Highlights and future plans

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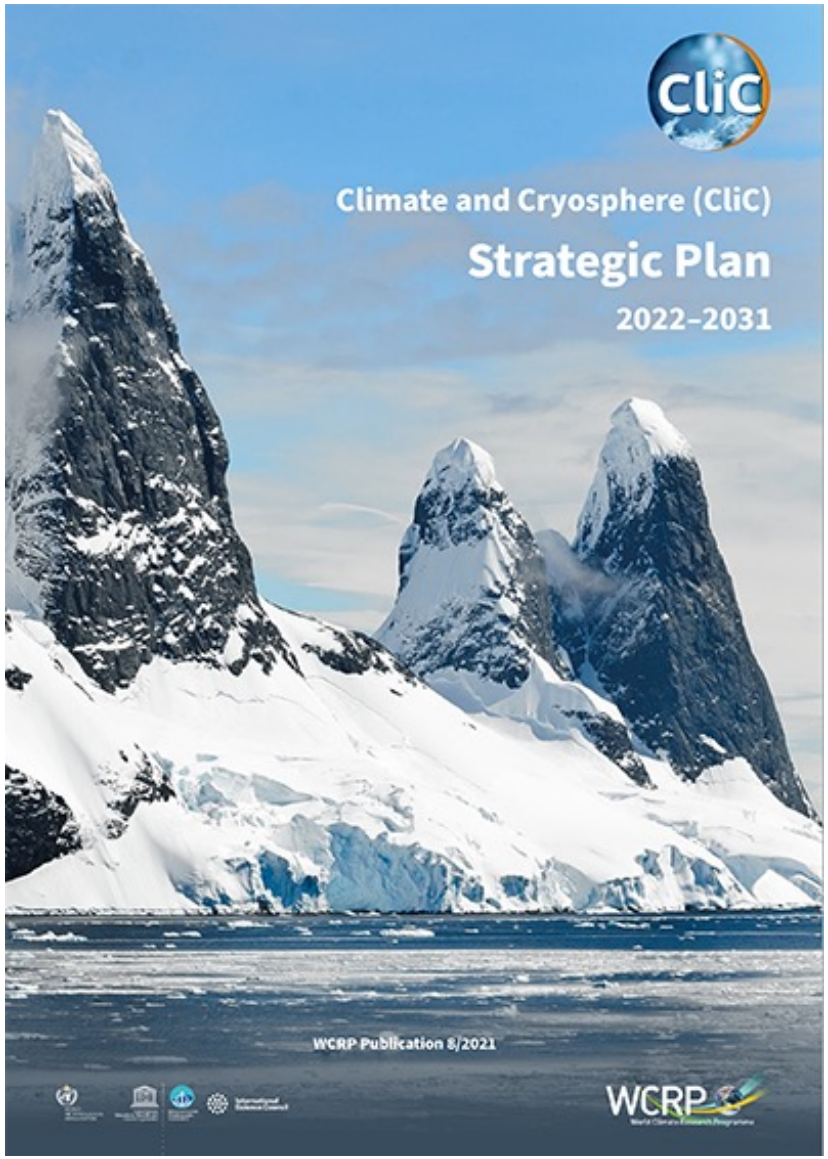
CliC & ISMIP6 SSG

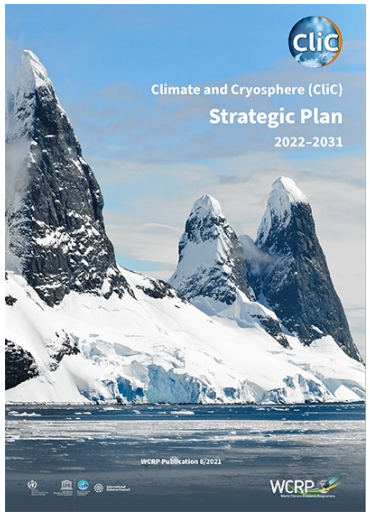
WGNE-37 & WGCM-25 joint meeting
9 November 2022, Boulder, CO



Strategic Plan 2022-2031

Expanding the scope of CliC

https://climate-cryosphere.org/about-clic/clic-strategic-plan-2022-2031/

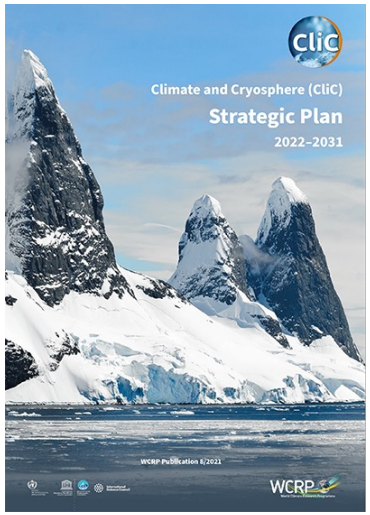


CliC Strategic Plan 2022-2031

Towards a system understanding of the cryosphere and its services

- Bridge across climate, ecosystems and human society at all scales
- Feedbacks to global climate & society
- Co-design of research with social scientists & stakeholders

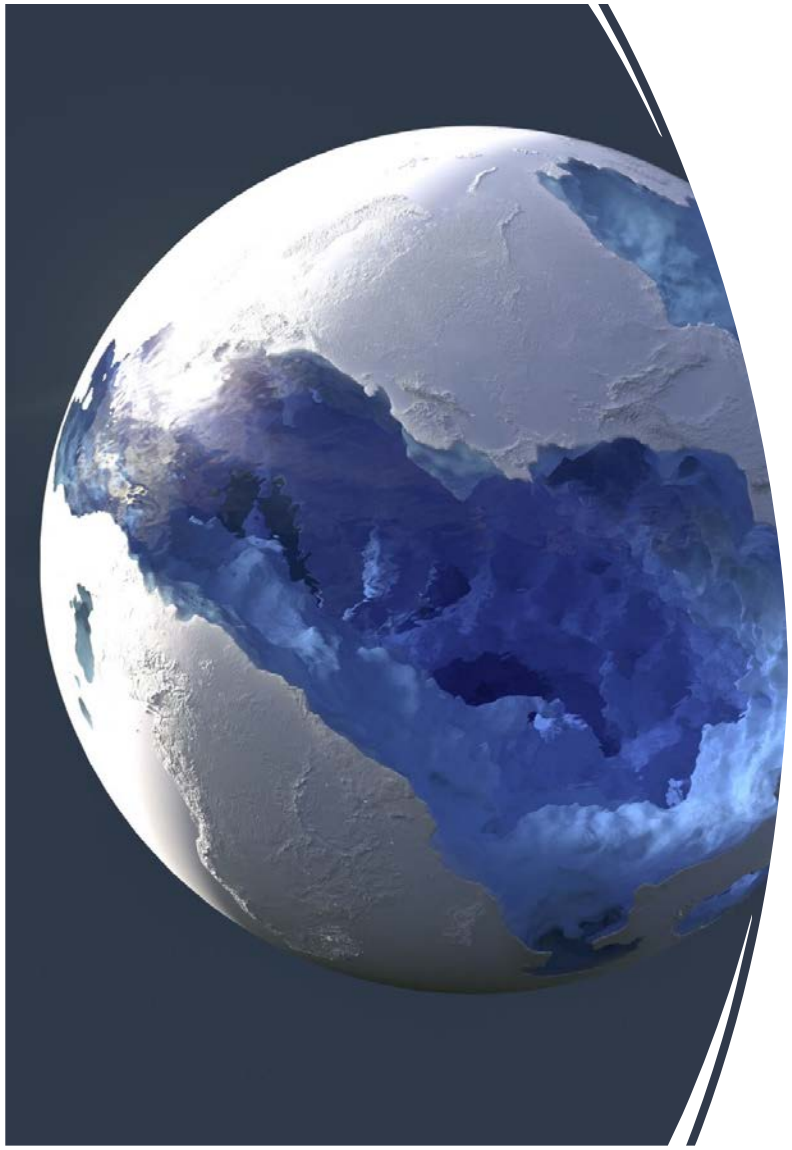
PHYSICS + *IMPACTS*



CliC Strategic Plan 2022-2031 (cont.)

PRIORITY AREAS

1. Engagement of a broad and diverse community in cryospheric research
2. Cryospheric ice loss: assessments and impacts
3. Projection of future ice loss and impacts
4. System description of the cryospheric regions
5. Knowledge syntheses and communication to stakeholders



CliC Modelling
An overview of MIPs

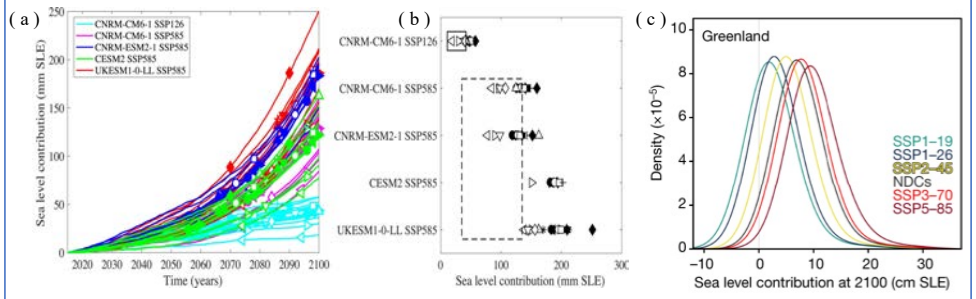
- *ISMIP6*: Ice Sheets
- *GlacierMIP*
- *ESM-SnowMIP-LS3MIP*: Earth System Snow - Land Surface, Snow and Soil Moisture
- *MISOMIP2*: Marine Ice Sheet-Ocean
- *SIMIP*: Sea Ice

Ice Sheet Model Intercomparison Project for CMIP6

Highlights

- ISMIP6 succeeded to generate projections of future SL contribution from ice sheets for IPCC AR6.
- ISMIP6 ensemble showed different response of the two ice sheets in a warming world: whereas Greenland loses mass with warming temperature (Figure 1), Antarctica is more complex as it depends on how increased temperature translate into local climate.
- ISMIP6 member publications ranged from describing their models and simulations (Quiquet and Dumas, 2021a, 2021b) to building on the protocol with additional ice-ocean interactions (Lipscomb et al., 2021), the use of emulators in 23rd century projections (Lowry et al. 2021), or projections to year 3000 (Chambers et al., 2021).
- Community building between ISMIP6 ice sheet modelers and climate modelers remained a key focus despite the pandemic, proof of which are the multiple presentations given by ISMIP6 SSG members to, e.g., EGU, AGU, IARPC, NASA Sea Level Change Team, TIPMIP and SCAR INSTANT

Web: https://climate-cryosphere.org/about-ismip6/



Global mean sea level rise contribution from the Greenland ice sheet to 2100. (a) Time series of contribution between 2015 and 2100 (in mm) for whole ice sheet as a function of experiment (legend) and ice sheet model (symbol). (b) Contribution at 2100. Symbols refer to ice sheet models while boxes refer to ranges from equivalent CMIP5-forced experiments. (c) Probability density function for CMIP6 scenarios obtained from statistical emulation of ISMIP6 ensemble. Panels (a-b) are from Payne et al. (2021) and (c) is from Edwards et al. (2021).

Future plans

- ISMIP6 will continue analysing the rich dataset to understand the uncertainty in SL projections and refine the protocol towards CMIP7
- Continue interactions with relevant activities such as other MIPs (e.g., MISOMIP, PMIP, TIPMIP) and other initiatives (e.g., GRISO, PROTECT, ISMASS, SCAR INSTANT). Interactions with GlacierMIP to avoid double counting or omission of ice in observational and modeling studies, as well as adopt a strategy for delineating between ice sheets and glaciers
- Launch of Antarctic projections to 2300. For this, interdisciplinary collaboration with oceanographers, meteorologists, glaciologists and statisticians in developing this new framework will be crucial.
- Community building: virtual workshops to interact with the climate modeling community that couples dynamic ice sheets to climate models. Planning to convene an in-person workshop linked with AGU or another large conference to review and discuss next steps in these activities.

GlacierMIP

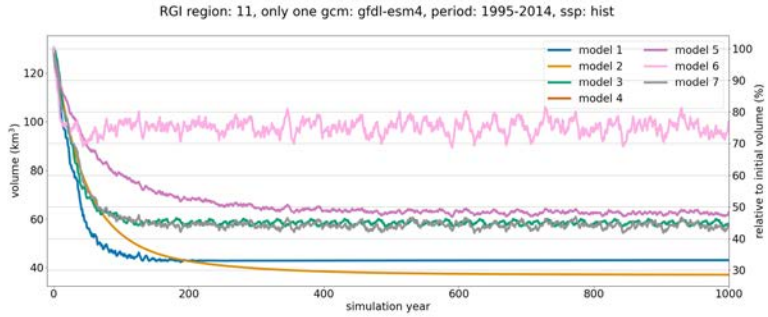
Highlights

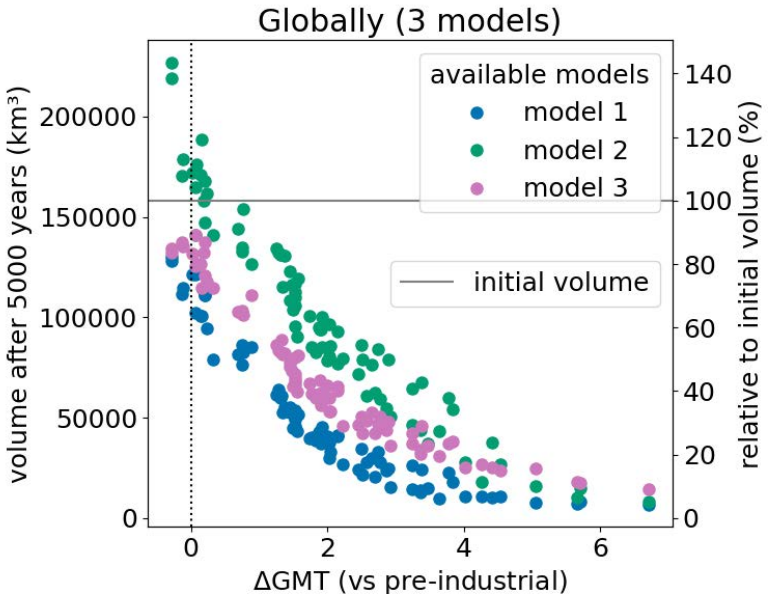
- Launched GlacierMIP3 to determine the equilibrium response of glaciers to various temperature increases above pre-industrial levels.
- GlacierMIP3 experimental design was presented at EGU2021 and the team met during the Cryosphere 2022 Symposium in Reykjavík, for in-depth analyses of the first results of the experiments

Future plans

- Submit a paper before the IUGG General Assembly in July 2023, summarizing the results of GlacierMIP3 experiments (most likely, more than one publication will result from GlacierMIP3)
- Start new GlacierMIP activities, including:
  - An updated estimate of the future sea-level contribution from glaciers and related uncertainties, thereby partly relying on new approaches (new methods since GlacierMIP2) and datasets (CMIP6 vs. CMIP5, new glacier outlines and ice thickness reconstructions).
  - Reconstruct past glacier changes, including detection and attribution experiments

Web: https://climate-cryosphere.org/glaciermip/





ESM-SnowMIP - LS3MIP

https://climate-cryosphere.org/esm-snowmip/

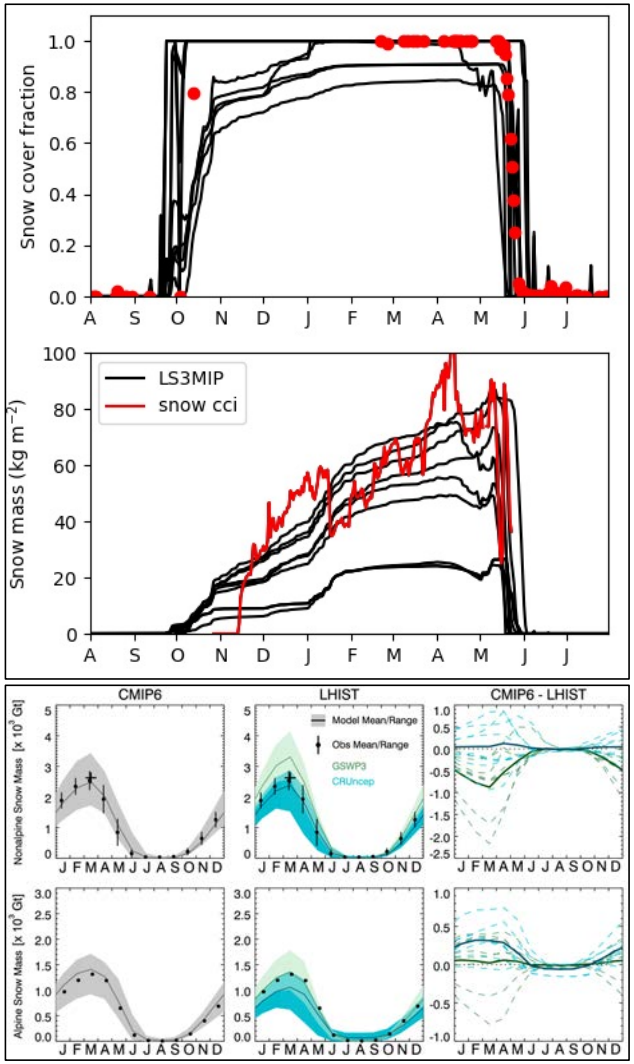
Highlights

- Newest generation of physical snow models driven by reanalysis meteorology
- New suite of northern hemisphere snow extent and snow water equivalent reference datasets, which reflect advancements in satellite-derived products (through the European Space Agency Snow CCI project)
- ESM-SnowMIP tundra experiment pilot study using existing LS3MIP simulations and evaluating the use of ESA Snow CCI products (*top figure*)
- Set of historical land simulations (land-hist) from LS3MIP to validate and bench snow and permafrost within the land-hist simulations, compared to the historical CMIP6 coupled simulations (*bottom figure*)

Future plans

- Continue ESM-SnowMIP experiments at tundra reference sites: challenging due to limited availability of forcing data over a full seasonal cycle, and the high degree of spatial heterogeneity in tundra snow properties
- Continue analysis of LS3MIP land-hist simulations: assess trends relative to historical reference data, determine influence of historical internal variability on the snow cover response to expected warming

Web: https://climate-cryosphere.org/esm-snowmip/



MISOMIP2

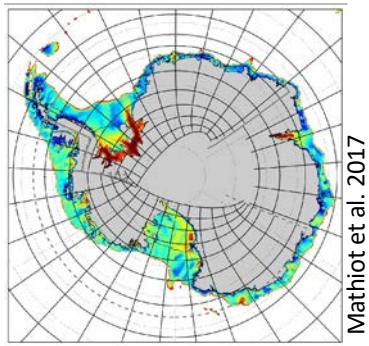
Highlights

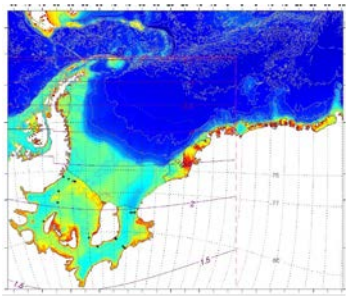
- Test-simulations were run for planned experiments. Results analysed, discussed, and refined. Post-processing routines for model output coded and tested.
- Oceanographic and glaciological data were gathered and processed to serve as a 'MIPkit' for comparison to model output.
- A first draft of a manuscript outlining the MISOMIP2 protocol is close to being completed.

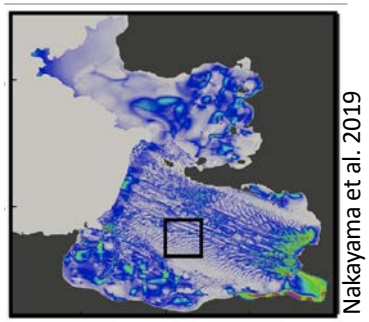
Future plans

- Share draft manuscript with the community to get final feedback on MISOMIP2 protocol.
- Submission of a manuscript to Geoscientific Model Development in 2023.
- Organise an informative Splinter session during EGU23 with the core team and selected members of the wider community. Funding for young scientists might be provided by CliC.

Web: https://climate-cryosphere.org/modeling/


Mathiot et al. 2017


Hausmann et al. 2020


Nakayama et al. 2019

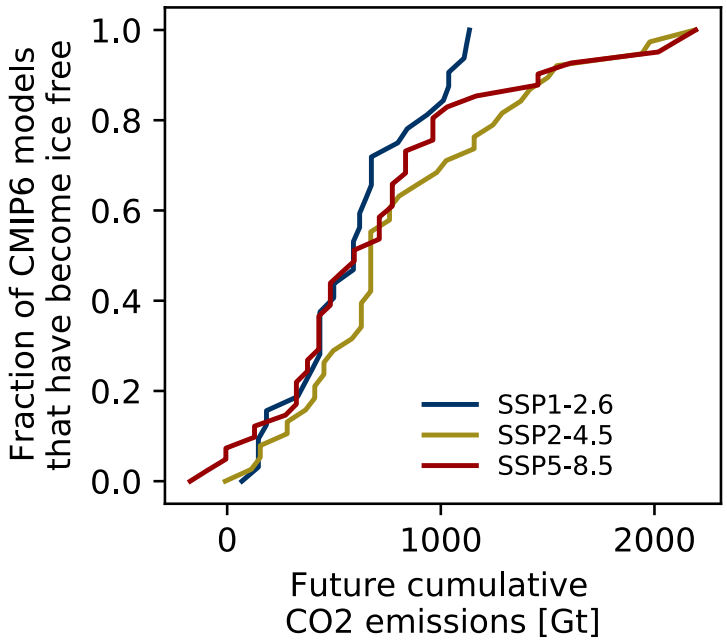
SIMIP

Highlights

- SIMIP showed that the Arctic will likely be practically sea-ice free in summer before 2050 in all scenarios (highly cited GRL study, SIMIP community, 2020).
- Our analyses contributed to the sea-ice assessment in IPCC AR6.

Future plans

Preparations for CMIP7 from a sea-ice perspective, more details to be discussed at IGS workshop in 2023.



https://climate-cryosphere.org/simip-about/

MIPs Contacts

	Co-chairs
ISMIP6	S. Nowicki (U Buffalo, USA) & T. Payne (U Bristol, UK)
SIMIP	D. Nortz (MPI Hamburg, Germany) & A. Jahn (U Colorado Boulder, USA)
MISOMIP2	J De Rydt (U Northumbria, UK), N. Jourdain (IGE-CNRS-UGA, France), R. Timmermann & M. van Caspel (AWI, Germany), Y. Nakayama (Hokkaido U, Japan)
GlacierMIP3	R. Hock (U Oslo, Norway), Ben Marzeion (U Bremen, Germany)
ESM-snowMIP/LS3MIP	C. Derksen (Environment and Climate Change Canada), G. Krinner (U Grenoble, France) & R. Essery (U Edinburgh, UK)

CliC International Office: *status*

December 2022: Contract termination with present host *Bjerknes Centre for Climate Research*, Norway

January 2023: IPO moves to its new host the University of Massachusetts, Amherst.

The IPO will be staffed with Director, Project Officer and Communications Expert >> *the positions will be announced soon!*

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