Report of the 10th Session of the Climate and Cryosphere Project Scientific Steering Group

17-20 February 2014
WMO, Geneva, Switzerland

CliC is a core project of:
WCRP World Climate Research Programme
WMO IOC ICSU International Council for Science

Introduction

The Tenth Session of the WCRP Climate and Cryosphere (CliC) Project Scientific Steering Group (SSG) took place in at the WMO Secretariat in Geneva, Switzerland, on 17-20 February 2014. This report provides a short summary of items discussed and recommendations and decisions agreed.

The acting director of WCRP, Valery Detemmerman, opened the session and welcomed CliC to the WMO and Geneva. She was particularly pleased to see young people in the audience and called on CliC to develop its targeted activities that are able to address the unique role of the cryosphere in the Earth System. After a round of self-introductions the session approved the agenda.

At the start of the meeting, Greg Flato gave a short summary of actions agreed at SSG-9 and presented his view, as the CliC SSG Chair, on the perspectives of the project development. The accent in planning will be on new targeted limited life-span activities rather than on long-standing traditional projects. CliC will try to effectively and energetically develop all aspects of climate modeling related to all elements of the cryosphere and their interactions, including for initialized predictions. This work will be conducted in cooperation with WGCM and WGSIP. Persistent questions such as issues related to the underestimation of the rapid Arctic sea ice decline and increase in the Antarctic sea-ice extent will be addressed as well.

Then Director of the CliC International Project Office (CIPO) Jenny Baeseman reported on the Office activities. A significant number of CliC related workshop have been organized and reports from all of them are available online. During the elapsed year, CliC has created an image of a resourceful program with a wide scope of interests. All of the received proposals for a workshop were funded to some degree or another. In the future CliC needs to be more selective and make sure that project activities pursue products as their outcomes. CliC needs to complete a science implementation plan and include in it the most important targeted activities. The plan will be built on their own activities and some results will be obtained by working together with partners such as IASC and SCAR.

Review of last SSG Actions/Decisions and Activities – Greg Flato

See presentation on website:
http://www.climate-cryosphere.org/meetings/past/2014/ssg-10/downloads

Activities/workshops/etc. supported by CliC IPO – Jenny Baeseman

See presentation on website:
http://www.climate-cryosphere.org/meetings/past/2014/ssg-10/downloads

International connections

To achieve its objectives CliC develops its own activities and also keeps under review relevant developments by partner programs and organizations, with a view to coordinate activities and achieve common goals. Several presentations by such partner organizations were made at the meeting.

Scientific Committee on Antarctic Research (SCAR)

Nancy Bertler, Victoria University, New Zealand, the chair of AntClim21 program presented the work of the Scientific Committee on Antarctic Research (SCAR). Out of 7 SCAR scientific research programmes (AAA, AntEco, AnT-ERA, AntClim21, EBA, PAIS, and SERCE), two are particular relevance for CliC. One of them is AntClim21. Its main goal is to find ways to improve robustness of climate change predictions and projections in Antarctica over the 21st century. During the first three years of the activity the group intends to verify available prediction models. This work will be undertaken with some other SCAR projects, for example SERCE will complement AntClim21 with regard to aspects relate to mass balance and ice sheet dynamics. The climate oriented SCAR community effort also involves the SCAR Antarctic Climate Change and the environment advisory group that produce annual updates led by John Turner and other themed publications, for example on the recovery of the stratospheric ozone hole.

With SCOR, SCAR is a co-sponsor of the Southern Ocean Observing System (SOOS) and CliC is a contributor to SOOS through the initiative generating Satellite User Requirements for Research in the Southern Ocean and other activities. SCAR, IASC and CliC co-sponsor Ice Sheet Mass Balance and Sea Level, a working group coordinating research into the mass balance of the ice sheets and their contributions to global sea level rise.

A major current effort of SCAR is its Horizon Scan. It aims to identify the most pressing Antarctic research questions that will be important in 20+ years. Rob Massom and Jenny Baeseman are representing CliC in this process.

Action: CliC to continue working with SCAR on current projects, and explore closer cooperation in other relevant areas. Recommend to SCAR that the AntClim21 modelling activity take into account and benefit from the developments in WGCM, WGSIP, and many other modeling groups of WCRP, and, as well, existing and emerging modeling experiments, such as CMIP(6), CHFP, and CORDEX (which has an Antarctic domain).

International Arctic Science Committee (IASC)

Volker Rachold, the IASC Executive Secretary, introduced IASC developments to CliC. In addition to its working group activities, many of which CliC is a partner with, IASC is forming a framework to define Arctic science priorities for the next decade, to ensure a collaborative effort and integrate research across disciplines. The effort is called the (third) International Conference on Arctic Research Priorities (ICARP III). It involves many international organizations and Jenny Baeseman is on the ICARP III Steering Committee representing CliC.

Association of Polar Early Career Scientists (APECS)

Eleanor Darlington reported that during the elapsed year the APECS expanded further its partnership with CliC. APECS members are regularly to several CliC activities and several joint projects are either ongoing or planned for 2014. CliC has sponsored some of these joint projects and as well as provided travel support for early career researchers and APECS members to attend its events. For example, in October 2013, CliC through APECS also provided support for several early career scientists to participate in the WCRP “Cryosphere in a Changing Climate” Workshop in Tromsø, Norway (16 – 18 October 2013). One of the APECS and CliC joint projects is FrostBytes – “Soundbytes of Cool Research”, an ongoing project to share interesting information about the Cryosphere. The FrostBytes produced so far can be viewed here http://www.climate-cryosphere.org/categories/138-frostbytes. Erik Warming, an APECS member, is helping CliC to

coordinate and produce these FrostBytes. All early career researchers funded by CliC are required to produce FrostBytes. To date there have been 260+ with many new ones coming in soon.

APECS is partnering with the Permafrost Young Researcher Network (PYRN) as well as the young researcher representatives of the two projects PAGE21 (Changing Permafrost in the Arctic and its Global Effects in the 21st Century) and ADAPT (Arctic Development and Adaptation to Permafrost in Transition) to hold a Permafrost Young Researcher Workshop 2014 at the Fourth European Conference on Permafrost (EUCOP IV) in Evora, Portugal (18 – 21 June 2014).

For 2014, APECS and CliC also are planning to partner on providing more experience for early career researchers in science management by offering science coordination fellowships.

European Space Agency (ESA)

Mark Drinkwater submitted a summary in advance of the meeting. The current highlight is the start of the Sentinel open and free data provision, which represents a major development in regular observations of the Planet Earth. A vast volume of additional information on Copernicus/GMES Sentinels is available online at: https://sentinel.esa.int/web/sentinel/home.

The ESA Climate Change Initiative (CCI) is progressing very successfully involving, inter alia, the
- CCI Ice Sheets products
- Surface Elevation Change (SEC) gridded data from radar altimetry
- Ice Velocity (IV) gridded data from synthetic aperture radar interferometry and feature tracking
- Calving Front Location (CFL) time series of marine-terminating glaciers, and
- Grounding Line Location (GLL) time series of marine-terminating glaciers.

The CCI Glacier has contributed extensively to the Randolph Glacier Inventory. The data can be downloaded via the website: http://www.esa-glaciers-cci.org. The CCI Sea ice conducted in 2013 two key meetings in 2013: 2nd International Workshop on Passive Microwave Sea Ice Concentration (18-19 February) and the Workshop on sea ice thickness retrieval from ERS and ENVISAT radar altimeters (15th March 2013, Cambridge, UK). Meanwhile, the CCI teams had a meeting 4-6 February 2014 to review the next phase of their activities. The points of contact are A. Shepherd for ice sheets, F. Paul for glaciers), and Leif Toudal Pedersen for sea ice. The Polar Space Task Group is also very active. The forthcoming ESA bid opportunities for scientific studies are available at: http://emits.sso.esa.int/. One of key relevance to CliC is SMOS + Cryosphere (see http://emits.sso.esa.int/emits/owa/emits_iitt.show_iitt?actref=13.155.32&user=Anonymous).

WCRP – World Climate Research Programme (WCRP)

Vladimir Ryabinin presented WCRP. The WCRP Objective is to develop the fundamental scientific understanding of the climate system to determine to what extent climate can be predicted and the extent of human influence on climate. WCRP strategy and structure have changed since 2005, and the WCRP Open Science Conference in 2011, the first gathering of the whole community, helped to conclude the transformation. The core of the Programme are the four research communities (SPARC = stratosphere/troposphere, CLIVAR = ocean, CliC = cryosphere, GEWEX = land) who spearhead climate research in their respective domains and work together on six grand

challenges: clouds, circulation and climate sensitivity; changes in cryosphere; climate extremes; regional climate information; regional sea-level rise; and water availability. There are multiple developments in the domains of modeling and observations, including making the data available in a uniform format (Obs4MIPS project) through the Earth System Grid Federation. At the JSC-34 in Brazil, May 2013, it was recommended that the WCRP communities develop synthesis papers in advance of IPCC reports. Core projects were also invited to provide input to CliC on the structure, goals and objectives of the cryospheric grand challenge. One task that CliC has to accomplish for WCRP is to involve Arctic Ocean research communities in addressing WCRP priorities. To achieve this involvement of key partners, such as IASC, would be beneficial.

Future Earth

Valery Detemmerman presented the Future Earth, a 10-year research program focused on societal challenges relating to a sustainable future. The project supports fast track initiatives with specific outputs and more integrated long-term activities. IGBP, IHDP and most of other ESSP activities will be folded into the Future Earth. There are currently grants available to fund Future Earth related research for two years, up to the amount of 100,000 USD. CliC SSG members are encouraged to apply for these funds because only core WCRP projects can sign up to one of the initiatives. The Future Earth is a global program and applications are welcome from all continents. The modus operandi with regard to the cooperation of the Future Earth and WCRP is being developed. The work of the WCRP is too important to fold it into Future Earth.

WCRP Grand Challenges

The WCRP Grand Challenges will represent major integrating efforts of the whole WCRP community. It was therefore considered very important for CliC to review how the project would fit to all the challenges. For that reason the SSG reviewed these challenges in detail.

Clouds, Circulation and Climate Sensitivity

Sandrine Bony presented this Grand Challenge. In the discussion several links were highlighted where collaboration between CliC and the Grand Challenge contributors, such as SPARC, would offer a real benefit to the understanding of the changing cryosphere. For example climate sensitivity estimates have improved in CMIP5 compared to CMIP3, however (solid) precipitation projections are still not so well understood. Regional patterns of climate change need to be better understood in order to appreciate the robustness of the models. At present, the modeling experiments mainly identify patterns in the clouds, rather than interactions with surface processes with feedbacks, such as ice and snow. There is currently a tropical bias in this research. However, receiving input from CliC regarding the Polar Regions would be highly beneficial. The role of clouds in polar amplification of global warming was highlighted as a key question, especially with low clouds over Greenland having caused the large surface melt in summer 2012. In Antarctica, clouds are also playing a role in the potential positive mass balance. Therefore, a better understanding of clouds in the Polar Regions and how much water they hold is required to determine how clouds interact with the cryosphere, affect mass balance and, subsequently, sea-level rise. CMIP6 was identified as a platform to facilitate these connections and address specific questions.

Action: One day joint meeting between CliC and SPARC to discuss the interactions between sea ice/glaciers with clouds, and how this can be implemented in CMIP6.

Regional Climate Information Grand Challenge

Annette Rinke reported on the large body of research work already underway to improve decadal prediction through the PCPI and SOOS, through activities focusing on sea ice and Southern Ocean, respectively. Long term climate predictions are being improved via high resolution GCM's and better downscaling methods. Consideration of the model resolution is very important when determining the role of the NAO and PDO in ocean and cryospheric initialization. Contributions from Polar CORDEX and CliC are targeting improving the sea ice in models, to better predict past and future climate. CliC activities targeting Arctic freshwater are providing information for impacts, adaptations and vulnerability.

Future CliC initiatives to improve regional climate change information include understanding the variability of sea ice from short-term to multi-decadal time scales and the impact of changing sea ice on high latitude climate. An improved organization and focused approach to understanding the current and future melt of global glaciers, particularly those in the Asian region, is drastically needed. These research foci would benefit from improved communication of Arctic regional climate information to the cryospheric community.

Regional Sea-Level Rise

Detlef Stammer presented this grand challenge. Regional sea level has immediate social relevance and is affected by all climate components. For this reason, sea level s an integrated measure of climate change. Glaciers and ice sheets will be contributing factors in the warming climate. Greenland ice sheet is a core focal point, since its glacial mass loss will instigate sea-level reduction around Greenland itself, and raise levels at lower latitudes. The ice – ocean interactions are currently poorly understood and not accounted for in current climate models. A focused initiative to further understand ice – ocean interactions could be a beneficial contribution from CliC. A review is needed to identify the key processes involved, their importance, and at which glacial interfaces these can be observed.

Action: CLIVAR to work with CliC to develop cryosphere section of this Grand Challenge

Water availability and Extremes Grand Challenges

Sonia Seneviratne, the recently appointed Co-Chair of the GEWEX SSG, presented these grand challenges to CliC. She has identified that lack of precipitation data and the subsequent errors in models are the key obstacle for better predictions of water availability. Research contributions from CliC would be highly beneficial in this area, especially with a focus to close the water and energy budgets in the cold regions. Understanding of snow-vegetation and climate feedbacks, as well as simulating snow with relation to land surface temperatures would be a very welcome contribution. An understanding of inter-seasonal trends in the cold regions is another important aspect because connections between summer and winter processes are important.

Cryosphere in a Changing Climate Grand Challenge

Greg Flato spoke on this grand challenge of special importance to CliC. The "cryosphere in a changing climate" workshop held in Tromso, 16 – 18th October 2013, was a beneficial opportunity to review the grand challenge white paper and provide updates on targeted activities. There are four defined areas of the Grand Challenge: permafrost and carbon, glaciers and ice caps, sea ice, and snow.

A series of synthesis papers is planned for conceptual approaches and modeling comparisons to identify the magnitude, timing and formations of greenhouse gas release from permafrost in a warming world using coupled permafrost/carbon models. An intercomparison of permafrost/carbon models is planned at particular sites for which suitable forcing and evaluation data is available.

There are a number of research questions concerning glaciers and ice caps, for example:

- What is the glacier and ice cap contribution to sea level rise?
- How can we reconcile various regional mass balance studies and measurement techniques?
- What is the total freshwater volume available in the cryosphere?
- How can we improve estimates of various contributions (e.g. snow, glacier volume, permafrost ice, etc.)?
- What is the fate of meltwater in the high-elevation regions of Greenland (where melt has started only recently)?
- How can we estimate the meltwater storage/transport in the snow/firn?
- What are the effects on/of thermal structure/albedo?

Collaboration with GEWEX will connect these issues with their remote sensing efforts and the water availability Grand Challenge. A global glacier mass balance intercomparison may help to address the regional glacier mass balance issues. Exploring methodological issues and uncertainties in global freshwater estimation will require workshops focusing on corresponding methodologies. A workshop on ice-sheet snowpack processes and their modeling is also desirable.

The impact of sea ice on high latitude climate systems remains a key research area. Related research questions are:

- What is the impact of changing sea-ice on high-latitude climate systems?
- What are the mechanisms underlying observed/modelled multidecadal variability in Arctic sea ice, and how does this affect predictability and model evaluation?

Further understanding is required on the mechanisms controlling variability on a multi-decadal scale in both observed and modeled data. A workshop on atmospheric responses to changing sea ice is proposed. A collaborative effort is required to improve long sea-ice time series, which will support analysis and model evaluation (bringing together multiple data sources). The ongoing analysis of CMIP5 multi-model archive will continue as it may bring useful information of relevance for the questions. All these research topics have strong connections with CLIVAR and GEWEX.

The lack of understanding around snow and its interactions with the wider climate system is one of the largest caveats in modeling, and the amount of snow and its coupling to the wider climate system still need to be much better understood. The main snow-related research questions are:

- How can we improve our understanding of snow variability and its coupling to the rest of the climate system?
- How will future changes in snow cover affect freshwater availability for human societies?

Interactions between sea ice and snow is another high-priority research area. The CliC strategy to target the integration of snow observations into models will include:

- a workshop/white paper on strategies to integrate snow observations into a comprehensive global data set (in-situ, airborne, satellite, models and data assimilation),
- a workshop on identifying a few 'supersites' to support snow and permafrost model intercomparison studies;
- a follow-on to SnowMIP, focused on snow representation in global earth system models; and
- an assessment of role of changing snow in water availability (using CMIP and CORDEX archives).

The WCRP Polar Climate Predictability Initiative will be formally a part of the Cryosphere Grand Challenge and will include 6 initiatives (with three of them being joint with the Polar Prediction Project), as follows:

1. Improve knowledge and understanding of past polar climate variations
2. Assess reanalyzes in polar regions (joint with PPP)
3. Improve understanding of polar climate predictability on seasonal to decadal time scales (joint with PPP)
4. Assess performance of CMIP5 models in polar regions
5. Identifying physical processes that leads to growing model error (joint with PPP)
6. Improve understanding of how jets and non-zonal circulation couple to the rest of the system in the Southern Hemisphere

Coordinated Regional Climate Downscaling Experiment (CORDEX)

Annette Rinke presented this item. Impacts, adaptations and vulnerability need to be better addressed by data from models. There is a plethora of modeled data available, however a multi-model of data assembly is required to maximize its potential. A guide is needed to define and quantify the added value, credibility, and limitations of climate models. High-resolution observational data sets are required to form better predictions at the regional scale. A CliC driven pilot study for the Barents Region was highlighted as a potential platform to address these methodological challenges. This could follow the framework laid by the AACA project initiated by AMAP. A CliC sponsored Arctic CORDEX workshop would actively increase involvement in targeting these downscaling problems in the Arctic. There is overlap with AMAP activities, however regional studies remain excluded and this is where CliC could provide a unique contribution.

Working Group on Coupled Modelling (WCRP)

Sandrine Bony, a WGCM Co-Chair spoke to CliC. The CMIP objective is to understand past, present and future climate variability and change through a coordinated international multi-model

experiment design. WGCM promotes and facilitates coupled model evaluation and diagnoses model shortcomings. CMIP is one the most important WGCM projects. The CMIP6 is organized around 3 grand challenge questions from WCRP and AIMES: 1) Origin and consequences of systematic model biases 2) how does the Earth System respond to forcings and how can we assess future climate changes given climate variability 3) climate predictability and uncertainties in scenarios. To tackle these questions a set of CMIP ongoing model Development Evaluation and Characterization Klima (DECK) experiments was established to gain basic information about model performance and sensitivity (CMIP). These will ensure continuity between different generations of CMIP phases. It was highlighted that the DECK has no ice-sheets, but the AMIP simulations have a snow component. The reason for not including the ice sheets is to work in line with other modelling groups who do not have them. However, the DECK will have full outputs, including over 'ice sheet' regions.

Input for CMIP6 design from all Grand Challenges is expected by September 2014. CliC can have greater involvement by suggesting coordinated model runs, and highlighting outputs that would be advantageous for the community. An inter-comparison snow model focused on local sites would have great benefits, and would be a good candidate for a model run. The aims would be two-fold: better understanding of the feedback systems and to determine model viability. In addition, a list of outputs from the Earth System Models will be made available. CliC will be able to assign priorities to these, determining which would be most beneficial for cryospheric problems, so that these can be taken into consideration when dealing with the model runs. The model groups determine which model runs are undertaken, so highlighting variables important to CliC will influence their choices. A greater involvement from the sea ice community and better version control in the archive has also been suggested.

Action:
Provide input on CliC requirements to CMIP6 especially with regard to the snow component of the Cryosphere Grand Challenge (deadline: September 2014).

WCRP Modeling Advisory Council (WMAC)

Michel Rixen spoke on this topic. Large WCRP projects are embracing the Earth System Grid Federation (ESGF) to be the main mechanism for exchanging data. The ESGF will set standards and preserve metadata continuity across MIPS; all future software will be developed with this system. This project is being led by WGCM, with CORDEX is already implementing the system.

Model development is a key aspect in climate science. With this in mind, a model development summer school is proposed for 2015 at MPI. This will entail a mix of lectures and hands-on training activities. The model tools will be packaged so that students can take them home to use. This aims to engage with a range of modeling groups. To ensure a critical mass of model developers within the climate science community, a model development prize has been suggested. This will be targeted at early career researchers who have made significant contributions to the field.

CliC needs to remain engaged with WMAC, particularly when many cryospheric challenges are currently focused on modelling. A meeting will be held in conjunction with the JSC meeting, in which cross synergies will be championed.

WCRP Data Advisory Council (WDAC)

By Walt Meier, the CliC-affiliated member of WDAC, provided a written summary on WDAC. The WDAC had its inaugural session in Beijing, China in July 2012. The second meeting was held in Darmstadt, Germany in March 2013. The upcoming third meeting will be 6-7 May 2014 in Galway, Ireland. The full reports and presentations from the first two meetings can be found at: http://www.wcrp-climate.org/index.php/wdac-activities. Information for the third meeting will be added in the future.

A topic of particularly note from the first two meetings and a major focus of the upcoming Galway meeting is regarding activities to improve approaches to intercomparisons between data, models, and reanalyses. One such activity is ESGF, whose goal is to assemble climate model output into common formats for greater interoperability, e.g., for Coupled Model Intercomparison Project (CMIP) efforts. Another activity is the NASA JPL initiated obs4MIPs – observations for Model Intercomparison Projects. This aims to assemble relevant climate data sets, particularly gridded climate parameters that are equivalent to climate model outputs. The idea is to put datasets into consistent formats, grids, and metadata, along with documentation on the data (e.g., guidance on proper usage) in a central, accessible portal. A wiki page has been implemented and dataset contributions are being sought from the community (http://obs4mips.llnl.gov). (W. Meier has been working with the group to provide sea ice concentration information.) An obs4MIPs workshop is planned at the NASA Headquarters in Washington, DC for 29 April – 1 May 2014. The focus of the workshop will be on developing recommendations for use of data within CMIP6. Similar to obs4MIPS, there is also an effort, anaMIPs to standardize reanalysis data.

Another focus of WDAC has been discussion of data set inventories to improve coordination between different inventories and recommend standards, particularly in regards to data quality assessment. One such inventory is the Global Observing Systems Information Center (GOSIC, http://gosic.org), established by GCOS. Another notable inventory is the Climate Monitoring Architecture, a joint activity of CEOS, CGMS, and WMO. Both aim to coordinate and document Essential Climate Variables (ECVs) and facilitate easier and more knowledgeable access to climate data sets.

Working Group on Seasonal-to-Interannual Prediction (WGSIP)

Paco J. Doblas-Reyes* presented this report. A collaborative effort between observationalists and modelers is required to ensure better seasonal climate predictions in the future. To help with this, WGSIP has created and maintains a depository of the Climate (system) Historical Forecasting Project (CHFP) prediction, hosted in Argentina, to bring the data collections together.

At present, seasonal predictions are fairly accurate in the tropics, but need to be improved in Europe and the higher latitudes where the stakeholders have a vested interest. Generally prediction skill of the NAO is fairly low, however recent developments are highlighting that improvements can inform better NAO prediction systems. There is a good fit between the modeled and observed data in winter (DJF).

CLIVAR - Climate Variability and Predictability

A co-chair of CLIVAR SSG, Detlef Stammer, presented the report by CLIVAR. The CLIVAR office is likely to be housed under a three node approach in Italy, China and India since funding from NERC has ceased. CLIVAR has a fraction of cryospheric activities pursued. For example, there is a focus there is on observations and modeling efforts of ice shelf – ocean interactions in the Southern Ocean - to understand how these are going to change in a warming climate. Model initiation parameters are being laid out in the CORE II protocol to maintain continuity in modeling efforts. Of particular interest are the boundary conditions for the ocean salinity, which play a pivotal role the circulation of the Southern Ocean.

The research efforts from CLIVAR are strongly aligned CliC study of ice shelves led by David Holland. To ensure the projects are targeting different aspects, a discussion will be held at the Southern Ocean Panels and SOOS meetings. The need for technological advances, allowing ocean observations beneath sea ice, was highlighted.

Actions:
David Holland is to discuss specific details with the Southern Ocean Panels and SOOS to ensure a coordinated approach. Greg Flato is to contact Lynne Talley and Matthew England.

U.S. Climate Variability and Predictability (US-CLIVAR) and the US-CLIVAR: Greenland Ice Sheet-Ocean (GRISO) Working Group

Mike Patterson introduced US-CLIVAR to CliC and Patrick Heimbach spoke on GRISO. Understanding the role of the oceans in climate is US-CLIVAR's principal goal. Of particular interest to CliC is their Greenland ice sheet/ocean interactions (GRISO) working group. This has pulled together a community of oceanographers and glaciologists to tackle the ice sheet - ocean interaction challenges. They are largely different to those in Antarctica and need to be treated as such.

Greenland has exhibited a four-fold increase in the loss of mass from the ice sheet in the last 20 years. The thinning and retreat of glaciers is contributing to the cumulative freshwater input, which is nearing the levels of the great salinity anomaly of the 1970's. For this reason, GRISO was formed to engage cross agency interactions, bringing together diverse research communities to create a dialogue. The following research areas are currently targeted: dominant climate forcing through fieldwork, remote sensing and modeling; accelerating marine-terminating glaciers; processes within the fjord and at the ice – ocean interface, and oceanic properties and what drives variability in the sub-polar gyre. Processes on a a range of scales, from large scale (1000km), continental shelf (100km), fjord (100 x 5km), and glacier ice-ocean boundary (0mm – 100m) need to be better understood. Determining the effects of melt driven convection and how this is affected by sub-glacial freshwater inputs is another priority.

A current understanding of the ice sheet – ocean process has been drawn up in a US-CLIVAR white paper, in addition to a BAMS 2013 article (Straneo et al., 2013). Critical glaciological and

oceanographic parameters are being monitored by the Greenland ice ocean observing system (GrIOOS), which will form a long time series, providing better temporal understanding of the processes. This working group has a limited lifetime, and a collaborative effort needs to be made with CliC to help maintain momentum in these research efforts and assist in forming a collaborative approach with the appropriate agencies to avoid duplication. A variety of study sites will be required to understand the full extent of the ice – ocean processes. Many fjords in Greenland have high proportions of ice mélange in front of their calving faces. For this reason, alternative sites or novel technology will be required to understand the processes taking place at the calving face. For this to be achieved, a multi-national, multi-lateral approach is required. It would fit into the Regional Sea Level Rise Grand Challenge. Discussions and debate between CliC and CLIVAR would be a welcome action.

Action:
CliC to continue discussions with US CLIVAR and GRISO on how to support future efforts.

Updates from World Meteorological Organization (WMO) initiatives

Global Integrated Polar Prediction System (GIPPS)

As presented by Peter Lemke, the Global Integrated Polar Prediction System (GIPPS) is being developed through the Polar Prediction Project (PPP, www.polarprediction.net) and the WCRP Polar Climate Predictability Initiative (PCPI), a part of the Grand Challenge on the Cryosphere. The PPP is spearheading cooperative international research to enable development of improved weather and environmental prediction services for the Polar Regions, on time scales of hours to seasonal. The time scales from seasonal and beyond are being tackled by PCPI. The transfer of knowledge and data from this research will be of great value to the cryospheric community, and should be shared to get the most from the findings.

Global Cryosphere Watch (GCW)

Miroslav Ondras spoke on GCW. An IPY legacy, the GCW is creating best practices of cryospheric observations and data products to ensure that data collected can be as valuable for users as possible. The GCW invites a CliC member to sit on the steering group to assist in driving this project forward. A core network of cryospheric observation stations under GCW is being set up, named CryoNet. The products team is working on identifying and meeting the requirements of users. In addition, an effort to create baseline cryospheric and atmospheric sites is being undertaken. At present, there is no financial commitment for long-term GCW operation. Once funding has been secured, the sites can be used a reference. There will also be large, multi-institutional sites to be known as an supersite. At these locations, researchers will be trained. Funding from GCW for CryoNet is to facilitate coordination activities and get the project off the ground. An initial list of stations which to form part of CryoNet has been formed. These stations are being assessed for their eligibility and reliability to contribute to the network. At present, the southern hemisphere remains underrepresented. A detailed website of the current state of the cryosphere (www.globalcryospherewatch.org) is maintained by the project. The site can be updated with relevant presentations, posters and research papers.

The Global Framework for Climate Services (GFCS)

Vladimir Ryabinin presented GFCS. Its primary goal is to improve the management of climate variability and adaptation to climate change, through the use of climate information in policy and practice, from global to national scale. The Intergovernmental Board of Climate Services (IBCS) maintains a record of the capabilities of climate services around the world. Many countries only have basic capabilities. The partnership environment of GFCS allows a communication platform between different communities, which is integrated at national, international and global levels. The GFCS aims to go the “last mile” in making research and data into usable products.

Predictability and skills on climate time scales are limited, as is the amount of information available as how predictions should be used in decision making. To make information more readily available, the Research, Modelling and Prediction Annex (RMPA) to the GFCS Implementation Plan is putting forward ideas and platforms, for the dissemination of such information. New partnerships will be required to support GFCS in science. A key area of research is being undertaken encapsulating water availability, on time scales from weeks to seasons. To achieve this fundamental data records are being reanalyzed, and such reanalyzes activities are being extended.

Other areas of research, which target the aims of GFCS, are welcome. At present, 9 out of 15 projects proposed in the RMPA are included in the Compendium of 40 initial GFCS projects that have higher potential to ben funded. CliC is asked to look at the campaign and documents to create additional projects regarding glaciers and their links with water availability.

Action: Jenny Baesman will send the relevant document to the CliC SSG for review

CliC Targeted Activities

Polar Jet Stream Connections to Mid-Latitude Climate

Ed Hanna introduced the research on polar jet stream and linkages to mid-latitude processes. Understanding the causality and attribution between Arctic forcing and mid-latitude chaotic flow are difficult. Current arguments mostly come from correlation studies and model output. There are potential hot spots for forcing by Arctic temperatures such as long-wave pattern/ blocking east of Urals and west of Greenland and local teleconnection Barents Sea/northern Europe. Lack of linkage in some models is not a proof of lack of linkage in real world. There is a need therefore for high-resolution models and multi-model ensembles. The workshop report and presentations are on the CliC website (http://www.climate-cryosphere.org/meetings/past-meetings/polar-jet-stream-13).

Ice Sheet Mass Balance and Sea Level (ISMASS)

As Ed Hanna reported, the ISMASS compilation of latest mass loss estimates of Antarctica and Greenland ice sheets has recently been published in *Nature*. This has contributed to chapter 13 of

AR5 and to model estimates of surface mass balance observations. A surface mass balance modelling intercomparison workshop was proposed (Sheffield, UK, Spring 2015) to help constrain/reduce uncertainties in Greenland Ice Sheet surface mass balance estimates. In addition, enhanced plans for additional in situ verification data/fieldwork will make a large contribution to reducing uncertainties. More frequent reporting of mass balance from satellite data will take place, as a follow up to the IMBIE project. There is a host of activity from a multitude of disciplines contributing to this research effort. The tele-connections between the tropics and the Arctic, as connected largely by the Atlantic, are a key focus area for this research. A warming Atlantic will have implications on weather patterns. ISMASS is working to bring together a hemispheric overview, bringing together research focused on regional scales, such as the WGSIP Jet stream workshop. It would be valuable to work together with existing projects, such as the NASA SeaRISE activity and the EU ice2sea. However, these projects have limited time spans, and it is important to ensure that research continues after their sunset. CliC hosts the ISMASS website and the ISMASS Steering Committee are to enroll an APECS member.

Arctic Freshwater Synthesis (AFS)

Larry Hinzman presented this activity. There is increasing scientific recognition that changes to the Arctic freshwater systems have produced great changes to bio-geophysical and socio-economic systems of special importance to northern residents and also produce some extra-arctic effects that will have global consequences. To address such concerns, a scientific assessment is being conducted that focuses on quantifying the various Arctic freshwater sources, fluxes, storage and effects. Notably, most of them are directly or indirectly controlled by cryospheric components and processes.

The AFS is structured around five major components: atmosphere, ocean, terrestrial hydrology, terrestrial ecology and resources, with modeling as a sixth cross-cutting component. The AFS is currently being developed with scientific and financial support from the CliC, IASC, and the Arctic Council's Arctic Monitoring and Assessment Program (AMAP). Publications plans for the AFS include a number of reports tailored to the scientific foci of the individual participating organizations, and to a suite of scientific-journal review papers. Research needs identified by the AFS are also to act as benchmarks for the upcoming International Conference on Arctic Research Planning III, to be held in 2015.

Permafrost and Carbon

Ted Schuur*, the lead of this activity, presented it. The objective of the Permafrost carbon Research Coordination Network (RCN) is to produce new knowledge through research synthesis, which can be used to quantify the role of permafrost carbon in driving climate change in the 21st century and beyond. To that aim, a number of activities exist, as follows:

- Organization of an interrelated sequence of meetings and working groups, designed to synthesize existing permafrost carbon research,
- Formation of a consortium of interconnected researchers to disseminate synthesis results, and
- Permafrost-carbon website and a young researcher network.

There are two primary research foci: how much carbon is stored in permafrost, and what quality is it and how easily this carbon can decompose. These are leading questions when determining how permafrost can affect atmospheric carbon levels and the subsequent feedbacks on climate. An evaluation of these has been published in the issue 'Policy implications of warming permafrost' sponsored by UNEP.

The RCN has also been compiling different synthesis products and using climate models to upscale the potential permafrost carbon releases. New data is being collected to identify connections between permafrost carbon emissions and high latitude wetland carbon emissions. These research efforts tie in with the Cryosphere Grand Challenge. There are also linkages with the Arctic 5-year plan at UAF.

Paleo-carbon, dating, e.g., prior to the last ice age, is not currently a primary research focus. New data is required to tackle this problem and because of that current efforts are focused on areas where there is enough literature to synthesize.

ASPeCt – Antarctic Sea Ice Processes and Climate

Marilyn Raphael, co-chair of ASPeCt, shared a written summary of activities over the past year.*
The group held a workshop at the Gordon Research Conference, Ventura, California March 2013. We worked to update the ASPeCt Plan for the next ten years, and will continue that work at the Hobart meeting in March, 2014. Major emphases are:

1) To make it compatible with SCAR Horizon.
2) ASPeCt as the "operating arm" for SOOS on the Future of Antarctic Sea ice, one of the six SOOS themes. Steve Ackley is the SOOS SSG member responsible for this. He has worked to develop the definition of the Essential Climate Variables (ECVs) for sea ice. A major part of this is circumpolar sea ice thickness and snow depths, something the ASPeCt observations have and will be contributing to. There is also an emphasis (for ASPeCt) in establishing calibration/validation (Cal/Val) through surface measurements of ice thickness (or e.g. airborne and ship-based EMI) for airborne lidar and satellite altimetry (IceSat and CryoSAT) algorithm development and use.
3) Updating ASPeCt observations using instruments like digital cameras, ship-based EMI, and lidar.
4) Ice Edge experiments.
5) Antarctic Fast Ice Network. Various levels of continuous observations on Fast Ice based at stations (Petra Heil is leading).

Part of the Science Plan discussion included discussion of two projects that were under review for funding at the time.

- To look at Terra Nova Bay and the Ross Ice Shelf Polynyas using NB Palmer funded by NSF. Since then we have confirmation that the grant proposal is going to be funded and with a cruise is scheduled for either 2015 or 2016. PIs are Ackley, Stammerjohn, Maksym, Cassano, Guest and Bell and
- To work on IceBridge airborne lidar analyses for sea ice thickness from China funded by NSFChina. This project is also going to be funded.

The group is also working on a review paper and the newest version of the paper will be reviewed

at the Hobart meeting in March, 2014.

ASPeCt also participated in the planning and execution of two important events, the Sea ice Workshop in June, 2013 and the WCRP Grand Challenge Cryosphere Workshop in October, 2013. At the June workshop, the formation of a joint subgroup of ASPect and the Arctic Sea Ice Working Group (Technical Committee on Integrating In-Situ Sea Ice Observations to work on updating sea ice observation technology from vessels and apply these technologies to vessels working in both the Arctic and Antarctic. This group will be providing updates on the activities as they occur with a specific target of informing the general community at the IGS Sea Ice Conference in Hobart in March, 2014. The goals are to facilitate: standardization of observational methods; archival of data collected; near-real time transference of data to users; and rescue and integration of historical data collections.

These goals may be accomplished through the following objectives:

- Development of a comprehensive Arctic/Antarctic observation system that can be adjusted to the local conditions;
- Design of robust equipment and software to facilitate standardized and autonomous observations;
- Development of novel observation methods, providing data follow WMO or accepted standards.
- Exchange technical information on hardware and software between institutes and nations to best leverage limited funding availability; and
- Provide expert development of technical and training material to broaden participation in sea ice watches with sufficient standardization and quality control.

Initial Membership: Jenny Hutchings (OSU), Petra Heil (AAD), Blake Weissling (UTSA), Alice Orlich (UAF), Marcel Nicolaus(AWI) and Stephen Ackley (UTSA). Other members are welcome to join, or may be asked to join, based on their interest and expertise in contributing to the objectives of the Technical Committee.

ASPeCt's Near Future plans include finalizing the sea ice core database and coordinating user interfaces for data access through the AAD data Centre. Additions to the ship observations database (ASPeCt observations) are being made on a continuing basis, and sea ice thickness and sea ice core properties databases are being developed.

2 meetings are planned for 2014
IGS Meeting in Hobart, Australia, March 2014
– Planned Workshop joint with the Arctic Sea Ice Working group in the morning and ASPeCt alone in the afternoon. We expect a further update of ASPeCt activities then and will provide those in in a Workshop report after the meeting.
SCAR OSC in Auckland, New Zealand, August 2014
– Convening a session on Antarctic Sea ice Status and Trends.

Arctic Sea Ice Working Group

Don Perovich presented an update on the Arctic Sea Ice Working group which has a prime

objective to improve sea ice prediction in both temporal and spatial scales, days, weeks, months and small to large scales. For this to happen, observational data needs a faster transition into the models, for all the main parameters. One of the key problems is the lack of data. To address this, the Ice Watch software has been developed, and will be distributed on ships over the coming year. A central depository for these, and current data will be required. Making the data more accessible will help with research efforts. Sea ice modeling currently spans several different projects, which are being integrated by small working groups using test cases. A continued effort is being made to work with the sea ice prediction network to improve model outputs.

Action: CASIWG should develop a Terms of Reference and working structure, including future goals by the next CliC SSG meeting.

Status of new Targeted Activities

Ice-Ocean Interactions

David Holland presented an update on this new targeted activity for CliC on the West Antarctic Ice Sheet (WAIS). WAIS is arguably posing the greatest rick to sea level rise in the next 100 years. For this reason, understanding the ice – ocean processes which may lead it to becoming unstable is of utmost importance to the global community. The processes involved are complex and currently poorly understood. Convection is moving warming ocean waters from the tropics to the Southern Ocean, creating a pathway for these water masses to reach the ice shelf. The warming of the North Atlantic has been demonstrated to have an impact on Antarctic climate change, which fits in with the see-saw effects of the monsoon belt and the sub-tropics. There has been a decrease in sea ice around the Antarctic Peninsula, whilst conversely sea ice has increased around east and west Antarctica.

A CliC targeted activity has been developed to address West Antarctica glacier – ocean modeling. This is focusing on regional modeling to establish if ice - ocean interactions will play a significant role in GCMs. A meeting is proposed for the NYU campus in Abu Dhabi (27 – 29th September 2014) to discuss coupled ice – ocean modeling. The attendees have been identified, and span a variety of different institutes who work in this area.

Ice-Sheet Modelling

Eric Larour presented a potential new targeted activity on ice sheet model intercomparisons. Through the SeaRISE and Ice2sea initiatives it was learned that CMIP needed a stronger link with the ice-sheet modeling community; CMIP currently lacks glacial modeling. Ice sheets highlight aspects of climate system modeling (such as polar oceans and meteorology) that are not well represented in ESMs, yet that are crucial for understanding the cryosphere in a changing climate. A CMIP6/ MIP workshop to bring together modelling groups from SeaRise and Ice2Sea would be beneficial. MIP has a list of requirements which include data on longer timescales, polar meteorology and oceanography. The CMIP6 experiments will not have an integrated ice-sheet, therefore they need to connect with ESM's that do have such capabilities. The DECK forms the model foundation and comprises of a limited number of experiments, which is run by each participating ESM, which will set out a basis of parameters. The control forcing will be at pre-

industrial levels, and the DECK will never have palaeo timescale hindcasting. To ensure the momentum and development within the modelling community, an ice sheet modelling network for young researchers was proposed. This would provide travel funding for students to ramp up ice-sheet models. In addition, a prize for a young researcher who has made a significant contribution to the modelling community received support.

Snow Intercomparison

Gerhard Krinner proposed a snow model intercomparison targeted activity. Snow is a very important to climate feedbacks, yet it is poorly represented in models. To assist in this, guidelines for representations of snow in ESM's should be formulated. In many ESM's there is only one snow layer with simple vertical discretization. Multi energy balance can be achieved in a particular grid square. The results from CMIP5 permafrost highlight the need for better representation of heat conduction through snow. To ensure improvements during the CMIP6 campaign, critical parameters need to be discussed with the CMIP community by September 2014.

It could be useful to evaluate snow in simulations that have already been undertaken. Collaboration with regional modelling groups and CORDEX would offer a wider insight; the more people participating in the group, the better. Intercomparision projects of snow extent and snow water equivalent have shown large differences in forested areas, as well as mountainous areas. To better understand these, assistance is needed from the remote sensing community. Ultimately, the research into snow requires more reliable datasets, over prolonged timespans for the modelled results to improve.

Sea-ice and Climate Variability

Dirk Notz share the a need for sea ice observations and models to be linked together. At the moment, there is a great deal of research, which is undertaken in parallels. This could be an opportunity for CliC to link these communities. Observational hot topics currently envelop the heat and salt transfer in water, and the need for improved satellite data, since the variation between products is see in model results.

Data that is 'wrong' needs to be falsified, so that sea ice can be better simulated. Also, modelling certain processes does not need to be highly detailed. For example, detailed modelling of sea ice - salinity doesn't improve model outputs much over a simpler method. Often when these processes are put into a large scale GCM, they get lost. A framework should be formulated so that data collection is more systematic, and will contribute to model inputs that will show the effects of a changing climate on the sea ice, and the associated processes. There is generally large variation between the models, and the short term trends around Antarctica would make an interesting research point.

Field experiments like MOSAIC could have benefit, depending on what they do. Internal and spatial variability need to be identified. This could be through the statistical distribution of snow depths and melt ponds on a grid scale. An upscaling effort is also needed from the observational side, to make point measurements on a larger scale.

The sea ice community should have their own part on the snow model ESM to cover snow on sea ice. It would be beneficial to find out how the sea ice predictions vary when snow is considered. Snow also holds great importance over the Southern Ocean, and variability of sea ice around Antarctica should be considered.

Action: Contact Thomas Jung's group to find out how these ideas can be attached to his research on predicting sea ice in a coupled system.

Sea-ice and climate modeling forum

Alex Jahn further addressed the presentation by D. Notz to address the creation of the CliC Sea Ice and Climate Modelling Forum. There is currently large scale spread in model results, as shown by the 5 - 6 sea ice models that were included in CMIP5. Arctic Ocean inter-comparison model showed that each gave a different answer. However, not one single model can give the exact internal variability, or cover the uncertainties. Sea ice thickness is one of the contributing factors to the model variation. Thickness needs to be used together with spatial extents. Parameters fed into the models should be prioritized, and there is a need to understand if the models are bias to the ice physics or the coupled system. Day of melt onset should be put forward as a parameter output request for CMIP6. A workshop for sea ice modelers would be beneficial. This would ensure that overlap is not prevalent, give an opportunity to share results and to determine who is doing what within the community.

Action: CliC to establish Sea Ice and Climate Modelling Forum

Polar CORDEX analysis

Annette Rinke gave an update on the expanded Polar CORDEX activity. The Polar CORDEX analysis is working with ~ 9 modelling groups from different institutions. Model evaluation is and regional projections at 50 km are taking place. ERA-interim driven runs are also being evaluated, with a focus on precipitation extremes. The models have been chosen from those that have shown good performance; some simulations have already been completed. Three main regions have been identified by AMAP and AACA, which are Barents, Chuckchi and the Davis Strait. Therefore efforts are focused at regions with ongoing research, both in the marine and terrestrial realm. A workshop about these regions would be of benefit, and would identify to what extent CliC should be involved in providing expertise to the GCM.

Action: Annette or John to contact David Bromwich to address Antarctic issues.

Glacier Inventory

Helmut Rott presented on the GLIMS Global Glacier Inventory. The Randolph Glacier Inventory is currently in press, and should be within a few percent accuracy in South America. Dates have been retrofitted to glacier outlines, and topographic changes determined by using iceSat track. Satellite base interferometry (inSAR) has proved to be an excellent tool for measuring glacier mass

change. Annual repeat observations from specific locations remain vital. To pursue continued observations, a case should be put forward to the DLR. A letter of support would be advisable from the wider community to take to the agency.

Action: CliC to write letter of support together with Helmut.

Recent Russian activity related to CliC

Alexandre Klepikov presented some recent activities in Russia that their CliC chapter has been working on. After a very successful research effort during the IPY, Russia has pursued sustained oceanographic research in the Arctic. Russian icebreakers have been used as 'ships of opportunity' to make sea ice thickness measurements with video cameras. The release of icebergs in the Barents and Kara seas have been studied, along with with outlet glaciers from Novozemlya and Franz Joseph land.

Other study areas include determining the retreat of glaciers and ice caps in northeast Siberia has throughout the second half of the 20th century by comparing modern satellite imagery with aerial photography from the 1950's. Studies into snow and precipitation have been taking place, to constrain the annual number of snow days in Eurasia. Permafrost studies are forming a core area of Arctic research, led by a team in Moscow.

In the Antarctic, Russian research has been concentrated on the Amery ice shelf, to resolve down slope plumes. This is forming an important research branch for SOOS, since greater temporal and spatial observations are required. A 7-year time series is underway at 70deg east. This work is being helped by the new scientific icebreak, which will predominantly be working in the Margerat Bay region.

Russia identifies that collaboration is required when studing the Polar Regions. Contributions are being made to the AMAP assessment reports, as well as forming cooperative links CliC. The 2nd assessment report on climate change and its consequences in the Russian Federation is to be published in 2014. Russia is also supporting young researchers through their Arctic floating university scheme, which offers oceanographic research cruises for early career researchers.

South American CliC Thoughts

Sebastian Mernild presented some thoughts on what CliC could do in regards to South American glaciers. Water resources are a key problem in Chile, whilst glaciers are decreasing in area dramatically. Current research project is looking at water availability from glaciers surrounding Santiago. Mass balance modelling of smaller, near term glaciers from the northern hemisphere to the glaciers in Chile was suggested. More precipitation data is required; is the decrease in glacier from reduced precipitation or temperature changes? The GCW will have a meeting in South America to gather data on the cryosphere. At the same time there will be an international ice charting workshop. Therefore a workshop to gather researchers in South America has been proposed.

ASSW Arctic Science Summit Week 2015 Japan

Tetsuo Ohata shared the plans for the next ASSW, which will be hosted in Japan 2015, comprising of business meetings with a public lecture and excursion. There will be an ICARP III planning conference attached and ISAR4 sessions for scientific discussion. The organizing committee would also like an APECS workshop to run alongside the meeting.

Greenland Research Coordination

Dorthe Dahl-Jensen presented some plans by colleagues at AWI and elsewhere that are working together on drilling surface ice cores in Greenland. This gives a measure of how the margins are retreating, however there is not currently enough known about surface mass balance. Therefore a workshop on the mass balance of the Greenland ice sheet was proposed. This would bring together regional surface mass balance modelers and observational researchers, to structure a sampling plan to benefit both communities.

The community was made aware of the NEGIS as a Megasite project. Activities will start in 2015 and include a drill core in the ice stream (2016 - 19), which is the only ice stream that can currently be modelled well. This is going to be a Greenland version of the WAIS project, which has proved to be very successful. Participation from the wider community is encouraged. There will be a runway opened on the ice stream for access to the ice, and the PolarStern will be headed to the vicinity to undertake oceanographic observations. A workshop was proposed to bring together all researchers who are working on the NEGIS, to coordinate and collaborate research activities.

Updating the CliC Science/Implementation Plan

There are currently four research themes identified by CliC: 1) terrestrial cryosphere 2) marine cryosphere 3) ice sheets, glaciers and sea level 4) global prediction and projection of the cryosphere. Plentiful discussion took place and highlighted that there is no cryosphere for the atmosphere and that the themes are currently not very homogeneous. New research themes were suggested to make them more cross cutting, and integrated over time: 1) document cryosphere evolution 2) promote process understanding 3) quantify climate – cryosphere interaction 4) prediction.

The structure of working groups and targeted activities seem to have become over complicated. Some of the working groups seem to be inefficient; however the permafrost group has had good press and tangible results. It was suggested that all groups should work on the same level and have a definitive end date. This would remove some of the levels in the system. Either way, a strong steering committee is required to lead projects, to control who is coming through and ensure that the group remains active. The working groups need to identify deliverables and have some terms of reference. A graphical structure could assist in detailing what CliC is about.

Structure of CliC SSG meetings was highlighted, with the overall consensus that 3 – 4 days is too long, and more science needs to be included in the meeting. An overview of the Grand Challenges should remain but the overall coordination of GCs and projects should come from WCRP JPS, A suggestion on the re-organisation of time was to consolidate CliC SSG with other meetings to save travel and logistics time.

CliC Management and Operation/Structure

Closed meeting

CliC SSG members only in attendance. Rob Massom joined online.

Greg Flato renewed his commitment to lead more regular communications between sessions with tele-conferences every other month to give updates, share information etc. Greg also agreed to revise the draft implementation plan based on discussions at this meeting and after via email.

Membership of the current SSG and potential new members was discussed. Three members will be rotating off soon Klepikov, Xiao and Rott. The committee agreed to put forward Pavlova (Russia), Kang (China) and Johannesen (Sweden) as potential new members of the SSG. It was agreed that the overall composition of the SSG should be reviewed to assure all areas of cryosphere/climate interactions are being covered by the expertise of the committee members.

Next year the following members of the SSG are due to rotate off: Flato, Hinzman, Koc, Massom, Dahl-Jensen and Krinner. Krinner has been asked to be a co-chair of the CliC SSG; both Krinner and Flato are due to rotate off. The succession of co-chairs needs to be considered so that both co-chairs don't rotate off at the same time.

CliC is a joint sponsor of the Southern Ocean Panel with CLIVAR and SCAR, but has not taken an active roll in recent years. Efforts should be made to better connect with this group.

The next SSG will take place in Boulder, Colorado hosted by Alex Jahn and NCAR. A potential list of the next SSG meetings was discussed, but no decisions were made at the meeting.

- 2016 Fairbanks – Arctic Council also meeting there at that time. Arctic Observation Summit 12 - 20th March
- 2017 could potentially be in Japan, perhaps with a symposium for the Cryosphere Grand Challenge

At the time of the SSG meeting, a full list of proposed workshops was not submitted. The workshop proposals should be submitted to the CliC IPO and a budget will be sent to the SSG for discussion and approval before the WCRP JSC in June.

References

Hanna et al., 2013: Ice-sheet mass balance and climate change, *Nature*, **498**, 51 – 59. doi:10.1038/nature12238

Straneo, Fiammetta, et al., 2013: Challenges to Understanding the Dynamic Response of Greenland's Marine Terminating Glaciers to Oceanic and Atmospheric Forcing. *Bull. Amer. Meteor. Soc.*, **94**, 1131–1144. doi: http://dx.doi.org/10.1175/BAMS-D-12-00100.1

Appendix

Abbreviations and acronyms

APECS	Association of Polar Early Career Scientists
ASPeCt	Antarctic Sea Ice Processes and Climate
ASSW	Arctic Science Summit Week
BAMS	Bulletin of the American Meteorological Society
CLIVAR	Climate Variability and Predictability
CMIP3	Coupled Model Intercomparison Project Phase 3
CMIP5	Coupled Model Intercomparison Project Phase 5
CORDEX	Coordinated Regional Climate Downscaling Experiment
DECK	Development Evaluation and Characterization Klima
DLR	Deutsches Zentrum für Luft- und Raumfahrt
EMS	European Meteorological Society
ENVISAT	Environmental Satellite
EOVs	Essential Observing Variables
ERS	European Remote Sensing
GCM	Global Circulation Models
GCW	Global Cryosphere Watch
GEWEX	Global Energy and Water Exchanges
GFCS	The Global Framework for Climate Services
GHG	Green House Gasses
GrIOOS	Greenland ice ocean observing system
GRISO	Greenland Ice Sheet-Ocean
IASC	International Arctic Science Committee
IMBIE	Ice sheet Mass Balance Inter-comparison Exercise
JSC	Joint Scientific Committee
NAO	North Atlantic Oscillation
NEGIS	North East Greenland Ice Sheet
PCPI	Polar Climate Predictability Initiative
PDO	Pacific Decadal Oscillation
PPP	Polar Prediction Project
SCAR	Scientific Committee on Antarctic Research
SLR	Sea Level Rise
snowMIP	Snow Models intercomparison project
SOOS	Southern Ocean Observing System
SPARC	Stratospheric Processes and their Role in Climate
SSG	Scientific Steering Group
WCRP	World Climate Research Programme
WDAC	WCRP Data Advisory Council
WGCM	Working groups on Coupled Modelling
WGNE	Working groups on Numerical Experimentation
WGRC	Working groups on Regional climate
WGSIP	Working groups on Seasonal to interannual prediction
WMAC	WCRP Modelling Advisory Council
WMO	World Meteorological Organization