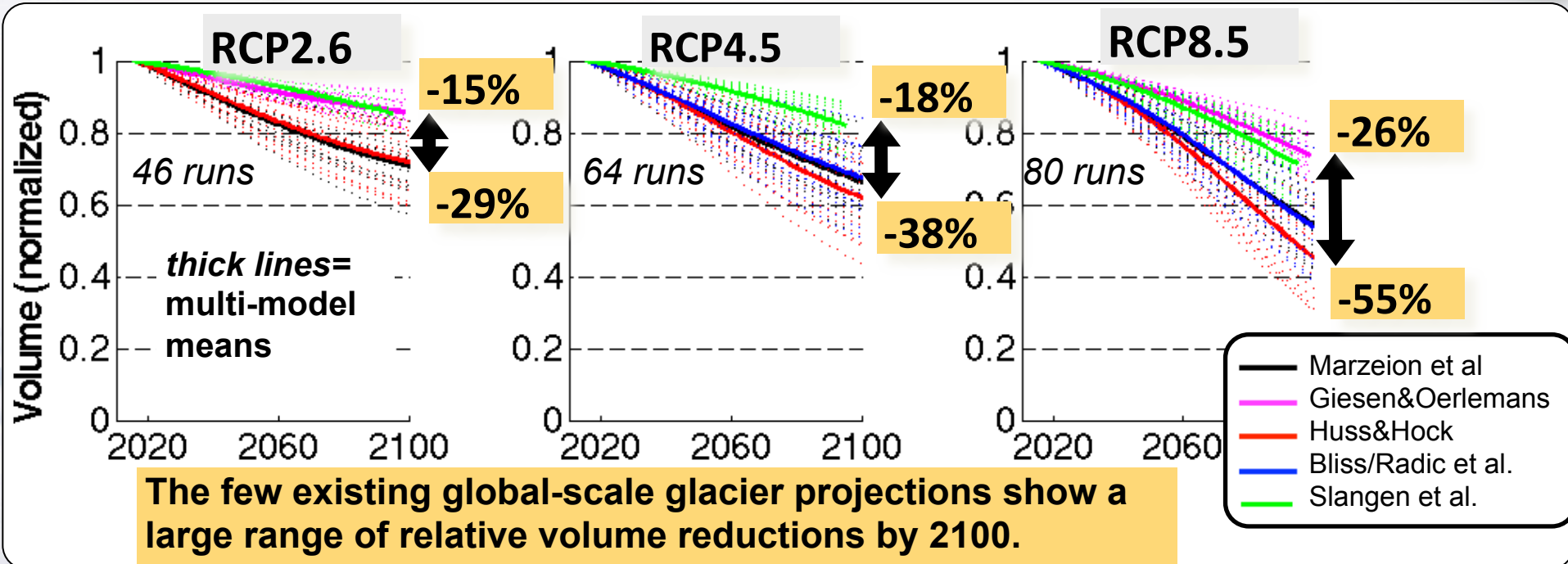
AWI	Potsdam, Germany
CCCma	Victoria, Canada
Colorado Uni.	Boulder, USA
DMI	Copenhagen, Denmark
EMUT	Trier, Germany
GERICS	Hamburg, Germany
ISU	Iowa, USA
Lund Uni.	Lund, Sweden
MGO	St. Petersburg, Russia
SMHI	Norrköping, Sweden
UNI	Bergen, Norway
Ulg	Liège, Belgium
UQAM	Montreal, Canada

Try to foster Antarctic CORDEX



GlacierMIP - Intercomparison of global-scale glacier models and projections

Regine Hock and Ben Marzeion



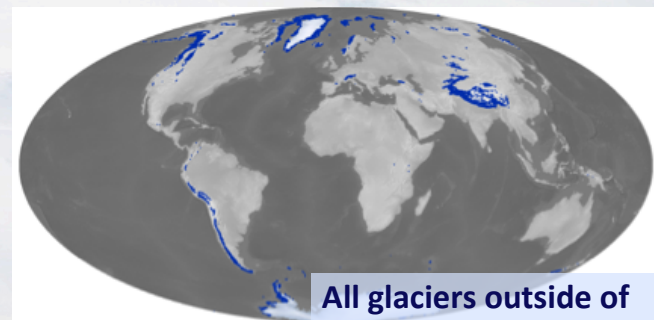
GlacierMIP's Phase 1:

-to compare the existing global-scale projections for each of the major glacierized regions

Submission of publication on model intercomparison envisaged by the end of 2016



www.climate-cryosphere.org



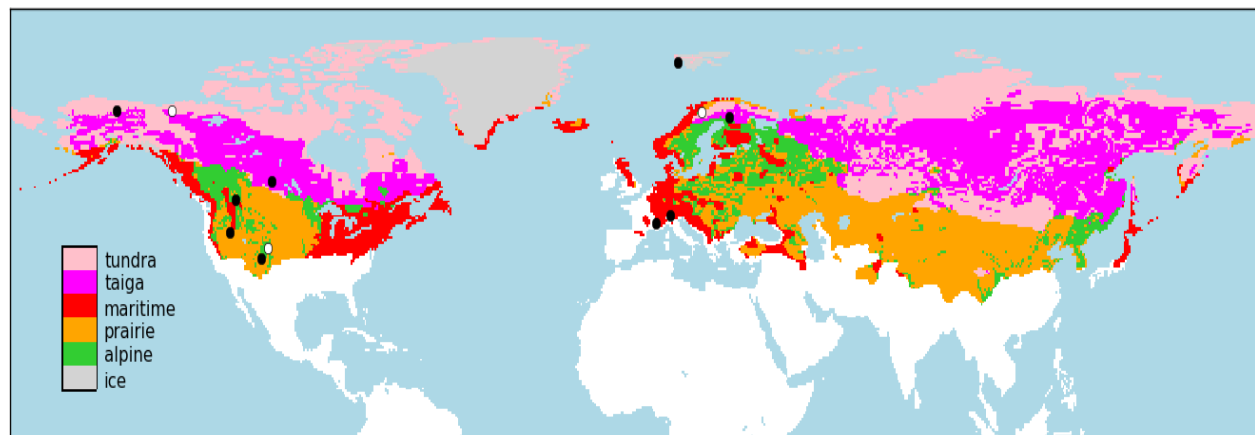
All glaciers outside of the ice sheets

ESM-SnowMIP: Snow model evaluation and snow feedback analysis

Strategy

- Strong link with LS3MIP: Coupled & forced global land surface model runs
- Strong link to GEWEX community
- Snow feedback analysis: Prescribed land surface state and shortwave radiative effect analysis
- Start with site-specific runs including dedicated snow models
- Additional global experiments after CMIP6

Meeting to launch site experiments at AGU 2016



Data provided by NCAR/EOL under sponsorship of the National Science Foundation. <http://data.eol.ucar.edu/>



www.climate-cryosphere.org

ISMASS + Marine Ice Sheet & Ice Shelf-Ocean Interactions

Perspective & Strategy

- ISMASS will essentially focus on model intercomparisons (all mass balance components) and data-model fusion
- Marine ice sheet – ice shelf – ocean interactions: Coordinating and connecting model intercomparison exercises

Workshops:

- ISMASS Workshop, Aug 2015, Cambridge, UK
- NYU Abu Dhabi – May 2016
- Splinter Meetings at EGU & AGU

Publications: Marine ice sheet intercomparison, Ice shelf-ocean interaction intercomparison (~Fall 2016)

WCRP GC Sea Level Initiative meeting on sea level change

NYU – July 2017; Planning meetings held – NYU – Spring, 2016



www.climate-cryosphere.org



Sea-ice working groups

Arctic Sea-ice Working Group (CliC); ASPeCt (Antarctic Sea ice Processes and Climate – CliC & SCAR); Technical committee on sea-ice observations

Ship-based visual observations: ASPeCt convention used for Antarctica; Ice Watch and ASSIST convention used for the Arctic. The aim is to **integrate the two efforts**.

Latest Achievements

- **New ASPeCt observation software** was released in March 2015 (for beta testing).
- The Arctic version of ASPeCt sea ice observations (**ASSIST**) has been **taken up widely** in 2015 with 7 ships participating (icewatch.gina.alaska.edu).
- **Successful field trial expanding the Arctic Ice Watch** program to merchant navy, using **ASSIST** on 4 tourist cruises.
- **ASSIST data** have been **provided to national ice services**, with efforts for **easy use** for ice charting and forecasting.

Future Plans

- **Convert ASSIST format to ASPeCt**
- Development of an **ASSIST-lite version** for use in the tourist industry and merchant navy.
- Further development of **ASPeCt Ice Observation Software**



SuPerMAG: Submarine Permafrost Mapping

Approach

- International and multi-disciplinary team led by P. Overduin (AWI)
- Circumpolar modelling
- Successive approach to parameterization with step-by-step sensitivity analyses

Challenges

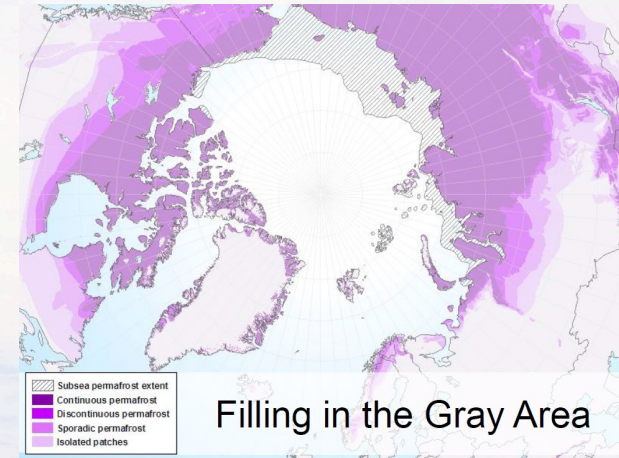
Parameterization over long time frames; Lack of validation data

Activities

- Model development completed in December 2015
- First-order parameterization completed in parallel to model development
- Early 2016: initial model runs completed

Current Outlook

- Publication & release of first results: at the 11th International Conference on Permafrost (Potsdam, Germany, June 2016)



WCRP Polar Climate Predictability Initiative (PCPI)

Marilyn Raphael, Cecilia Bitz

Third Polar Prediction Workshop 4-6 May 2016 Palisades, USA. ~75 participants with 38 talks and 12 posters. Expected outcomes: Discussion of review article and/or compilation of articles in a journal, recommendations for the Sea Ice Outlook.

Workshop on Feedbacks in Polar Regions 17-19 May 2016 Louvain-la-Neuve, Belgium. ~14 participants. Expected outcomes: Papers (1) summarizing the observational needs for constraining polar climate feedbacks and (2) compare standard methods within several climate models

PCPI organised sessions at the EGU 2016, ICSHMO 2015 and AGU 2015

PPP/PCPI Polar Prediction School 5-15 April 2016 Abisko, Sweden. 27 students and 10 instructors. Daily meteorological observations, lectures, and practical sessions.

A PCPI/PAGES Workshop on Large-scale climate variability in Antarctica and the Southern Ocean over decades to centuries and links to extra-polar climate 24-26 March 2015 La Jolla, USA. 25 author review paper submitted: Are recent trends in high latitude Southern Hemisphere climate unusual?

PCPI Leads Meeting 9 - 11 September 2015. Hosted by Ted Shepherd at the University of Reading, UK



CLiC-SOLAS Forum on Sea Ice Biogeochemistry

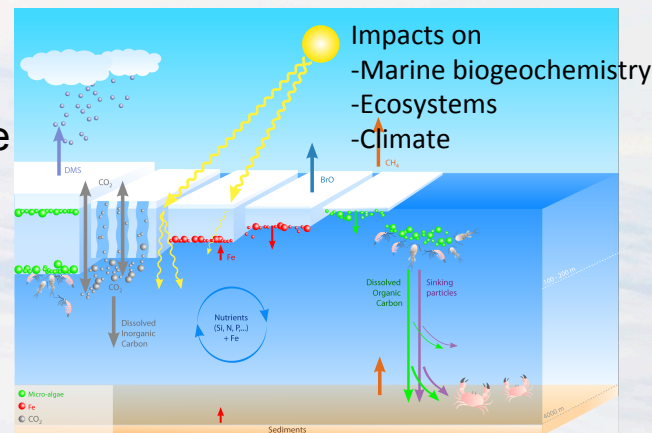
A follow up to BEPSII (Biogeochemical Exchange Processes at the Sea Ice Interfaces)

Proposed Forum

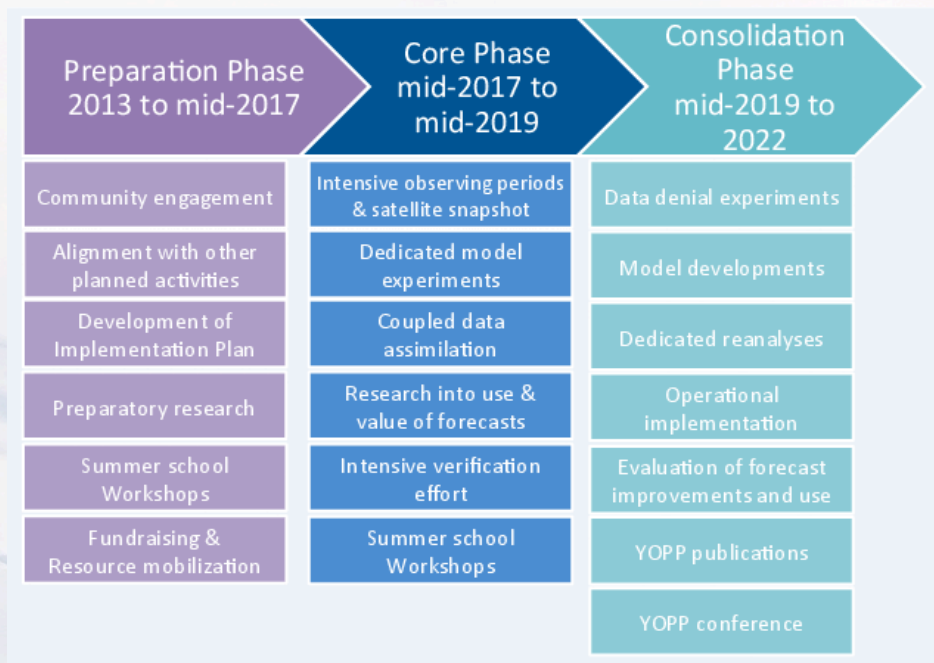
- BEPSII = SOLAS + CLiC + [IMBER] + ?
- Plans: remain a discussion forum WITH ACTIONS
 - **Methodologies:** Intercalibration experiment
 - **Databases:** Continue large-scale data collections + infrastructure
 - **Technology:** Think
 - **Modeling:** Inter-comparison project
 - **Integration** of modelling and observational knowledge
 - **Outreach**

2016:

- Last SCOR-WG workshop in Paris in March
 - Wrap up of the 3 TG
 - Plans for future
 - Funding: both SOLAS and CLiC have committed funding
 - Scope: what are the limits of BEPSII?
- Session at the Goldschmidt Conference organised by BEPSII



CliC contributions to YOPP



Next meetings:

PPP SG meeting group (May 2016),
YOPP preparation meeting (September 2016)

How CliC supports YOPP

Observations

Standardization of observational procedures (ASPeCt, ASWIG)
Coordination of campaigns
Evaluation of sea ice models

Modeling

Homogeneization of model output (SIMIP)
Utilizing models as sources of information (SIPN)
Regional modeling (Polar CORDEX)

Assessment

Support for mod-obs comparison
Data assimilation (Obs4MIPs)

Education

Inclusion of early-career scientists in YOPP (Bradley & Massonnet)
Support of summer schools (e.g. Abisko 2016)

Southern Ocean Satellite Requirements

Allen Pope, Penelope Wagner, Robert Johnson, Jamie Shutler, Louise Newman, Jenny Baeseman)

Community Consultation:

- Draft created Spring 2015. Solicited comments from particular experts to strengthen key areas of the report.
- Open comments collected on draft report last summer.

The Report:

- Submitted as a review article in mid-November
- Currently under review at *Antarctic Science*

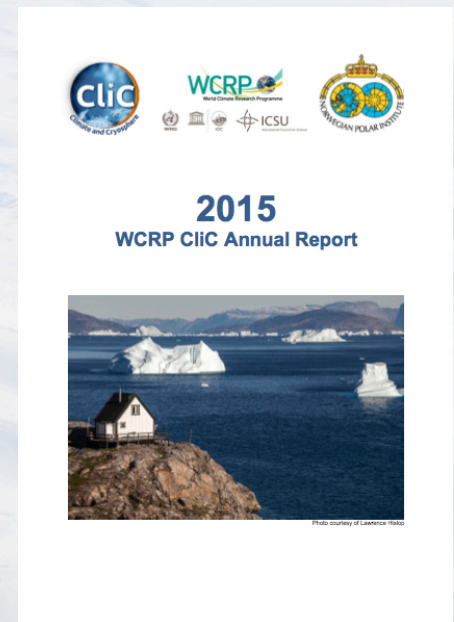
Next:

- Resubmit with edits by end of April 2016.
- Write executive summary, for wider audience, possibly in *Nature Geoscience* or *EOS*!



Reporting

- The **CliC 2015 Annual Report** is a compilation of all our contributions over the past year. Sincere thanks to all of the Leadership group for providing these. And of course to Gwen for pulling it all together.
- We will continue this practice of producing a comprehensive account of our activities each year. As budget pressures inevitably arise, it is important that we convey clearly and convincingly what we have accomplished and why it is important.
- We have the **CliC Action Plan** covering the period 2015-2020 which we hope will be useful in conveying to others what CliC is about, and in guiding/prioritizing our activities. Input to WCRP review.



Grand Challenges

- CliC has the primary lead for the Grand Challenge: Cryosphere in a Changing Climate, which will have as its initial focus:

Melting Ice – Global Consequences

- Contributing one of the work packages (cryospheric contributions) to the Grand Challenge on Regional Sea Level Rise
- The anticipated Grand Challenge on Decadal Climate Prediction will necessarily have strong links the WCRP Polar Climate Predictability Initiative (PCPI)
- Permafrost and cold regions hydrology aspects in CliC, GEWEX, Melting Ice GC, and Biogeochemical Cycles GC



Data-related issues

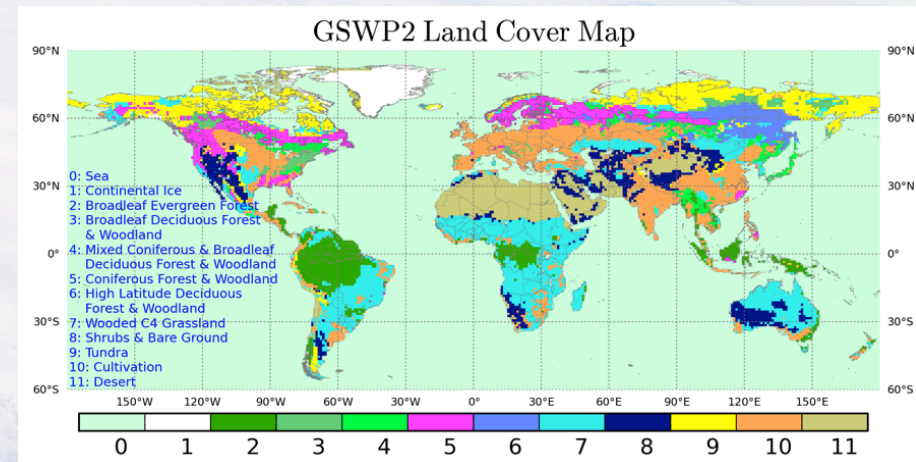
- Polar and mountain regions generally data-scarce
- Potential for targeted compilation and assessment of observational datasets (e.g. pros/cons of different sources, better quantification of uncertainty, ...) that would support model evaluation and climate change impact research relevant to the cryospheric elements of the upcoming IPCC Assessment.
 - This should be done in a way that complements Obs4MIPS – needs ongoing dialog
- (Initial) Obs4MIPS focus on global data sets well justified but possibly problematic for cryosphere observations
- Some CliC activities might be coordinated with Global Cryosphere Watch:
 - Technical Committee on Sea Ice Observations
 - Arctic Sea Ice Working Group
 - ASPeCt (Antarctic Sea Ice Processes and Climate)



Model-related issues

CliC effort to address past JSC request to engage more strongly with the climate modelling community

- 3 new activities connected to CMIP6 under the Grand Challenge banner
 - Ice Sheet MIP (ISMIP6)
 - Snow in ESMs (integrated into LS3MIP)
 - Diagnostic Sea Ice MIP (SIMIP)
- Ensure focused analysis of CMIP6 output in polar regions
- Aim for improved representation of cold processes
- Coupling with cryospheric and non-cryosphere elements



Regional facets

- Cryosphere is concentrated in some regions
- On the impact side: People tend to be where the permanent cryosphere is not
 - Melting ice has global impacts
 - Local importance of cryosphere:
 - Freshwater availability (glaciers, snow)
 - Transportation (marine: sea ice; land: snow)
- Regional modeling: Arctic CORDEX well established; Antarctic community to be mobilized
- Regional science: Discussion ongoing on pre-IPCC reviews and synthesis of non-English cryosphere-related scientific literature (South America, Russia, Third Pole). Opportunity for capacity development



EO and Cryosphere Science 2016

- Conference on Earth Observation and Cryospheric Science, co-sponsored by ESA, in May, part of LPS-16 symposium
- 233 papers (oral and poster) have been accepted on a broad range of topics.
- Other conferences:
 - 2/2017 Wellington Symposium on Cryosphere in a Changing Climate, CliC/IACS/IGS
 - 7/2017 NYC Sea Level conference via CliC contribution to Sea Level GC

Earth Observation and Cryosphere Science 2016
10th-13th May 2016
Prague Congress Centre, Prague, Czech Republic
Co-organized by [ESA](#), [CliC](#)

Earth Observation and Cryosphere Science 2016

Recent advances in Earth observation (EO) satellites have enabled improved observations of several key parameters governing important cryosphere processes. Current ongoing and future missions, as well as historical EO mission data, offer an exciting panorama for new scientific developments and discoveries in cryospheric science. The full exploitation of this capacity by the scientific community requires coordinated research efforts to develop robust EO-based products and facilitate their integration into suitable modelling systems aiming at better characterising the different processes in the cryosphere domain and the interactions among the cryosphere, the atmosphere and the oceans.

The purpose of this topical conference is to advance our knowledge on the potential offered by EO technology to answer some of the major open questions in cryosphere science; to review the latest developments on advanced EO-based geo-information data products addressing key cryosphere processes; and identify the major scientific requirements and challenges of the cryosphere scientific community for the coming years where EO may contribute.

Copyright © European Space Agency. All rights reserved.





Climate and Cryosphere

Understanding the changing cryosphere and its climate connections



Contact Us

You are here: [Home](#) » [Categories](#) » [FrostBytes](#)

[Discover](#) [Media](#) [Categories](#) [Albums](#) [Playlists](#) [Upload](#) [Search](#)

FrostBytes



If you are looking for interesting soundbytes of cool research happening in the cryosphere, this is the category for you to search. CLIC has teamed up with the [Association of Polar Early Career Scientists](#) (APECS) to help enhance their FrostBytes project. FrostBytes are short (often 30-60 second) videos of researchers talking about their current projects and neat discoveries. Erik Warming, an APECS member and ice sheet graduate student, has been helping early career scientists who have attended recent CLIC sponsored workshops to create some new FrostBytes.

Search Clear

All media Display # 100

Thumbnail	Title
	FrostByte D Olefeldt: Mapping thermocast pre-disposition at the pan-arctic scale This FrostByte was made by David Olefeldt for the 3rd Carbon Pools in Permafrost Regions, 12 - 14 May, 2014, Stockholm University, Sweden.
	FrostByte J Ely: Flowstrips 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 Emetsc: Antarctic Mass Balance: Integration of modeling and observation This FrostByte was made by Veronika Emetsc for the ISSM workshop held in Bergen, Norway June 2014. Workshop webpage: http://issm.jpl.nasa.gov/issmworkshops/

FrostByte A. B. Stenstrom: Assessment of the net Ecosystem Carbon Balance of a NE Siberian tundra
 This FrostByte was made by A. B. Stenstrom for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte G. Sørensen: Dynamics of sea-ice ice sheets
 This FrostByte was made by G. Sørensen for the ISSM workshop held in Bergen, Norway June 2014. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte R. Rasmussen: Coastal Change, Sediment and Carbon Dynamics of the Arctic Shelf
 This FrostByte was made by R. Rasmussen for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte J. Jantzen: Carbon transport in sub-arctic streams
 This FrostByte was made by J. Jantzen for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte L. Lecomte: Arctic permafrost: a review
 This FrostByte was made by L. Lecomte for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte M. Hering: Impacts of permafrost degradation on greenhouse gas fluxes in northwestern Canada
 This FrostByte was made by M. Hering for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte P. Gorbunov: Permafrost Heating Soil Interaction Taking into Account Temperature Dependence of Contact Parameters
 This FrostByte was made by P. Gorbunov for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte I. Saurin: Subglacial permafrost in central west Poland - critical evaluation
 This FrostByte was made by I. Saurin for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte P. Håkkinen: Depth and ice content estimation of permafrost in peatlands and peat bogs with the use of electrical resistivity tomography
 This FrostByte was made by P. Håkkinen for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte O. Gorbunov: Rock glaciers of the Russian Altai Mountain
 This FrostByte was made by O. Gorbunov for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte D. Klover: Simulating Permafrost Distribution and Thickness during the Last
 This FrostByte was made by D. Klover for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte J. Lutz: Permafrost: Implications from an 11,500 years old meltwater lake in northwestern Canada (Pechora delta, Yukon)
 This FrostByte was made by J. Lutz for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte K. Ganes: Downscaling of snow distribution for permafrost modeling
 This FrostByte was made by K. Ganes for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte O. Gorbunov: Cataloging of Rock Glaciers in Chukotka (Russia)
 This FrostByte was made by O. Gorbunov for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte G. Gorbunov: Sedimentology and permafrost development in Holocene deposits (Adventdalen, Svalbard)
 This FrostByte was made by G. Gorbunov for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte S. Wilmann: Remote Sensing of thaw ice dynamics
 This FrostByte was made by S. Wilmann for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte A. Håkkinen: Detection of permafrost on Earth-like geomorphological setting
 This FrostByte was made by A. Håkkinen for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte J. Brier: Interactions between soilification and vegetation on lateral moraines in the Turtman glacier bedrock (Svalbard)
 This FrostByte was made by J. Brier for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte A. Gorbunov: Permafrost distribution and characteristics in Southern Caucasus, Romania
 This FrostByte was made by A. Gorbunov for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte S. Håkkinen: Variation of remotely sensed soil moisture for permafrost studies in the Arctic
 This FrostByte was made by S. Håkkinen for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>

FrostByte S. Håkkinen: Geomorphological mapping in NE Greenland
 This FrostByte was made by S. Håkkinen for the Permafrost Young researcher's workshop at EUCCOP 19-21 June 2014, Bonn, Portugal. Workshop webpage: <http://issm.jpl.nasa.gov/issmworkshops/>



www.climate-cryosphere.org

<http://www.climate-cryosphere.org/categories/138-frostbytes>

CliC business

- Thinking of more clearly pre-defining lifetimes for targeted activities
- We thank Gwen sincerely for stepping in as interim Director after Jenny Baeseman moved to her new position at SCAR.
- We welcome Lawrence as the new CliC IPO Director!
- We welcome Hiroyuki Enomoto, Stephen Hudson, Dario Trombotto Liaudat, and Lars Smedsrud to the SSG starting 2016
- One SSG member (Dorthe Dahl-Jensen) and one co-chair (G. Flato) rotating off 12/2016. Proposed incoming co-chair: James Renwick
- As always, sincere thanks to the Norwegian Polar Institute for their ongoing support.
- Special thanks to JPS - Mike Sparrow
- Future of CliC office: Currently funding until beginning of 2018
- Through the year, CliC leadership teleconferences (approx. 6/year) on various topics (MIPs, SSG preparation,...). Very useful and appreciated!

