



2017 WCRP CLiC Annual Report



About CliC

Who we are...

The Climate and Cryosphere Project (CliC) is one of five core projects of the WMO/ISCU/IOC World Climate Research Programme (WCRP) (<http://www.wcrp-climate.org>) together with CLIVAR, GEWEX, SPARC, and CORDEX. The core projects work closely with the WCRP Joint Planning Staff (JPS) and other working groups of WCRP. The projects organize their work through various focused initiatives, experiments, scientific advisory committees, and panels.

What we do...

The Climate and Cryosphere project encourages and promotes research into the cryosphere and its interactions with the global climate system. It highlights emerging issues, encourages communication between researchers with common interests in cryospheric and climate science, promotes international cooperation, and highlights the importance of this field to policy makers, funding agencies, and the general public. CliC also publishes scientific papers on the role of the cryosphere in the global climate system and recommends directions for future study.

How we work...

The CliC Scientific Steering Group (SSG) is composed of high calibre researchers and has the overall responsibility for planning and guiding the CliC science plan. SSG members are appointed by the WCRP Joint Scientific Committee (JSC), based on recommendations from the CliC SSG. Initial membership is for three years and, as a rule, two extensions of two years each may be recommended. The SSG usually meets once per year.

The CliC International Project Office (IPO) is hosted at the Norwegian Polar Institute in Tromsø, Norway. The IPO supports the SSG and the CliC community in coordinating and implementing the CliC science projects and tasks. Its functions of international communication and liaison make it the primary point of contact for those wishing to participate in, contribute to, or learn more about CliC activities.

CliC is fortunate to have a large number of leading cryosphere researchers working through regional and national programs, working groups, and expert panels.

Report prepared by Gwénaëlle Hamon and Lawrence Hislop with contributions from Gerhard Krinner, James Renwick, Mike Sparrow, Sophie Nowicki, David and Denise Holland, Chris Derksen, Regine Hock, Ben Marzeion, Alexandra Jahn, Dirk Notz, Christina Schaedel, Don Perovich, Marilyn Raphael, Penelope Wagner, Martin Vancoppenolle, Kazuyuki Saito, Dave McGuire, Frank Pattyn, Inga Smith, John Fyfe, Amy Solomon, Annette Rinke, John Cassano, Andrew Orr, Letizia Tedesco, Jack Kohler, Matthias Forwick, Kenichi Matsuoka, Leif Toudal Pedersen, Stefan Kern, Linling Chen, Yoshihiro Iijima, Lei Han, Jordan Hisel, Sarah Bartholow, and Michael Karcher.

Table of Contents

Overview from the Co-Chairs	4
Scientific Steering Group (SSG) Members	5
The International Project Office	6
Report Format	7
WCRP Grand Challenge - Melting Ice and Global Consequences	8
Ice Sheet Modelling Intercomparison Project 6 (ISMIP6)	9
Marine Ice Sheet Ocean Model Intercomparison Project (MISOMIP)	10
Earth System Model - Snow Model Intercomparison Project (ESM-SnowMIP)	11
Glacier Model Intercomparison Project (GlacierMIP)	12
Sea Ice and Climate Modeling Forum / Diagnostic Sea Ice Model Intercomparison Project (SIMIP)	13
Permafrost Carbon Network	14
Sea Ice	16
Arctic Sea Ice Working Group (ASIWG)	17
BEPsII - Biogeochemical Exchange Processes at Sea Ice Interfaces	18
Permafrost	19
Permafrost Modeling Forum	20
Ice Sheets	21
SCAR/IASC/CliC Ice Sheet Mass Balance and Sea Level (ISMASS)	22
Regional Activities	23
CLIVAR/CliC/SCAR Southern Ocean Regional Panel	24
CLIVAR/CliC Northern Oceans Region Panel	26
Polar Coordinated Regional Downscaling Experiment (Polar CORDEX)	27
Inter-disciplinary Activities	28
WCRP Polar Climate Predictability Initiative (PCPI)	29
2017 CliC Meetings and Workshops	30

Cover photo courtesy of Lawrence Hislop

Overview from the Co-Chairs

2017 was another exciting and productive year for the CliC community and we are pleased to share this annual report highlighting some of our progress and achievements during the past year. The report also covers the outputs resulting from the WCRP Grand Challenge on “Melting Ice and Global Consequences”.

With an ambitious agenda but using limited resources, CliC had a busy year, including a series of workshops, covering all major components of the CliC Action plan. The year began with the CliC sponsored International Symposium on the Cryosphere in a Changing Climate in Wellington New Zealand. CliC contributed to the event as a member of the science and organizing committees and hosted two workshops and the annual CliC SSG meeting.

An exciting new initiative this year was the establishment of the Northern Oceans Regional Panel (NORP). This panel is jointly run with the WCRP CLIVAR project and will complement the work of the Southern Ocean Regional Panel (SORP). The overall focus will be on cryosphere, ocean, and atmosphere linkages in Arctic and sub-Arctic seas. Thematic task teams have been set up during the initial on-line project calls and the members will have their first workshop together with SORP at the POLAR2018 conference in Davos in June 2018.

The Grand Challenge “Melting Ice and Global Consequences” (GC) has been moving forward on its initial focus areas. CliC plays an important role in contributing to the GC’s goals by mobilizing the global cryosphere modelling community and supporting the sixth iteration of the WCRP Coupled Model Intercomparison Project (CMIP6). CliC is currently sponsoring model intercomparison projects covering snow, ice sheets, glaciers and sea ice (ESM-SnowMIP, ISMIP6, MISOMIP, GlacierMIP, SIMIP). These initiatives are the result of a strategy aimed at tightening the links between the cryospheric research and global modelling communities.

Throughout the year, CliC actively contributed to a number of United Nations and WMO linked initiatives, programs, conferences and events. CliC regularly provides input to the Executive Council Panel of Experts on Polar and High Mountain Observations (EC-PHORS), the Global Cryosphere Watch (GCW) and the Year of Polar Prediction (YOPP). Current and previous SSG-members are also playing active roles the Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report and Special Report on the Oceans and Cryosphere.

The co-chairs are happy to see the close cooperation between the CliC project office, the WCRP joint planning staff and the Norwegian Polar Institute. These links provide vital strategic support for CliC.



*From left to right: G. Krinner; M. Sparrow; J. Renwick
at the WCRP JSC Meeting, April 2017, Paris, France*

Scientific Steering Group (SSG) Members

Chairs

James Renwick, Victoria University of Wellington, New Zealand (1/2017-12/2019)

Gerhard Krinner, LGGE, France (Co-Chair, 7/2014-12/2017, member 1/2013-7/2014) (outgoing)

Fiamma Straneo, Scripps Institution of Oceanography, UCSD, USA (1/2018-12/2020) (incoming)

Members

Alexandra Jahn, University of Colorado Boulder, USA (1/2014-12/2018)

Hiroyuki Enomoto, National Institute of Polar Research (NIPR), Japan (1/2016-12/2019)

Shichang Kang, State Key Laboratory of Cryospheric Sciences, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, China (1/2015-12/2019)

Sebastian Mernild, Nansen Center, Bergen, Norway (1/2014-12/2018)

Stephen Hudson, Norwegian Polar Institute, Norway (1/2016-12/2019)

Lars H. Smedsrud, University of Bergen, Norway (1/2016-12/2019)

Dario Trombotto Liaudat, Centro Cientifici Tecnológico CONICET Mendoza, Argentina (1/2016-12/2019)

Outgoing Members

Margareta Johansson, Lund University, Sweden (1/2015-12/2017)

Rob Massom, Australian Antarctic Division, Antarctic Climate and Ecosystems Cooperative Research Centre, Australia (1/2013-12/2017)

Tatiana V. Pavlova, Voeikov Main Geophysical Observatory, Russia (1/2015-12/2017)

WCRP Joint Science Committee Liaisons

Mauricio M. Mata, Federal University of Rio Grande-FURG, Brazil (2014 -)

Jens Hesselbjerg Christensen, Danish Meteorological Institute, Denmark (2016-)



ClIC SSG13 Session, February 2017, in Wellington, New Zealand

The International Project Office

The CliC project office enjoyed another productive year in 2017 with workshops and related events taking place every month of the year. The IPO staff also attended a wide range of WCRP events, international conferences and joined some exciting fieldwork campaigns in the high Arctic.

The project office facilitated 20 workshops throughout the year with total attendance in excess of 400 researchers and the participants coming from over 20 countries and organizations globally. The CliC staff were also fortunate to participate directly in some of these workshops including those organized by SIMIP, PCPI, and ISMIP6 as well as WMO events led by IICWG and GCW. Attending these meetings helps the IPO link WCRP throughout the cryosphere community and opens networking opportunities and new collaborations with partner organizations.

The CliC website and social media continue to expand rapidly in terms of content and viewership. Our social media feeds on Facebook and Twitter grew again in 2017 (with more than 1800 Likes on Facebook and more than 2400 Followers on Twitter) and we are regularly looking for opportunities to showcase the scientific outputs from our network on partner media channels. CliC also hosted more than 80 online project meetings on its GoToMeeting account.

Links with the other WCRP core project offices are important and we regularly rotate the hosting of online meetings to help coordinate our research more effectively and to manage our activities efficiently. CliC also attended the CLIVAR and GEWEX SSG meetings in 2017 and used the occasions to present CliC's current science plan, recent achievements and prospects for collaboration.

Working at the Norwegian Polar Institute (NPI) offers unique opportunities for the office staff to support fieldwork campaigns of NPI colleagues around Svalbard. The executive officer joined the A-TWAIN cruise led by NPI aboard RV Lance and helped communicate real-time information about high Arctic ocean moorings deployments and recoveries as well as CTD measurements. The CliC director joined the INTPART field school and helped document ice coring, snow pit digging, and ice floe monitoring.

Finally, we would like to thank our out-going CliC co-chair Gerhard Krinner and welcome our incoming co-chair Fiamma Straneo. We look forward to having a productive and fun time working together over the coming years.



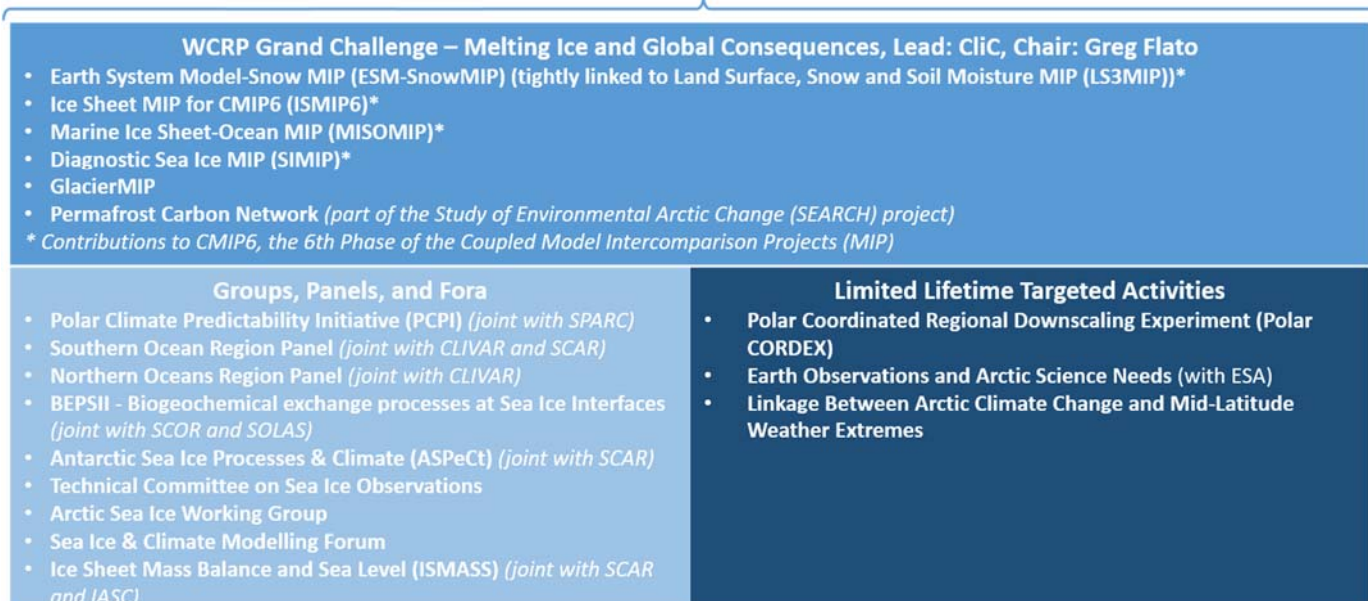
L. Hislop and G. Hamon at the Science in Svalbard Conference, November 2017, Oslo, Norway

Report Format

The remainder of this report presents the science highlights, publications and future plans of the various projects in the CliC network. Our projects are generally clustered into three activity areas that can be seen in the graphic below. These encompass modelling activities that support the WCRP Grand Challenge on Melting Ice and Global Consequences (contributions to the CMIP6 process), limited lifetime activities that typically have a bounded timespan, and partner projects that CliC co-sponsors with other international organisations. To help present the contributions of these activities we have divided the remainder of this report into the following sections:

- WCRP Grand Challenge - Melting Ice and Global Consequences
- Sea Ice
- Hydrology & Permafrost
- Ice Sheets
- Regional Activities
- Inter-disciplinary Activities

Structure of CliC



WCRP Grand Challenge - Melting Ice and Global Consequences

Ice Sheet Model Intercomparison Project for CMIP6 (ISMIP6)

Introduction

ISMIP6 has the objectives of improving projections of sea level from the Greenland and Antarctic ice sheets, and increasing our understanding of the cryosphere in a changing climate. It maps into the 'Melting Ice and Global Consequences' and 'Regional Sea-level Change' Grand Challenges of the World Climate Research Program. ISMIP6 is an endorsed activity within CMIP6.

- Two workshops: initMIP-Antarctica at EGU, and annual ISMIP6 PreAGU.
- Presentations at EGU, AGU, IARPC, PMIP, WCRP-CLIVAR Regional Sea Level Changes and Coastal Impacts Conference, and SCAR #GreatAntarcticClimateHack.

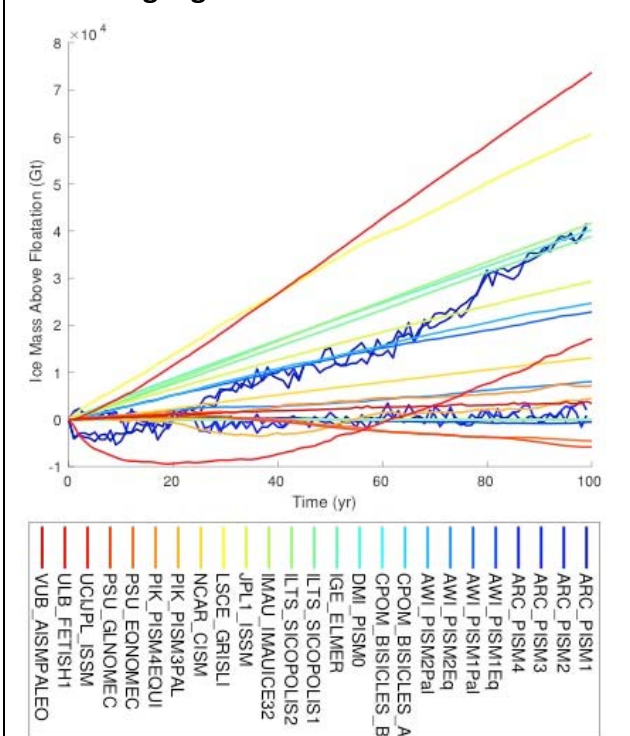
2017 Publications

Goelzer, H., et al.: Design and results of the ice sheet model initialization experiments initMIP-Greenland: an ISMIP6 inter-comparison, *The Cryosphere Discuss.*, doi:10.5194/tc-2017-129, in review, 2017.

Future activities and developments

- Publication of the initMIP-Antarctica results.
- Preparation of forcing dataset for ice sheet models.
- Workshops at EGU, and large workshop on evaluation of CMIP6 climate models to derive forcing for ice sheet models.

Science Highlight



Centennial sea level background trend in control experiments due to model drift or transient initialization from the initMIP-Antarctic models, an effort that investigates uncertainty resulting from the initialization.



Contact:

Sophie Nowicki, NASA GSFC, USA,
sophie.nowicki@nasa.gov

Tony Payne, University of Bristol, UK,
a.j.payne@bristol.ac.uk

Eric Larour, NASA JPL, USA, eric.larour@jpl.nasa.gov

www.climate-cryosphere.org/activities/targeted/ismip6

2017 Highlights

- 16 modelling groups participated in initMIP-Greenland.
- 15 modelling groups participated in initMIP-Antarctica.
- Analysis of the initMIP-Greenland and initMIP-Antarctica model simulations.

Marine Ice Sheet Ocean Model Intercomparison Project (MISOMIP)

Introduction

The potential societal impacts of sea-level rise in a warming climate are widely recognized, but rates of future sea-level change are not well constrained. In the coming centuries, one of the largest, but also most uncertain, sources of sea-level rise is likely to be mass loss from the marine-based ice sheets, particularly the West Antarctic Ice Sheet (WAIS). The large uncertainties result, in part, from the lack of ice sheet-ocean coupling in the current generation of global climate models.

As a step toward remedying this situation, MISOMIP has held annual workshops bringing together the international ice sheet-ocean modeling community to plan collaborative research toward fully coupled regional-scale simulations focused on WAIS. To date, this work has yielded a set of idealized experiments to aid in building, testing and further understanding the coupled ice sheet-ocean models and their components. MISOMIP's longer term goal is to produce physically-based estimates of sea-level change from WAIS over the coming centuries. This regional-modeling research will lay the groundwork for including ice sheet-ocean interaction in global scale, IPCC class models.

2017 Highlights

A MISOMIP splinter meeting was held on 24 April as part of the European Geosciences Union (EGU) General Assembly 2017. The splinter meeting discussed primarily the progress to date and the upcoming deadlines for MISOMIP+, ISOMIP+ and MISOMP1. A poster by S. Cornford et al. (EGU2017-15426 Abstract) also presented some preliminary MISOMIP+ on April 27.

Science Highlight

Zhang et al. (2016). A schematic of the different basal boundary masking schemes used by two Stokes ice sheet models. They find that FELIX-S (Elmer/Ice) grounding lines are relatively more retreated (advanced). They show this to be due to different choices in the implementation of basal

boundary conditions in the two models.

2017 Publication

Zhang, T., Price, S., Ju, L., Leng, W., Brondex, J., Durand, G., and Gagliardini, O.: A comparison of two Stokes ice sheet models applied to the Marine Ice Sheet Model Intercomparison Project for plan view models (MISOMIP3d), *The Cryosphere*, 11, 179-190, doi:10.5194/tc-11-179-2017, 2017.

Future activities and developments

Side-bar MISOMIP meetings will be held at AGU, EGU, IGS and related meetings. Several publications analyzing MIP results are expected in early 2018. The third MISOMIP meeting is now set for May 7-9, 2018.

Contacts:

Professor David M. Holland, NYU,

dmh4@nyu.edu

Denise Holland, NYU, dh416@nyu.edu

Earth System Model-Snow Model Intercomparison Project (ESM-SnowMIP)

Introduction

The Land Surface, Snow and Soil Moisture Intercomparison Project (LS3MIP) is an endorsed subproject of CMIP6. The ESM Snow Model Intercomparison (ESM-SnowMIP) is an extension to LS3MIP focusing on the evaluation of the representation of snow in global and dedicated process models.

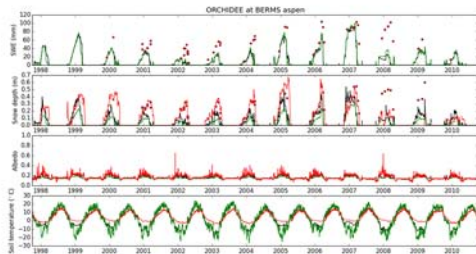
In addition to global land surface and coupled simulations similar to LS3MIP, ESM-SnowMIP consists of site-scale simulations designed at evaluating the quality of the models at small scales.

Other preparations for CMIP6 as a whole were delayed for all modelling groups for several reasons, among which there are critical delays in the production of several forcing files, but also typical delays due to last-minute adjustments of model versions. This has some consequences for LS3MIP and to a lesser degree for ESM-SnowMIP which is currently not supposed to be in the production phase of global runs.

Future activities and developments

ESM-SnowMIP site simulations will be analysed in detail during the next year, with good reasons to expect rapid publication of the main results. Next year will be the start of the production phase for the LS3MIP global land-only and coupled simulations, while ESM-SnowMIP simulations are planned after this main CMIP6 period. A joint LS3MIP/LUMIP/ESM-SnowMIP workshop is planned September or October 2018 in conjunction with a CRESCENDO project meeting in Europe.

Science Highlight



A preliminary evaluation of recently obtained model output at some selected snow sites immediately allowed to identify unrealistic model features, here underestimated winter soil temperatures in one version of the ORCHIDEE land surface model.

2017 Highlights

Site simulations for ESM-SnowMIP at a number of sites have now been produced for most of the participating models. A first evaluation of these simulation output, including reference simulations and modified parameter simulations (high snow conductivity, constant snow albedo) is underway. The meteorological forcing data for land-only global simulations for LS3MIP and ESM-SnowMIP have been prepared and quality-controlled; there is no remaining obstacle for global land-only simulations foreseen in 2018.

An official LS3MIP kick-off teleconference was held in September, allowing to identify issues relative to the data request and simulation setup ahead of the CMIP6 production phase.

Contact:

Gerhard Krinner, IGE/CNRS,

Gerhard.krinner@cnr.fr

Chris Derksen, Environment and Climate Change Canada, chris.derksen@canada.ca

Bart van den Hurk, KNMI,

bart.van.den.hurk@knmi.nl.

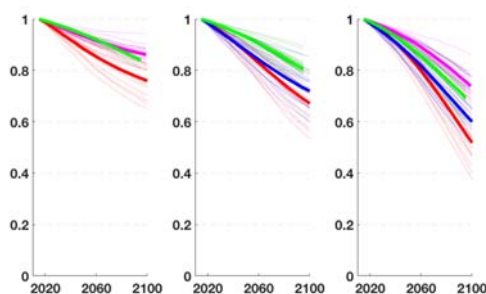
GlacierMIP – A model intercomparison of global-scale glacier models

Introduction

GlacierMIP is a model intercomparison project focusing on all glaciers in the world outside the ice sheets. It provides – for the first time – a framework for a coordinated intercomparison of global-scale glacier mass change models, to foster model improvements and reduce uncertainties in global glacier projections. Primary goals are (a) to coordinate a model intercomparison of existing state-of-the-art large-scale glacier models with respect to decadal to century scale glacier mass change projections, and (b) to identify current model deficiencies and data needs, and work towards a new generation of global-scale glacier models that allow more accurate projections.

Science Highlight

Preliminary results from the model intercomparison indicate that globally, glaciers will lose between 15 and 55% of their current volume by 2100 (multi-model mean of runs forced by 8-15 GCM and a variety of emission scenarios). This corresponds to 7 – 22 cm sea-level equivalent. Differences between the glacier models are substantially greater for individual glacier regions than at the global scale. Rates of sea-level rise from glaciers increase steadily for the RCP8.5 scenario with multi-model means reaching 3 mm/yr towards the end of the 21st century (multi-GCM mean), while rates peak, and later decrease for more moderate emission scenarios.



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).

2017 Highlights

A half-day GlacierMIP meeting was held at the IGS/IACS/CliC conference in Wellington in February 2017. Almost all participants were able to join the meeting either in person or by Skype. Preliminary GlacierMIP results have been presented at the IGS/IACS/CliC conference in Wellington, the WCRP-CLIVAR Regional Sea Level Changes and Coastal Impacts Conference in New York in July 2017, and the EGU conference in Vienna in April 2017.

Progress has been made towards a joint peer-reviewed publication comparing recent global glacier projections.

Future activities and developments

A GlacierMIP meeting was held at the AGU conference in New Orleans in December 2017 and another meeting will be held at POLAR2018.

Contact:

Regine Hock, University of Alaska, Fairbanks, USA, rehock@alaska.edu
Ben Marzeion, University of Bremen, Germany, ben.marzeion@uni-bremen.de

Sea Ice and Climate Modeling Forum

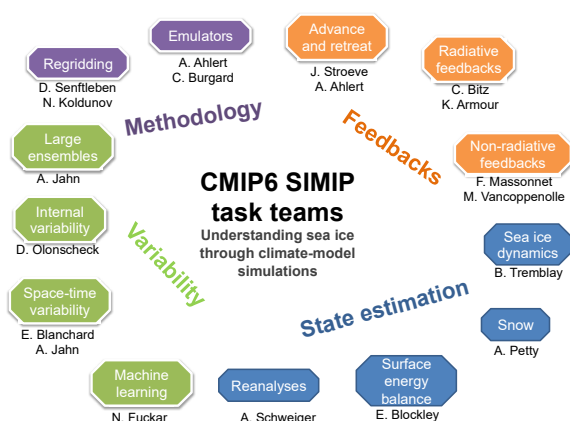
Diagnostic Sea Ice Model Intercomparison Project (SIMIP)

Introduction

The CliC Sea Ice and Climate Modeling Forum contributes to a better understanding of the role of sea ice for the changing climate of our planet. To reach this aim, we coordinate large-scale model simulations and facilitate conversations between modelers and observers through joint workshops.

Science Highlight

We have defined 13 sub-groups that will take the lead on analyzing different aspects of the CMIP6 sea ice output, once it becomes available. By defining these task groups before CMIP6 data becomes available, we hope to enable in-depth processes-based assessments of the CMIP6 sea ice simulations early in the process.



(Graphic: F. Massonnet)

2017 Highlights

Over the past year, we primarily worked on preparing the scientific analyses within the CMIP6 sea-ice model intercomparison project SIMIP. To achieve this aim, we organized a workshop at the Alfred Wegener Institute (Bremerhaven, Germany) that defined 13 key tasks that will be tackled as part of SIMIP (see science highlight for details).

We also contributed to the organisation of a workshop on improved satellite retrievals of sea-ice thickness and concentration in Hamburg, bringing together modelers and observationalists working on sea ice. The main focus was to discuss sea ice concentration and thickness data sets and how to compare them with model simulations.

The insights gained at the workshop will benefit the planned analysis of the CMIP6 sea ice output.

Future activities and developments

For 2018, we expect the first science results coming out of CMIP6-SIMIP. We will guide this process through the close interaction with the task teams that have formed this year. We have organized a dedicated session at the POLAR2018 conference in Davos that will allow for the presentation of first results from these efforts.



Participants of the 2nd SIMIP Workshop in Bremerhaven, April 2017
(Graphic: F. Massonnet)

Contact:

Alexandra Jahn (Univ. Colorado, USA, alexandra.jahn@colorado.edu)
Dirk Notz (Max Planck Institute for Meteorology, Germany, dirk.notz@mpimet.mpg.de)

Permafrost Carbon Network (PCN)

Introduction

The Permafrost Carbon Network and Permafrost Action Team are part of the Study of Environmental Arctic Change (SEARCH). This National Science Foundation funded collaborative program facilitates synthesis of Arctic science and communicates our current understanding to help society respond to a rapidly changing Arctic. The focus of the Permafrost Action Team is performing synthesis science on how the degradation of permafrost will affect both the Arctic and the globe.

Science Highlight

As part of SEARCH, we have prepared short science briefs focused on relevant topics related to degrading permafrost. All science briefs provide scientific information in a format that can be used by scientists, stakeholders, policy- and decision-makers, as well as students and journalists. Each 1-2 page brief is the top of a 'knowledge pyramid' and is structured in paragraphs that summarize the main issue, why it matters, the state of the science and where the science is headed.

The three science briefs that we developed are:

- What is the impact of permafrost carbon release on climate change?
- What are the consequences of thawing permafrost on infrastructure?
- What are the consequences of thawing permafrost on local ecosystem goods and services?

All Arctic science briefs can be found here:
<https://www.arcus.org/search-program/arctic-answers>

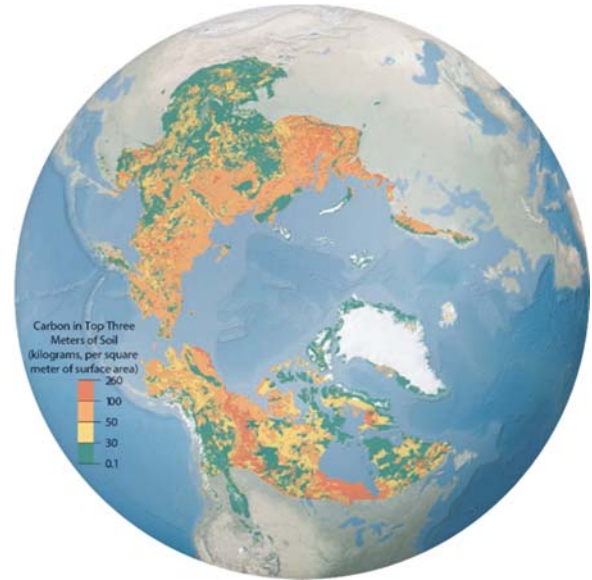


Figure: Carbon in the upper 3m of northern permafrost zone soils

2017 Highlights

The steering committee of the Permafrost Action Team met in June 2017 in Fairbanks, Alaska for a one-day meeting to advance and foster the development of Knowledge Pyramids and new synthesis activities. The workshop was supported by the National Science foundation and in part by CliC, which covered travel for two scientists.

2017 Resulting Publications

Strauss J et al. (2017) Yedoma permafrost: A synthesis of depositional characteristics and carbon vulnerability. *Earth-Science Reviews*. <https://doi.org/10.1016/j.earscirev.2017.07.007>

Xia J et al. (2017) Terrestrial ecosystem model performance in simulating productivity and its vulnerability to climate change in the northern permafrost region. *Journal of Geophysical Research: Biogeosciences*, 122, 430-446. [doi:10.1002/2016JG003384](https://doi.org/10.1002/2016JG003384)

Future activities and developments

The Permafrost Carbon Network organized its 7th Annual Meeting in New Orleans, Louisiana,

December 10, 2017. Synthesis leads and co-leads presented updates on synthesis activities in the morning and smaller breakout discussions in the afternoon focused on individual syntheses as well as new emerging topics. This meeting was used to connect with the large scientific community and to provide feedback to individual synthesis leads.



Contact:

Ted Schuur – Principal Investigator, Northern Arizona University, USA ted.schuur@nau.edu

Christina Schädel – Network Coordinator, Northern Arizona University, USA
christina.schaedel@nau.edu

www.permafrostcarbon.org

Sea Ice

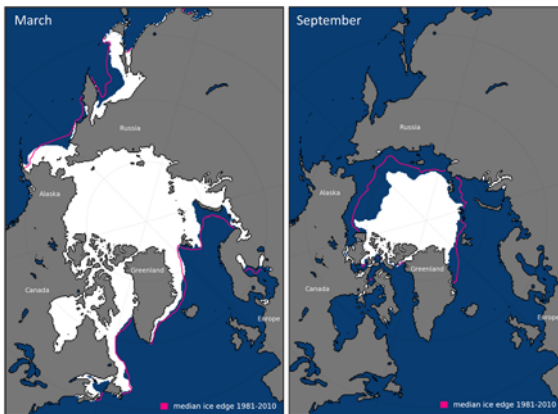
Arctic Sea Ice Working Group (ASIWG)

Introduction

The goals of the Climate and Cryosphere Arctic Sea Ice Working Group are: i) Develop, standardize, and implement measurement protocols for Arctic sea ice in coastal, seasonal, and perennial ice zones; ii) Integrate surface-based observations with remote sensing and modeling efforts; and iii) Foster connections between international groups involved in sea ice observations, modeling, and remote sensing. The ASIWG has organized workshops and produced documents addressing these goals.

Science Highlight

March and September 2017 ice extent from National Snow and Ice Data Center. The March maximum ice extent was the smallest in the satellite record. The ASIWG has contributed to codifying ice concentration satellite retrievals.



2017 Highlights

ASSIST, the sea ice observation software, continues to be used on both research and tourist cruises. ASIWG members have continued to contribute to the Sea Ice Section of the NOAA Arctic Report Card and to the Bulletin of the American Meteorological Society State of the Climate issue. ASIWG members have participated in the planning of MOSAiC – Multidisciplinary drifting observatory for the Study of Arctic Climate. ASIWG members participated in 2017 Sea Ice Prediction Network and in a joint modeling/observing workshop examining sea ice thickness.

2017 Publications

Richter-Menge and others. The Arctic (in "State of the Climate in 2016"). *Bull. Amer. Meteor. Soc.* 98, 2017.

Future activities and developments

The ASIWG will continue to integrate Arctic sea ice related activities into MOSAiC and the Year of Polar Prediction. Coordinating autonomous buoy deployments is a particular focus. This coordination is critical since the Year of Polar Prediction happening now and the MOSAiC field campaign will start in fall 2019. We will work with MOSAiC to standardize snow and ice observational protocol. We will continue disseminating the ASSIST ice watch software to research vessels and to cruise ships operating in the Arctic. We plan to work on implementing an essential sea ice variables sustained observing framework. These proposed activities will be done in collaboration with other CiC groups. An ASIWG workshop in 2018 is being planned, most likely to be held in conjunction with a MOSAiC planning meeting.

Contact:

Don Perovich, Thayer School of Engineering,
Dartmouth College, jonesperovich@myfairpoint.net

<http://www.climate-cryosphere.org/activities/groups/arctic-sea-ice-working-group>

Biogeochemical Exchange Processes at Sea Ice Interfaces (BEPSII)

BEPSII, "Biogeochemical Exchange Processes at Sea-Ice Interfaces" started in 2011 with a focus on sea-ice biogeochemistry. BEPSII was a SCOR working group from 2012 until September 2016, and has since been endorsed as a SOLAS-CliC forum (2016), as a SCAR Action Group.

BEPSII is now coordinating some community activities linked to the biogeochemistry of sea ice-influenced environments, with ~120 involved scientists.

Science Focus

Amongst the wealth of our activities, this year, we emphasize:

* An analysis of sea ice microbial diversity from >300 ice cores (van Leeuwe et al, in press)

* A model study of Baltic sea ice primary production from a mesoscale sea ice-ocean model (Tedesco et al., 2017)

2017 Highlights

- Joint ECV-ICE BEPSII Meeting in La Jolla, CA, Apr 3-5, 2017. (~30 participants).
- BEPSII 1D Model Inter-comparison Project meeting, Helsinki, Finland, Nov 2017.
- ECV-ICE SCOR WG kickoff (co-chairs F. Fripiat, D. Nomura, B. Else) focused on the design of inter-calibration experiments for sea-ice biogeochemical observation techniques.
- BEPSII Special Feature (in *Elementa*) finalized and closed.
- COST action proposal EN-Ice submitted (PI J. Stefels).
- Draft of BEPSII 5-yr Science Plan (PI N. Steiner).

2017 Publications



BEPSII [Special feature](#) in *Elementa: Science of the Anthropocene* finalized (16 accepted contributions)

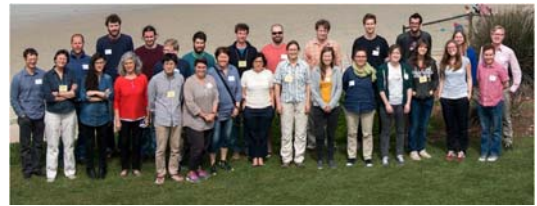
Future activities and developments

We are actively designing our future activities. Just a few examples.

- Expert contribution to ongoing discussions on the design of biogeochemistry and ecosystem components of MOSAiC.
- Model development and inter-comparison (links to CMIP6, SIMIP and FAMOS).
- Finalization of the 5-yr activity plan.
- Position Analysis on sea-ice biogeochemical response to climate change
- BEPSII winter school to be held in Cambridge Bay, Canada, Apr 2019

2018 Agenda

- ECV-ICE Primary production intercalibration experiments, Hokkaido, Japan, March.
- BEPSII annual meeting, Davos, Switzerland, June.
- ECV-ICE gas experiments, Norwich, UK, July.



Participants in the ECV-ICE BEPSII Meeting in La Jolla, CA, April 2017

Contact:

CliC BEPSII contacts are
Bruno Delille, ULg, Belgium
bruno.delille@ulg.ac.be

Klaus Meiners, UTAS, Australia
Klaus.meiners@aad.gov.au

Martin Vancoppenolle, CNRS, Paris, France
mvlod@locean-ipsl.upmc.fr

<https://sites.google.com/site/bepsiiwg140/home>

Permafrost

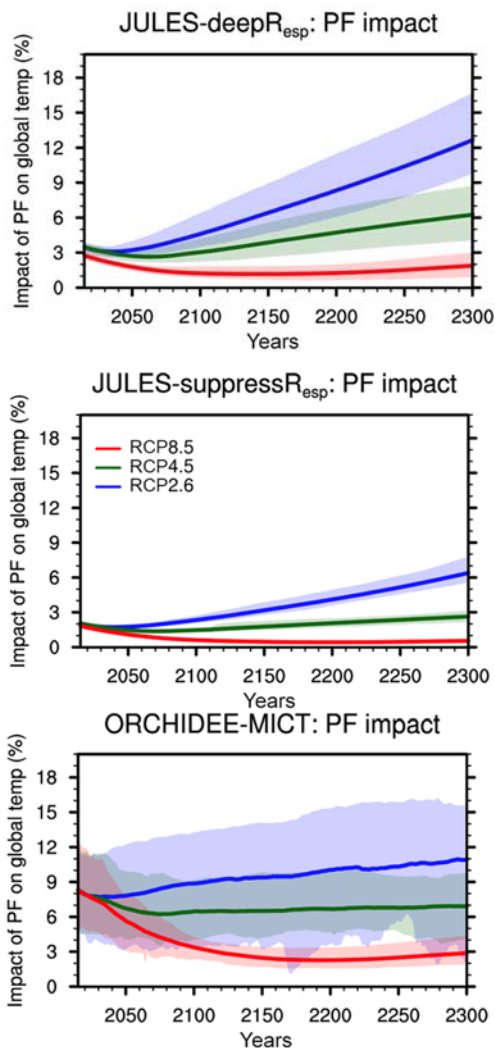
Permafrost Modeling Forum

Introduction

The Permafrost & Climate Modeling Forum is an interdisciplinary activity that attempts to represent the modeling of both natural and social processes related to the goals of the Climate and Cryosphere, with frozen ground dynamics modeling as a primary focus. This forum has close ties with Permafrost Carbon Network (PCN), Next-Generation Ecosystem Experiments-Arctic (NGEE), and other Ground Challenge activities (e.g., biogeochemistry).

Science Highlight

Uncertainties of permafrost carbon – climate feedback under warming were quantified using two land surface models, JULES and ORCHIDEE by Burke et al. (2017).



The permafrost carbon feedback has a greater impact on the low-emissions scenario than on the higher-emissions ones. Structural differences

The permafrost carbon feedback has a greater impact on the low-emissions scenario than on the higher-emissions ones. Structural differences between the land surface models (the representation of the soil carbon decomposition) are a larger source of uncertainties than differences in the climate response.

2017 Highlights

- Evaluation of terrestrial ecosystem model performance in simulating productivity in the northern permafrost region completed by the Permafrost Carbon Network (Xia et al. 2017).
- A new synthesis project on mapping and modeling of frozen ground of the Tibetan Plateau (m2TPfg) started at ACOP2017 to bring young Asian scientists.

2017 Resulting Publications

- Burke EJ et al. (2017). Quantifying uncertainties of permafrost carbon–climate feedbacks. *Biogeosciences*, 14(12), 3051-3066.
- Xia J et al. (2017) Terrestrial ecosystem model performance in simulating productivity and its vulnerability to climate change in the northern permafrost region. *JGR: Biogeosciences*, 122, 430-446.

Future activities and developments

- m2TPfg will work with ESA's post-GlobPermafrost project.



m2TPfg participants at ACOP 2017.

Contact:

Kazuyuki Maza Saito, JAMSTEC, ksaito@jamstec.go.jp; A. David McGuire, UAF, adm McGuire@alaska.edu

Ice Sheets

Ice Sheet Mass Balance and Sea Level (ISMASS)

Introduction

The Expert Group on Ice Sheet Mass Balance and Sea Level (ISMASS) is co-sponsored by the Scientific Committee on Antarctic Research, the International Arctic Science Committee (IASC), and the WCRP Climate and Cryosphere Project. The goals of ISMASS are to promote the research on the estimation of the mass balance of ice sheets and its contribution to sea level, to facilitate the coordination among the different international efforts focused on this field of research, to propose directions for future research in this area, to integrate observations and modelling efforts, as well as the distribution and archiving of the corresponding data, to attract a new generation of scientists into this field of research, and to contribute to the diffusion, to society and policymakers, of the current scientific knowledge and the main achievements in this field of science. Further details on the goals of ISMASS can be found in the Terms of Reference at

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

Science Highlight

ISMASS Workshop addresses impact of 1.5°C global warming on Greenland & Antarctic ice sheets

An Ice Sheet Mass Balance and Sea Level (ISMASS) workshop was held in Brussels from 11-13 January 2017 with the purpose of preparing a review paper on the contribution of Greenland and Antarctic ice sheets to future sea level under a 1.5-degreeC warmer climate (in line with the Paris agreement). This workshop was funded by SCAR and CliC. Discussions at the meeting led to the conclusion that the review paper would address the following: Forcing (non-linearities, SMB, circulation changes, feedbacks...), Advances in understanding processes. -uncertainties since IPCC Assessment Report 5 (calving, GIA, basal processes...), Expected centennial response for Greenland and Antarctica, and Expected long-term response (including commitment). The resulting review paper is planned to feed into the IPCC Special Report on 1.5 degrees.

Participants at the meeting were Frank Pattyn (organizer), Lionel Favier, Gael Durand, Catherine Ritz

co-organiser and chair of ISMASS), Xavier Fettweis, Edward Hanna, Michiel van den Broeke, Heiko Goelzer, Xylar Asay-Davis, Alexander Robinson, Tony Payne, Helene Seroussi and Sophie Nowicki. Rob DeConto joined by Skype.

Other 2017 Highlights

Catherine Ritz gave presentations on the above activity at: (1) 2017 European Geosciences Union meeting; and (2) WCRP/IOC conference on "Regional Sea Level Changes and Coastal Impacts" in New York in July 2017.

2018 Publication

A review paper arising from the January 2017 Brussels workshop is in preparation, intended for submission to *Nature Climate Change*.

Future activities and developments

- There will be an ISMASS related session during next Open Conference in DAVOS in 2018. CR5: "Interactions between ice mass balance, the solid Earth, and sea-level changes" (C. Ritz convener)
- ISMASS will organize a one-day workshop on 15 June 2018 as a side meeting of the above Open Conference. Title: "Update on mass balance of Greenland and Antarctica (linkages between data and models)". A review article should be an outcome of this workshop (Contact Edward Hanna)
- The review article on "Contribution of Greenland and Antarctic ice sheets to future sea level under a 1.5 degree warmer climate" will be finalised and submitted during spring 2018 (contact F. Pattyn, C. Ritz)
- ISMASS will continue to endorse the ice-sheet-ocean model intercomparisons by helping organizing workshops related to this issue (e.g., MISOMIP).
- We will hold an ISMASS Steering Committee Meeting on 17 June (at the Davos SCAR open conference).

Contacts

Chair: Catherine Ritz (catherine.ritz@univ-grenoble-alpes.fr)

Representatives from member organizations are Frank Pattyn (SCAR), Francisco Navarro (IASC) and Edward Hanna (CliC, ehanna@lincoln.ac.uk).

Regional Activities

SCAR/IASC/CliC Southern Ocean Region Panel (SORP)

Panel overview

The Southern Ocean Region Panel (SORP) is cosponsored by the World Climate Research Programme's Climate and Ocean: Variability, Predictability and Change (CLIVAR) and the Climate and Cryosphere (CliC) projects, and the Scientific Committee on Antarctic Research (SCAR). The SORP serves as a forum for the discussion and communication of scientific advances in the understanding of climate variability and change in the Southern Ocean. It advises CLIVAR, CliC, and SCAR on progress, achievements, new opportunities and impediments in internationally-coordinated Southern Ocean research.

Achievements for 2016-17

The SORP's main activity during 2016-2017 was to organize the 12th session (face-to-face meeting) of its members and guests at the National Centre for Atmospheric Research (NCAR) in Boulder, Colorado, USA. The main obstacle to holding the SORP-12 was finding sufficient funds for travel and accommodation of members needing support, because CLIVAR funding administered through the ICPO was not available for any panel meetings in 2017. This obstacle was eventually overcome, with funding from US-CLIVAR, SCAR, and CliC, and a very successful meeting was held in conjunction with a Year of Polar Prediction (YOPP) – Southern Hemisphere meeting. The second main activity was to help instigate and support an initiative to establish a new northern panel as a natural cousin to the SORP. This new panel, titled the Northern Oceans Regional Panel (NORP), is now official under the auspices of CLIVAR and CliC. It is Co-Chaired by John Fyfe (Canada) and Amy Solomon (USA) and consists of 14 members organized into six task teams. The task teams are as follows: 1) Developing state-of-the-art Arctic ocean reanalyses; 2) Understanding of the role of the Arctic ocean in Arctic amplification; 3) Advancing the understanding of climate variability due to Arctic - mid-latitude linkages; 4) Quantifying the response to natural variability in the Arctic ocean; 5) Assessing model errors in Arctic projections

through initialized forecasts; 6) Evaluating Greenland ice sheet and ocean interactions.

The CLIVAR/CliC/SCAR Southern Ocean Region Panel (SORP) has been very active, with a panel meeting in September 2016 alongside the CLIVAR Open Science Conference in Qingdao, China and another jointly with the Year of Polar Prediction Southern Hemisphere workshop in June 2017. Extensive participation in international research coordination and collaboration has occurred with several relevant programmes, including the Southern Ocean Observing System (SOOS), the Ocean Observations Panel for Climate (OOCIP), the Year of Polar Prediction Southern Hemisphere (YOPP-SH) and the CLIVAR/CliC Northern Oceans Region Panel (currently under formation). The panel has two new members (Robin Robertson and David Bromwich).

The SORP has proposed or help organize sessions at several international conferences including the CLIVAR Open Science Conference (Qingdao, China; September 2016) and POLAR2018. SORP co-sponsored a Townhall meeting on "Ocean-Cryosphere Interactions" at the CLIVAR Open Science Conference. The panel helped to organize a Polar Prediction Workshop in Bremerhaven, Germany (March 2017) co-sponsored by the Polar Climate Predictability Initiative (WCRP-PCPI), the Polar Prediction Project (WWRP-PPP), and the Sea Ice Prediction Network (ARCUS-SIPN). The panel was represented, with poster or oral presentations about SORP, at several international conferences/workshops, including the IGS/CliC/IACS International Symposium on The Cryosphere (Wellington, New Zealand, February 2017), the SOOS SSC meeting, and the SOOS/POGO Observing and Understanding the Ocean below Antarctic Sea Ice and Ice Shelves workshop (Bremerhaven, Germany, June 2017). The SORP has developed a template to maximize input from national reports, has solicited and posted to the website a series of national reports, and has strengthened coordination of national representatives between SOOS and SORP (led by Inga Smith).

The SORP has reported to several sponsoring and related organizations such as SOOS (Inga Smith

and Jiuxin Shi ; Bremerhaven, Germany, June 2017), the Ocean Observations Panel for Climate (OOCp; Katsuro Katsumata; WoodsHole, USA, March, 2017), the Polar Prediction Project (PPP) Steering Group (François Massonnet), the CLIVAR Scientific Steering Group (John Fyfe and Inga Smith, Qingdao, China, September 2016, and the CliC Scientific Steering Group (Inga Smith, Wellington, New Zealand, February 2017).

Plans for 2018 and beyond

We propose that the thirteen meeting of the SORP be held 14-15 June 2018 in Davos, Switzerland in conjunction with the SCAR/IASC Open Science Conference (POLAR2018). Room bookings for SORP-13 are in place for 14-15 June with afternoon of Friday 15 June set aside for a joint meeting with NORP. Although this is outside the 18 months between meetings guidelines, SORP believes POLAR2018 is a unique opportunity for SORP to interact with the new NORP and to raise the profile of Southern Ocean oceanography in particular at the SCAR OSC aligned parts of POLAR2018.

SORP Co-Chairs:

John Fyfe

john.fyfe@canada.ca

Inga Smith

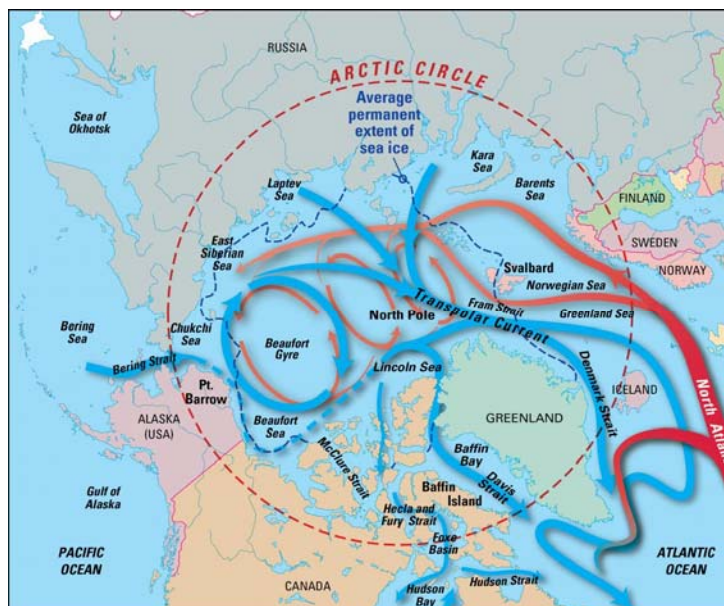
inga.smith@otago.ac.nz

<http://www.clivar.org/clivar-panels/southern>

CLIVAR /CliC Northern Oceans Region Panel (NORP)

Panel overview

The CLIVAR/CliC Northern Oceans Panel serves as an international forum for coordinating and strategizing activities on the role of the Arctic Ocean in the context of the global climate system from a coupled perspective. In addition, this panel facilitates progress in developing new tools and methods to observe the Arctic Ocean and neighbouring seas and their climate impacts, to standardize and archive observations of the Arctic Ocean and the coupling with other components of the climate system, and to extend what will be learned through activities organized for the Year of Polar Prediction (YOPP), which is organized under the World Weather Research Program (WWRP), beyond 2019.



"Illustration by Jack Cook, Woods Hole Oceanographic Institution"

This image shows the movement of water in the Arctic Ocean. Blue arrows show cold, relatively fresh water and red arrows show warm, salty water that has entered the system from the North Atlantic.

Achievements for 2016-17

NORP was proposed on the CLIVAR Open Science Conference in September 2016 and the CliC SSG meeting On February 2017 and was finally endorsed by the 38th Session of the WCRP Joint Scientific Committee on April 3, 2017.

Presentations were made at ASSW, EGU, AGU and various WCRP events.

The NORP panel completed their Terms of Reference and set up an initial set of Task Teams including: Improving Arctic Ocean reanalyses, The role of the Arctic Ocean in Arctic amplification, Understanding Arctic – mid-latitude linkages, Quantifying the response to natural variability and external forcings, Model errors in Arctic projections, Greenland ice sheet – ocean interactions

Plans for 2018 and beyond

NORP will have its first face to face meeting of members during the SCAR/IASC Open Science Conference (POLAR2018), 14-15 June 2018 in Davos, Switzerland. On the Friday 15 June, a special meeting time will be set aside for a joint meeting with SORP in order to exchange experiences and benefit from SORPs successes.

NORP Co-Chairs:

Amy Solomon

amy.solomon@noaa.gov

John Fyfe

john.fyfe@canada.ca

<http://www.clivar.org/clivar-panels/northern>

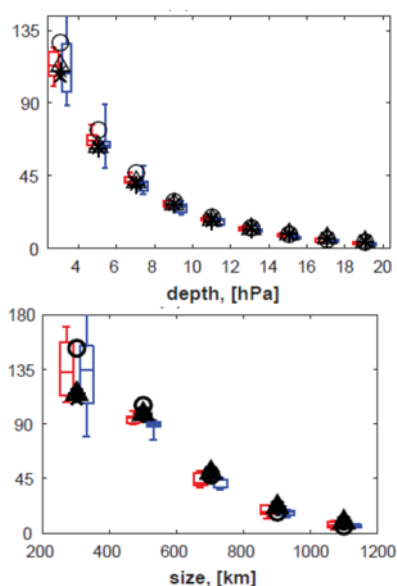
Polar CORDEX

Introduction

Polar CORDEX focuses on both Arctic and Antarctic RCM simulations.

Science Highlight

13 Arctic CORDEX runs are compared with four re-analyses for cyclones. Largest cyclone frequency bias is for small (radius < 400 km) and shallow (depth < 4 hPa) cyclones.



Frequency distribution of cyclone depth (top) and size (bottom) for summer (see for details in Akperov et al., 2017)

2017 Resulting Publications

- Akperov, et al., 2017: Cyclone activity in the Arctic from an ensemble of regional climate models (Arctic CORDEX), J. Geophys. Res., in review
- Beaumet, et al., 2017: Assessing bias-corrections for oceanic surface conditions for atmospheric models, Geosci. Model Develop., submitted
- Cassano et al., 2017: Development of the Regional Arctic System Model (RASM): Near-surface atmospheric climate sensitivity, J. Climate, doi:10.1175/JCLI-D-15-0775.1
- Glisan et al., 2017: A metrics-based analysis of seasonal daily precip. & near-srfc temp. within seven CORDEX domains, Atmosph. Sci. Lett., prep.

- Kohnemann, et al., 2017: Extreme Warming in the Kara & Barents Seas during the winter period 2000 to 2016. J. Clim., doi: 10.1175/JCLI-D-16-0693
- Matthes, et al., 2017: Uncertainties in coupled regional Arctic climate simulations associated with the used land surface model, J. Geophys. Res., doi: 10.1002/2016JD026213
- Spengler, et al, 2017: Summary for the 13th Polar Low Workshop. BAMS, doi:10.1175/BAMS-D-16-0207.1
- Takhsha, et al., 2017: Dynamical downscaling with Canadian CRCM5 over the CORDEX Arctic domain: effect of large-scale spectral nudging & empirical correction of SST, Clim Dyn, doi:10.1007/s00382-017-3912-6
- Zahn, et al., 2017: Trends of cyclone characteristics in the Arctic and their patterns from different re-analysis data, J. Geophys. Res., under review

Future activities and developments

- Arctic: Process-evaluation of multi-model RCM ensemble, based on ASCOS 2014 observational data; preparation for MOSAiC activity
- Antarctica: Multi-model RCM future projection runs driven by different CMIP6 GCMs; input to ISMIP6



Polar CORDEX meeting at BAS in Cambridge, UK, Oct. 18-20, 2017

Contact:

Annette Rinke, AWI, Potsdam, Germany

Annette.Rinke@awi.de

John Cassano, CIRES, Boulder, USA

John.Cassano@Colorado.edu

Andrew Orr, BAS, Cambridge, UK

anmcr@bas.ac.uk

www.climate-cryosphere.org/activities/targeted/polar-cortex

Inter-disciplinary Activities

Polar Climate Predictability Initiative (PCPI)

Introduction

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. Polar predictability stems from the unique persistence of signals in ice and snow and through exchange with the ocean at all depths and with the stratosphere. PCPI is concerned with the success of modelling and observing the rapid changes seen in the Arctic and the varied changes occurring in the Antarctic. PCPI is investigating the role of the poles in global climate and prediction. We work jointly with the Polar Prediction Project of the WWRP on mutual interests, though our focus tends towards longer timescales.

2017 Highlights

PCPI underwent a change in leadership as co-lead Cecilia Bitz stepped down in Spring 2017 and is replaced by Julie Jones.

In March 2017 a follow-on workshop (also joint with PPP) to the 2016 Polar Prediction workshop, was held at the Alfred Wegener Institute, Bremerhaven, Germany. It focused on Decadal variability and was held synchronously with CliC's Sea Ice MIP Workshop.

In October 2017, PCPI participated in SCAR's AntClim21's Great Antarctic Climate Hack Workshop held at Scripps Oceanographic Institute. A major workshop goal was the determination of key metrics with which to evaluate Earth System Model results for the Antarctic.

2017 Publications

None: Publications are in preparation

Future activities and developments

A teleconference of the PCPI leads to discuss future activities, is planned.

Contact:

Marilyn Raphael, UCLA

raphael@ucla.edu

Julie Jones, University of Sheffield

julie.jones@sheffield.ac.uk

<http://www.climate-cryosphere.org/wcrp/pcpi>

2017 CliC Meetings & Workshops

GlacierMIP Workshop at the AGU Fall Meeting, December 11, 2017, New Orleans, USA

--Contributed by Ben Marzeion

A meeting of GlacierMIP was held on December 11, 2017, during the AGU Fall Meeting in New Orleans. Almost all active participants of GlacierMIP were able to join, either in person or by video conference, including two new participants (Philip Kraaijenbrink and Walter Immerzeel from the University of Utrecht, NL). Each participant reported on the progress of modeling for phase II. At least seven global and three regional models confirmed their participation. Goal of phase II is the production of global glacier projections based on homogenized initial and boundary conditions. The results are expected to be available for analysis to the GlacierMIP community in spring/early summer 2018, such that first results can be discussed during the next GlacierMIP meeting, planned for the SCAR/IASC Open Science Conference in Davos in June 2018.



ISMIP6 Workshop at the AGU Fall Meeting, December 10, 2017, New Orleans, USA

--Contributed by Sophie Nowicki

The ISMIP6 annual Pre-AGU meeting focused on a review of current standalone ice sheet model simulation and planning for the next suite of experiments. Our current effort, initMIP-Antarctica, investigates the uncertainty in sea level projections arising from the choice of initialization procedure for ice sheet models. As the initMIP-Antarctica runs have been completed, a preliminary analysis of these results were presented and discussed. The second part of the meeting reviewed the current plans for the ISMIP6-PMIP simulation, the coupled AOGCM-ISM simulations, and how to translate CMIP6 atmospheric and oceanic fields into drivers for the standalone ice sheet simulations. This included presentations of what is possible on the ice sheet model side (for example, how ice sheet models currently implement oceanic forcing), but also presentations on what can be expected from the CMIP6 ocean models. The meeting was attended by 25 participants, with expertise in ice sheet modeling, climate modeling and observationalists in the polar regions.

7th Annual meeting of the Permafrost Carbon Network, December 10, 2017, New Orleans, USA

--From <http://www.permafrostcarbon.org/>

The Permafrost Carbon Network met for its annual meeting on December 10, 2017, in New Orleans, on the margins of the 2017 AGU Fall Meeting. In the morning, synthesis leads gave short presentations and updated the group on ongoing and new activities. Breakout discussions in the afternoon focused on advancing existing syntheses and brainstorming new ideas and topics. The breakout discussions focused on a) Expert assessment of permafrost; b) Thermokarst: what have we done, what do we know, where are we going; c) Bottom-up estimations of methane emissions; d) Model benchmarking; e) Thaw-induced changes to the permafrost microbiome and the functional implication; f) Bottom-up CO₂ flux synthesis; g) Organizing validation data for remote sensing product, and h) Surface water analysis for pan-Arctic permafrost.



BEPSII - CliC Workshop: Inter-comparison of 1D sea-ice biogeochemical models, November 27-29, 2017, Helsinki, Finland

--Contributed by *Letizia Tedesco*

The BEPSII workshop was held at the Finnish Environment Institute in Helsinki on 27-29 of November 2017. The WS aimed to make progress for BEPSII Task 3.3, i.e. the inter-comparison of 1-D sea-ice biogeochemical models. During the first day of the WS, every modelling group gave their updates on their modelling configurations and interests in the inter-comparison. Available time-series to serve the inter-comparison were discussed and two datasets were



found suitable from all the modelling groups: the Resolute time series (Canadian Arctic, Mortenson et al., 2017, Elementa) and the N-ICE refrozen lead time-series (Svalbard area, Duarte et al., 2016, JGR). During the second day of the WS the group started working on the N-ICE refrozen lead test case study, while during the third day the Resolute case study was analysed. The WS closed by setting a new roadmap and tentative timeline. Every modelling group can now continue to work on their own on both test case studies and will produce the first control runs by early February (first videoconference for updates). Further runs will be produced by June (second videoconference for updates) and preliminary results will be presented at the annual BEPSII meeting (15-17 of June 2017, Davos, Switzerland) just before POLAR2018. The next WS will be tentatively held on 18-20 of September 2018 in Iceland, where all of the modelling groups would most likely be able to participate. The aim of the WS will be to wrap up all of the work done and start drafting one or more collaborative papers.

Liestøl Symposium in conjunction with Svalbard Science Conference, November 8-9, 2017, Oslo, Norway

--Contributed by Jack Kohler

The Liestøl Symposium: Integrating field measurements, remote sensing, and models of Svalbard glacier mass balance was organised by Dr. Jack Kohler from the Norwegian Polar Institute, in conjunction with the Svalbard Science Conference in Fornebu, Norway, on November 7-8-9, 2017.

The talks in the Symposium took us from the early days of field measurement of surface mass balance at Midre Lovénbreen, Austre Brøggerbreen and Finsterwalderbreen, through modern modelling and remote sensing techniques, into literally uncharted waters. The speakers highlighted the breadth of contemporary glaciological research in Svalbard, and its links with biological, oceanographic, atmospheric, terrestrial and geodetic research.

The difficult aim of the Symposium was to not only bring together researchers from the international groups studying Svalbard glacier mass balance, but to better integrate their activities.

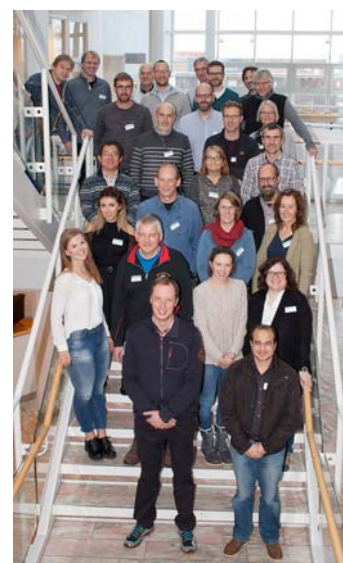
The CliC International Project Office presented a poster at both the Svalbard Science Conference and the Liestøl Symposium, where CliC Director Lawrence Hislop also gave a talk about CliC and its activities.

Linking onshore and offshore investigations in the Dronning Maud Land, Antarctica – an interdisciplinary workshop, November 2-3, 2017, at UiT The Arctic University of Norway in Tromsø

--Contributed by Matthias Forwick and Kenichi Matsuoka

Almost 30 scientists from UiT The Arctic University of Norway in Tromsø, the Norwegian Polar Institute, the Geological Survey of Norway, the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (Germany), the British Antarctic Survey (UK) and the National Oceanography Centre (UK) gathered for a workshop at UiT on November 2nd and 3rd with the purpose of identifying topics for interdisciplinary, collaborative efforts to improve the understanding of geological, glaciological and oceanographic processes in the Dronning Maud Land sector of Antarctica at present and in the past. The workshop included scientific presentations about the bedrock geology in Dronning Maud Land, present glacial and oceanographic processes, available bathymetric data, ice-sheet configurations and dynamics during the past ~4 million years, as well as past processes in a large channel system in the Riiser Larsen Sea.

Presentations about planned expeditions in Antarctica and the southern Ocean within the framework of the International Ocean Discovery Program (IODP), an update about pre-site



model evaluation, impact studies, and projections. Holding both the Arctic CORDEX and Antarctic CORDEX meetings together allowed the many synergies between these two initiatives to become apparent. This helped to create a dynamic and interesting meeting, with all the participants coming away with a high level of knowledge exchange. The meeting closed with a discussion on future activities and plans. These included using observations from ASCE2014 for a multi-model RCM ensemble process-evaluation, preparation for the MOSAiC field campaign, and producing multi-model RCM future projections driven by CMIP6 for input to ISMIP6.

Workshop on improved satellite retrievals of sea-ice concentration and sea-ice thickness for climate applications, October 9-11, 2017, Hamburg, Germany

--Contributed by Stefan Kern and Dirk Notz

The main purpose of this workshop was to bring together scientists from the sea-ice remote sensing community with scientists from the sea-ice modelling community to examine how observations and models can best be combined to understand the evolution of sea-ice concentration and thickness. The workshop was designed as a discussion forum



with a few keynote presentations to set the scene for discussion. We also had two long poster sessions that allowed for additional in-depth discussion of the workshop themes.

It became obvious throughout the workshop that neither satellite observations nor large-scale model activities can ever describe the "true" sea-ice concentration or sea-ice thickness. Nevertheless, both sources of information can provide useful information on this true state. We also found that in comparing models and observations, it might be useful to examine in both communities which observable bears the best compromise of observational uncertainty and availability from model simulations. For sea-ice thickness, for example, it might be more useful to evaluate modeled sea-ice freeboard rather than satellite derived sea-ice thickness, as the latter can only be estimated with much larger uncertainty.

The workshop with its about 80 participants was sponsored by CiSAP, the ESA Climate Change Initiative, and CliC.

International Ice Charting Working Group (IICWG) and WMO Requirements for Ice Analysts and Forecasters

--Contributed by Penelope Wagner

As sea ice conditions become more dynamic in the Arctic and the Antarctic it is crucial that operational ice services maintain the consistency of the high quality in their products while keeping up with new developments in satellite technology. Operational sea ice products are considered a valuable tool to provide guidance for ship operators and in the science community, they include an additional



quality control (QC) by expert analysis. The analysts help to resolve exceptions found within the natural seasonal variability of drifting ice due to local, regional, climate influences. Sea ice operational products are a compilation of several satellite products with varying temporal and spatial resolutions which is required to capture sea ice features throughout the pack ice, the marginal ice zone (MIZ) and the ice edge. Ice services' focus on safety in navigation within their mandated area but it will be important in the future for all services to follow a minimum standard of knowledge and competencies for the QC input when assessing the impact of sea ice phenomena, variables, and parameters on marine operations. Establishing a minimum requirement of competencies can present a metric to resolve the differences introduced by the human bias QC and allow for more cohesion with all the ice services.

From May 30 – June 2, 2017 the U.S National Ice Center (USNIC) welcomed representatives from two International Ice Charting Working Group (IICWG) (<https://nsidc.org/noaa/iicwg>) member nations to discuss development of an international standardized ice charting training program. The U.S NIC, Canadian Ice Service (CIS) and the Norwegian Ice Service (NIS) met to initiate the first draft of the World Meteorological



Organization (WMO) Ice Analysts and Forecasters Competency Requirements. This effort will implement established guidelines for shared training of ice analysts and ice forecasters to align with WMO ice service qualification standards. In order to implement new requirements to ice services, it is necessary to be prepared for the training and technological undertaking it will require.

As a continuing supporter of the sea ice operational community, CliC sponsored the US NIC IT specialist to attend the 18th International Ice Charting Working Group (IICWG) annual meeting September 25-29 in Hobart, Tasmania to provide insight on how ice services can incorporate new requirements for analysts and forecasters, as well as how we should collectively deal with big data challenges. Discussions from this meeting led to a planned workshop in 2018 to finalize the WMO competencies draft which will include input from the analysts and IT personnel on the best and most effective way to move forward without disrupting day-to-day operations.

The IICWG issued the following statement:

“Extreme variability, both from place to place and from year to year, makes knowledge of

local and regional ice conditions critically important for polar shipping. The IICWG and its members regularly engage their users to ensure they are providing the best possible ice information, in the form of satellite images, charts, and forecasts, to help keep ships, their passengers, and the environment safe.“

Effects of Arctic Changes on European Weather and Climate, Helsinki, Finland, September 11-14, 2017

--Contributed by Linling Chen

The disproportionate Arctic warming relative to mid-latitudes — referred to as Arctic amplification (AA) — emerged from the noise of natural variability in the late 1990s. This signal will strengthen as human activities continue to raise greenhouse gas concentrations. Both observational and modeling work suggested that the AA might have contributed to the extreme weather in the Northern Hemisphere mid-latitudes. However, compared to other areas in the mid-latitudes, the potential AA linkages in Europe are less clear and more complex in the sense that severe weather involves multiple causes, including the tropical as well as Arctic forcing factors.



The workshop titled ‘Effects of Arctic Changes on European Weather and Climate’ attracted 11 scientists from Finland, Norway, Iceland, the United Kingdom, Germany and the United States to discuss our current understanding and challenges in dynamical interpretation of the linkages between AA and European weather extremes and climate variability. Our goal is to, for the first time, provide an up-to-date review and systematical analysis of the impact of Arctic forcing on European weather and climate relative to other forcing factors (a paper in preparation). The World Climate Research Programme (WCRP)’s Climate & Cryosphere (CliC) Project and the Finnish Meteorological Institute are the cosponsors.

Thawing permafrost carbon: a challenge for climate science - A joint CliC/iLEAPS session at the 5th iLEAPS science conference

--Contributed by Gerhard Krinner

The vast amounts of organic carbon locked in frozen soil at high northern latitudes have long been known as a potential source of positive feedback to climate change. However, understanding of the processes and quantification of the potential feedback have been hampered by factors including the difficulty of accessing permafrost terrain, and the high spatial variability and complexity of the physical and biogeochemical processes. Progress has been achieved by combining a range of approaches and spatial scales but most large-scale climate models still do not represent well the fundamental biogeochemical processes of carbon-rich permafrost areas – hence thawing permafrost is recognised as a central issue for two WCRP Grand Challenges (“Melting Ice”, “Carbon feedbacks”). This provided an overview of recent progress in the quantification, understanding and modelling of permafrost processes and permafrost-related climate feedbacks, as well as identify the most pressing

issues in modelling and observation, and discuss avenues for future progress. In order to review recent progress in this domain, a joint CliC/iLEAPS session was organized at the 5th iLEAPS science conference in Oxford, UK, in September 2017. The abstracts of the talk and posters presented in this session can be found at <http://www.ileaps.org/content/5th-ileaps-science-conference-abstracts-c2>.

The 2nd Asian Conference on Permafrost (ACOP2017), July 2-6, 2017, Hokkaido University, Sapporo, Japan

--Contributed by Yoshihiro Iijima, Mie University, Japan

Local organizers: Mamoru Ishikawa (chair), Norikazu Matsuoka and Yoshihiro Iijima (vice-chairs) and 17 Local Organizing Committee members; 16 International Science Committee members.



Supporting agencies: IPA, CliC, Hokkaido University Arctic Research Center, and ArCS

The 2nd Asian Conference on Permafrost (ACOP2017) was held from 2 to 6 July at Hokkaido University, Sapporo, Japan. 178 participants from 17 countries (China, Japan, Russia, Norway, Canada, Mongolia, USA, Germany, France, Republic of Korea, Switzerland, Austria, Denmark, Indonesia and Slovenia) met in a pleasant climate of Sapporo. A total of 141 presentations (86 oral and 55 posters) covered a wide range of topics around the conference's theme "needle ice to deep permafrost" with special emphasis on the current state of permafrost and frozen ground engineering in Asia.

Eight invited plenary speakers, including three early career researchers, presented state-of-the-art topics regarding the conference's theme. Early career researchers actively participated in the conference activity organized by the Permafrost Young Research Network (PYRN), with 20 of them receiving financial assistance to attend the conference. A joint workshop on mapping initiative and GlobPermafrost held during the conference discussed current conditions and future collaboration on permafrost mapping and remote sensing. The conference organized pre- and post-conference field trips on the Daisetsu Mountains and the Tokachi plain in Hokkaido, the Artificial frozen soil wall in Fukushima Dai-ichi nuclear power plant, and Mt. Fuji to learn both natural and engineering aspects of frozen ground in Japan.

12th Session of the CLIVAR/CliC/SCAR Southern Ocean Region Panel, June 29-30, 2017, Boulder, CO, USA

--Contributed by Lei Han, International CLIVAR Project Office, China

The 12th session of the CLIVAR/CliC/SCAR Southern Ocean Region Panel (SORP) was held on 29-30 June 2017 at the National Center for Atmospheric Research (NCAR) Foothills campus in Boulder, Colorado, USA. The meeting was held in conjunction with the 12th workshop on Antarctic Meteorology and Climate and the 2nd planning meeting of the Year of Polar Prediction in the Southern Hemisphere project (YOPP-SH). A joint YOPP-SH and SORP session was convened the morning of June 29 where enhanced collaboration between the two groups was discussed.



At the joint YOPP-SH and SORP session, the YOPP-SH mission of achieving a significant improvement in environmental prediction in-and-around the Southern Ocean was discussed. In this regard, it was recommended that work on high-quality coupled atmosphere-ocean reanalyses be continued as a priority. It was also agreed that an implementation plan for YOPP-SH be developed as soon as possible in order to establish what can be practically implemented on the given (short) time-frame, and what would be the best strategy to achieve maximum return for investment. SORP members were invited to contribute to the drafting of the implementation plan.

During the remainder of the SORP session, representatives of the Southern Ocean Observing System (SOOS), Sea Ice Model Intercomparison project (SIMIP), Estimating the Circulation and Climate of the Ocean (ECCO), the Southern Ocean State Estimation (SOSE), the “Polynyas, ice production, and seasonal evolution in the Ross Sea” (PIPERS), and the Northern Ocean Region Panel (NORP) reported on their groups’ latest activities and achievements. Enhancing links between SOOS and SORP was discussed extensively, with SOOS viewing SORP as a crucial partner. SORP was centrally involved in the development of SOOS objectives and scope. The SOOS and SORP objectives are complimentary, with SORP focusing on articulation of the observational data requirements required for understanding climate variability and predictability in the Southern Ocean, and SOOS focused on the design and implementation of an observing system to deliver said observations.

The SORP session also welcomed its newest members, David Bromwich (Chair of YOPP-SH) and Robin Robertson. At the SORP session it was agreed to establish five “Task teams” focused on: 1) Sea-ice and ice-shelf ocean-atmosphere interactions; 2) Climate variables for the Southern Ocean; 3) Ocean state estimates; 4) Ocean carbon; 5) Liaising with YOPP-SH. In addition, planning of a white paper, or position statement, related to needs for climate predictability in the Southern Ocean was initiated.

ESA Polar Science Collocation Meeting, June 28-30, 2017, Frascati meeting

--Contributed by Gerhard, Krinner

The ESA Polar Science Collocation Meeting took place at ESRIN Frascati between the 28th and 30th of June. More than 50 satellite remote sensing specialists met to discuss the status and prospects of satellite remote sensing in the polar regions, with a particular attention on ESA orientations for the coming years. CliC was represented by Gerhard Krinner. The meeting was organized in topical sessions on ice sheets (Greenland and Antarctica), sea ice, glaciers, snow, permafrost and cross-cutting pan-Arctic and polar initiatives; much time was provided for discussions. The need for continued exchange between the remote sensing and climate modeling communities was often stressed during the meeting; in this respect, the substantial ESA efforts to contribute to the Obs4MIPs initiative are extremely welcome. Naturally, some long-standing challenges for the remote-sensing and climate analysis/modelling communities, such as trustworthy global datasets of seasonal snow water equivalent, remain elusive.

Permafrost Action Team Steering Committee Meeting, June 26, 2017, Fairbanks, AK, USA

--Contributed by Christina Schaedel, Northern Arizona University, USA

The Steering Committee of the Permafrost Action Team met on June 26, 2017 in Fairbanks Alaska for a one day workshop. The purpose of the meeting was to discuss material needed for three different types of Knowledge Pyramids and to produce a short 2-page written brief that can be distributed to a wide variety of interested people. The short briefs provide scientific information on societally-relevant questions in formats usable by a variety of stakeholders,



including policy- and decision-makers. During the workshop, we focused on these three top-level questions: 1) what is the impact of permafrost carbon release on climate change? 2) How does permafrost thaw impact infrastructure? 3) How will ecosystem services critical to human livelihood in the Arctic be affected by permafrost thaw? The second half of the workshop was dedicated to brainstorming new synthesis products that focus on issues involving infrastructure and ecosystem services in the permafrost zone.

Outcomes of this one day workshop are Knowledge Pyramids and science briefs that will be made available on the SEARCH website (<https://www.arcus.org/search-program/arctic-answers>).

Follow up activities of the Permafrost Action Team are quarterly phone calls with the Steering Committee and a one day all scientist meeting of the Permafrost Carbon Network the day before AGU (Sunday, December 10, 2017) in New Orleans, USA. This one day workshop at AGU will be the 7th annual meeting of the Permafrost Carbon Network.

MISOMIP Activities at the 31st Forum for Research into Ice Shelf Processes (FRISP) workshop, June 19-22, 2017, Bergen, Norway / Observing and Understanding the Ocean below Antarctic Sea Ice and Ice Shelves (OASIIS) workshop, June 14-17, 2017, Bremerhaven, Germany

--Contributed by Jordan Hisel and Denise Holland

New York University graduate student, Ms. Jordan Hisel, was supported by CliC to attend two science meetings this past June. Both Meetings, the OASIIS in Bremerhaven and the FRISP in Bergen, focused on ice-ocean interactions, including presentations and discussion relevant to the CliC MISOMIP supported target activity. Ms. Hisel shared her experience during these meetings:

'The OASIIS meeting in Bremerhaven, Germany focused on past projects and future plans for observation and data collection in the Southern Ocean. As I became more and more familiar with the scope of the newly developed technologies discussed over the week, I found myself inspired by possibilities of tomorrow's research. Witnessing the fundamentals, I am currently learning expanded upon over decades into ground-breaking and relevant research was compelling and encouraging.

The FRISP meeting in Bergen, Norway covered recent research into the physics and mechanisms of ice-shelf processes. Brief lectures allowed researchers to share their new findings and pose relevant questions for future work. This was well complemented by poster board time, wherein researchers summarized their projects and discussed with colleagues. I found this part of the forum especially intriguing, as researchers were happy to answer any of my questions about their work, no matter how comparatively basic. I came away from the forum aware of many new processes I am excited to look into further, and with a broader understanding of the many different methods of researching ice-shelf interactions.'

Marine Ice Sheet-Ocean Model Intercomparison Project (MISOMIP) Splinter Meeting, European Geosciences Union (EGU) General Assembly 2017, April 24, 2017, Vienna, Austria

A MISOMIP splinter meeting was held on 24 April as part of the European Geosciences Union (EGU) General Assembly 2017, April 23-28, 2017. The splinter meeting discussed primarily the progress to date and the upcoming deadlines for MISOMIP+, ISOMIP+ and MISOMP1. A poster by S. Cornford et al. (EGU2017-15426 Abstract) also presented some preliminary MISOMIP+ on April 27.

CliC Arctic Sea Ice Working Group (CASIWG) Meeting, April 23, 2017, Reston, VA, USA

The meeting covered updates and strategic discussions on some of the core activities that CASIWG is engaged in. The IceWatch ASSIST Data Network is expanding and has recently

included citizen data collection on Arctic cruises. ASSIST was also used on an INTPART funded PhD field school cruise aboard R/V Lance in the marginal ice zone north of Svalbard (<http://cirfa.uit.no/intpart-project-to-cirfa-arctic-field-summer-school/>). The meeting also focussed on next steps for CliC engagement in the Year of Polar Prediction (YOPP), the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAIC), the Global Cryosphere Watch (GCW), and in particular Coastal flagship observatories and Cryonet.

3rd Polar Educators International (PEI) Workshop, April 11-14, 2017, Rovereto, Italy

--Contributed by Sarah Bartholow

The 3rd Polar Educators International (PEI) Workshop was held in Rovereto (Italy) in the Spring of 2017. The meeting brought together a total of 76 teachers, scientists and high school students from 12 countries worldwide. PEI (www.polareducator.org) is a vital international network of educators and researchers aiming to provide a deeper understanding of current polar science. PEI represents trusted leaders working to inspire appreciation and knowledge of the polar regions, their connectedness to all Earth's systems, and importance to all humans across latitudes and cultures.



The program included presentations on polar research, education, and outreach from researchers and experts across many fields, as well as formal and informal educators. Presentations consisted of lectures, poster presentations, snap talks, and hands-on activities. PEI live-streamed the workshop, with archived recordings and materials available on the PEI website.

Gracious support for the meeting provided by CliC (Climate and Cryosphere) and other global partners including SCAR (Scientific Committee Antarctic Research), CNR (Consiglio Nazionale delle Ricerche), Liceo Fabio Filzi. (Rovereto, Trento), and IPRASE (Rovereto, Trento), Students on Ice, IASC (International Arctic Science Committee), AWI (Alfred Wegener Institute), APECS (Association of Polar Early Career Scientists) and DGP (Deutsche Gesellschaft für Polarforschung) among others.

BEPSII shapes international collaboration on the biogeochemistry of sea ice and ice-covered oceans at its annual meeting

--Contributed by Martin Vancoppenolle

BEPSII (BEPSII - Biogeochemical exchange processes at Sea Ice Interfaces) 2017 meeting at Scripps, La Jolla, California; Apr 3-5, 2017; 27 participants.
Local organizers: Lynn McNutt, Jeff Bowman, Nadja Steiner, Lisa Miller.
Supporting agencies: SOLAS, CliC, IASC, and SCAR.

The BEPSII research community held a 3-day workshop in April 2017, joined by the new SCOR Working Group (#152) on Measuring Essential Climate Variables in Sea Ice (ECV-Ice). Twenty-seven scientists from Australia, Belgium, Canada, Finland, France, Germany, Japan, the Netherlands, Norway, Switzerland, the United Kingdom, and the United States gathered in La Jolla, California to discuss the results of the past year's activities, plan upcoming activities, and to present scientific talks and posters.

Scientific Highlights include the gathering of large-scale databases of sea ice biogeochemical parameters, including nutrients and POC/DOC, of which the paper by Fripiat et al (see Science Highlights above) is an example. Let us also mention the presentation of new optical sensors for sea ice by Raffel et al., or the mapping of chlorophyll on a sea ice floe by Meiners et al. using an ROV, as well as memorable discussions on whether nitrate in sea ice are intra-cellular or concealed in biofilms, following a presentation by Mundy et al. Some of BEPSII's major upcoming activities planned for the coming 3 years include: method intercalibration experiments, advising the upcoming Arctic field campaign Mosaic, and sea ice model intercomparisons.



What is BEPSII? BEPSII (Biogeochemical Exchange Processes at the Sea Ice Interfaces) research community is a global community of sea-ice researchers including biogeochemists, atmospheric scientists, oceanographers and sea-ice physicists, which was initiated as a SCOR WG (140) to address fundamental communication and methodological issues in sea-ice biogeochemistry. BEPSII was then approved by SOLAS and CliC (Climate and Cryosphere) as a longer-lived activity with additional endorsement from SCAR (the Scientific Committee on Antarctic Research). The ongoing second phase of BEPSII is focused on developing the tools to tackle big-picture questions about the global relevance of biogeochemical processes within and around sea ice, including climate-change feedbacks.

Interested to join BEPSII or ECV-Ice? Send a message the chairs Jacqueline Stefels and Nadja Steiner or to the leaders of the relevant task leaders. For entertaining reading, see the BEPSII special feature in Elementa Journal.

<https://www.elementascience.org/collections/special/special-feature-biogeochemical-exchange-processes-at-sea-ice-interfaces-bepsii/>).

Next meeting: BEPSII annual 2018 meeting, June 15-17, Davos, Switzerland (before SCAR/IASC POLAR2018 Conference).

Sea Ice Model Intercomparison Project Meeting, March 29-30, 2017, Bremerhaven, Germany

--Contributed by Alexandra Jahn and Dirk Notz

The 2017 SIMIP workshop was held on March 29th and 30th in Bremerhaven, Germany. It was jointly organized with the preceding 2017 Polar Prediction Workshop, and attracted 60 participants. Funding was provided by WCRP-CliC and the Government of Canada, Department of the Environment.



The aim of the 2017 SIMIP workshop was to coordinate the analysis of CMIP6 sea ice simulations for improved understanding of sea ice processes and improved sea ice projections, making use of the SIMIP-coordinated newly defined sea ice model output (Notz et al., 2016, GMD). After a few short overview talks about current challenges and new opportunities for sea ice simulation analysis and assessments, we had very successful break-out group discussions on several aspects of the sea ice system. These break-out groups identified several new targeted analysis efforts, with the goal of enhancing the process-level understanding of sea ice simulations and the cause of their biases. These are listed on the SIMIP website, with leaders identified for each topic, to facilitate the coordination of the analysis of CMIP6 sea ice output as it becomes available. Other topics of discussion were the need for better model documentation and the central collection of errors in model output files, which SIMIP is involved in coordinating and will link on its website as they become available.

"Arctic and sub-Arctic ocean observations: where do we go?", ASOF workshop in Sopot, March 2017

--Contributed by Michael Karcher

The Arctic Subarctic Ocean Flux Study (ASOF) is an international program on the oceanography of the Arctic and Subarctic seas and their role in climate. The program was established in 2000 and run as an interest driven program since. The yearly workshops serve as fora for discussion and research planning. This year's meeting was hosted by the Institute of Oceanology of the Polish Academy of Sciences in Sopot, Poland from March 20-22.



The science theme for the meeting was "Arctic and sub-Arctic ocean observations: where do we go?", as new Arctic and sub-Arctic observational programs are upcoming, for example an Arctic observing system (e.g. INTAROS, AOS), high-latitude/mid-latitude interaction (e.g. APPLICATE, BLUE ACTION), prediction capabilities (e.g. YOPP, SIPN) or the drifting observatory MOSAIC, while some of the long-term programs have been cancelled due to funding problems.

The workshop discussed questions such as how well the observational programs are suited to contribute to objectives of ASOF, the identification of gaps, the status of the integration of models and observations. Furthermore, research presentations were given on the freshwater and heat dynamics of the Arctic and Subarctic basins, the transports at the Arctic gateways, ice-ocean dynamics in fjords, new observational datasets, and a presentation and discussion of the new observation programs.

As an early career scientist, sponsored by CliC/APECS, following an application procedure, Mattia Almansi from Johns Hopkins University in Baltimore, USA, gave a presentation on the variability of circulation and hydrography in Denmark Strait.

A discussion on the future activities of ASOF concluded with the decision to collaborate more with CliC, the Year of Polar Prediction (YOPP) and to liaise with the developing Northern Ocean Regional Panel (NORP) of CLIVAR and CliC.

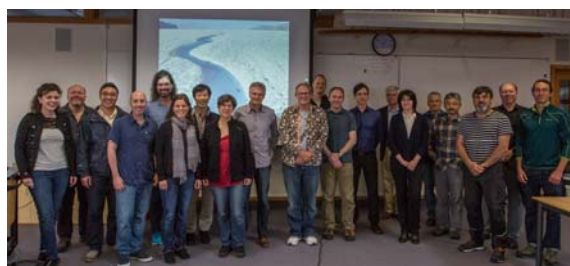
A concrete result of the enhanced collaboration with CliC is the successful application for Norwegian Research Council funding of a joint CliC/ASOF workshop 'Climate Change at the Arctic Gateways' in Bergen in 2018. The focus of the workshop is the development of benchmark data sets of ice-ocean fluxes and associated processes at the gateways, to identify their role in Arctic change and to develop a reference dataset for model skill evaluation and improvement. The workshop will be a major step to write a full research proposal for the set-up of the database.

IGS/IACS/CliC International Symposium on the Cryosphere in a Changing Climate, February 12-17, 2017, Wellington, New Zealand

In February CliC co-sponsored an international symposium that brought together three of the leading international organisations in the field of cryospheric research: the International Glaciological Society (IGS), the International Association of Cryospheric Sciences (IACS), and the WCRP Climate & Cryosphere Project (CliC). The theme of the conference was 'The Cryosphere in a Changing Climate' and had a strong focus on physical processes within the cryosphere, and interactions between the cryosphere and the climate system. The event attracted over 250 participants and featured a combination of plenary and breakout sessions covering all aspects of cryospheric science. CliC is looking forward to planning future events together with IGS and IACS.

13th Session of the CliC Scientific Steering Group Meeting, February 17-18, 2017, Wellington, New Zealand

The Scientific Steering Group of the World Climate Research Programme (WCRP)'s Climate and Cryosphere (CliC) Project met for its 13th session on February 17-18, 2017. The meeting was hosted at the Victoria University of Wellington (VUW), and was co-sponsored by WCRP, the CliC IPO, the Norwegian Polar Institute (NPI), and VUW. The CliC SSG-13 took



place in conjunction with the IGS/IACS/CliC

International Symposium on the Cryosphere in a Changing Climate held at VUW from February 13-17, 2017. Twenty-seven participants from thirteen different countries attended the meeting (twenty-five in person; two remotely). The meeting was chaired by CliC Co-Chairs Gerhard Krinner and James Renwick.

Glacier Model Intercomparison Project (MIP) Meeting, February 17, 2017, Wellington New Zealand

--Contributed by Ben Marzeion, University of Bremen, Germany

At the meeting of the GlacierMIP participants in Wellington on February 17, 2017, the progress of phase I of GlacierMIP was reported, and basic decisions for phase II were made. In phase I, existing projections for global glacier mass change were compiled and are being analyzed jointly. This will allow a first consensus estimate of future glacier mass change of the glacier modelling community and highlight the key differences of the response of individual glacier models to the different CMIP5 scenarios. Preliminary results have been presented at several international meetings, including the IGS/IACS/CliC International Symposium on The Cryosphere in a Changing Climate, at which the GlacierMIP meeting was held.

In phase II of the project, dedicated projections of glacier mass loss will overcome the problem of inconsistent initial conditions used by the individual glacier models, as well as increase the comparability between the models, by maximizing the overlap of CMIP5 experiments used as boundary condition. While some of the glacier models that participate in phase I will not be able to continue in phase II because of lack of funding and/or job changes of the developers, newly developed models will join, so that a total of six to seven global, and three to four regional, models (depending on funding decisions) confirmed their participation.

The next meeting of the GlacierMIP project is planned to take place at the AGU Fall Meeting 2017, where the progress of phase II will be discussed.

SCAR/CliC Antarctic Sea Ice Processes & Climate (ASPeCt) Meeting, February 14, 2017, Wellington, New Zealand

The ASPeCt team met in Wellington, NZ and had the main goal of increasing coordination with other groups conducting sea ice related research in the Antarctic region. The group mainly focussed on increasing linkages with ongoing and emerging initiatives such as the SCOR Working Group for Measuring Essential Climate Variables in Sea Ice (ECV-Ice), the Year of Polar Prediction-Southern Hemisphere, and the CLIVAR/CliC/SCAR Southern Ocean Region Panel (SORP). Technical discussions also focussed on the development of standardised equipment for Fast Ice measurements and the goal of extending (automated) standardised fast-ice instrumentation to include underway, ship-based (and possible plane/airframe-based) sensor packages to complete in situ sea-ice observatories. ASPeCt also fills an important observation role in establishing technical standards in the World Meteorological Organisation's Global Cryosphere Watch programme.

ISMASS Workshop on ice sheets and sea level rise if global warming is limited to 1.5°C, January 11-13, 2017, Brussels, Belgium

--Contributed by Frank Pattyn

An ISMASS workshop was organized in Brussels from 11-13 January 2017 with the purpose of preparing a review paper on the contribution of Greenland and Antarctic ice sheets to future sea level under a 1.5 degree warmer climate (in line with the Paris agreement). Participants to the meeting were Frank Pattyn (organizer), Lionel Favier, Gael Durand, Catherine Ritz (co-organizer and chair of ISMASS), Xavier Fettweis, Edward Hanna, Michiel van den Broeke, Heiko Goelzer, Xylar Asay-Davis, Alexander Robinson, Tony Payne, Helene Seroussi and Sophie Nowicki. Rob DeConto joined by Skype. The meeting discussions led to a canvas of such a paper that would cover the following: Forcing (non-linearities, SMB, circulation changes, feedbacks, ...), Advances in understanding processes - uncertainties since AR5 (calving, GIA, basal processes, ...), Expected centennial response for Greenland and Antarctica, and Expected long-term response (including commitment). The paper should be in time for the IPCC Special Report on 1.5 degrees.



**c/o Norwegian Polar Institute
Fram Centre
Postbox 6606 Langnes
9296 Tromsø
Norway**

www.climate-cryosphere.org

