

# Grand Challenge “Melting Ice & Global Consequences”

Greg Flato (Gerhard Krinner)

Our project office host ...



## Scientific Steering Group (SSG)

Co-chairs:

Gerhard Krinner (until end of 2017)

Greg Flato (until end of 2016)

James Renwick (starting in 2017)

## International Project Office

Director: Lawrence Hislop

Executive Officer: Gwénaëlle Hamon

*Hosted by the Norwegian Polar Institute*

## WCRP Grand Challenge – Melting Ice and Global Consequences, Lead: CliC, Chair: Greg Flato

- Earth System Model-Snow MIP (ESM-SnowMIP) (tightly linked to Land Surface, Snow and Soil Moisture MIP (LS3MIP))\*
- Ice Sheet MIP for CMIP6 (ISMIP6)\*
- Marine Ice Sheet-Ocean MIP (MISOMIP)\*
- Diagnostic Sea Ice MIP (SIMIP)\*
- GlacierMIP
- Permafrost Carbon Network (*part of the Study of Environmental Arctic Change (SEARCH) project*)

\* Contributions to CMIP6, the 6th Phase of the Coupled Model Intercomparison Projects (MIP)

### Groups, Panels, and Fora

- Polar Climate Predictability Initiative (PCPI) (*joint with SPARC*)
- Southern Ocean Region Panel (*joint with CLIVAR and SCAR*)
- Antarctic Sea Ice Processes & Climate (ASPeCt) (*joint with SCAR*)
- Technical Committee on Sea Ice Observations
- Arctic Sea Ice Working Group
- Sea Ice & Climate Modelling Forum
- Ice Sheet Mass Balance and Sea Level (ISMASS) (*joint with SCAR and IASC*)
- Permafrost & Climate Modelling Forum

### Limited Lifetime Targeted Activities

- Polar Coordinated Regional Downscaling Experiment (Polar CORDEX)
- Arctic Freshwater Synthesis (*completed*)
- Southern Ocean Satellite Requirements (*completed*)
- Where Are They Now? (*completed*)
- Interactions Between High-latitude Cryosphere Elements
- Earth Observations and Arctic Science Needs (with ESA)
- Linkage Between Arctic Climate Change and Mid-Latitude Weather Extremes



# Coordinated model experiments, model development, model improvement

- Coupled Model Intercomparison Project (CMIP6) subprojects: GMD MIP description papers published
- MISOMIP and global glacier mass balance modelling activities are closely aligned, results being published

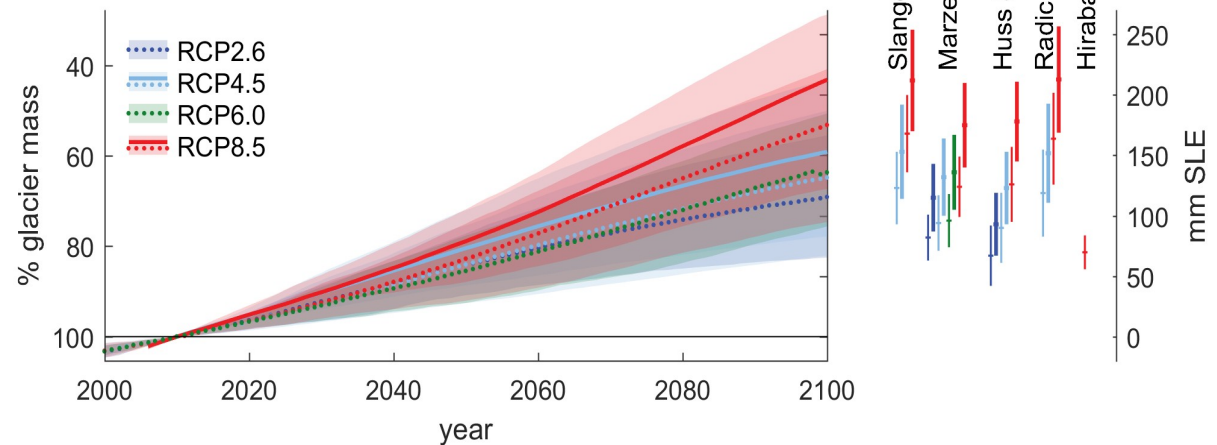
*Medium-term CliC task to improve cryosphere visibility in climate modeling community: achieved*

CMIP6 Endorsed MIPS (\* indicates diagnostic MIP)

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



## Example: GlacierMIP

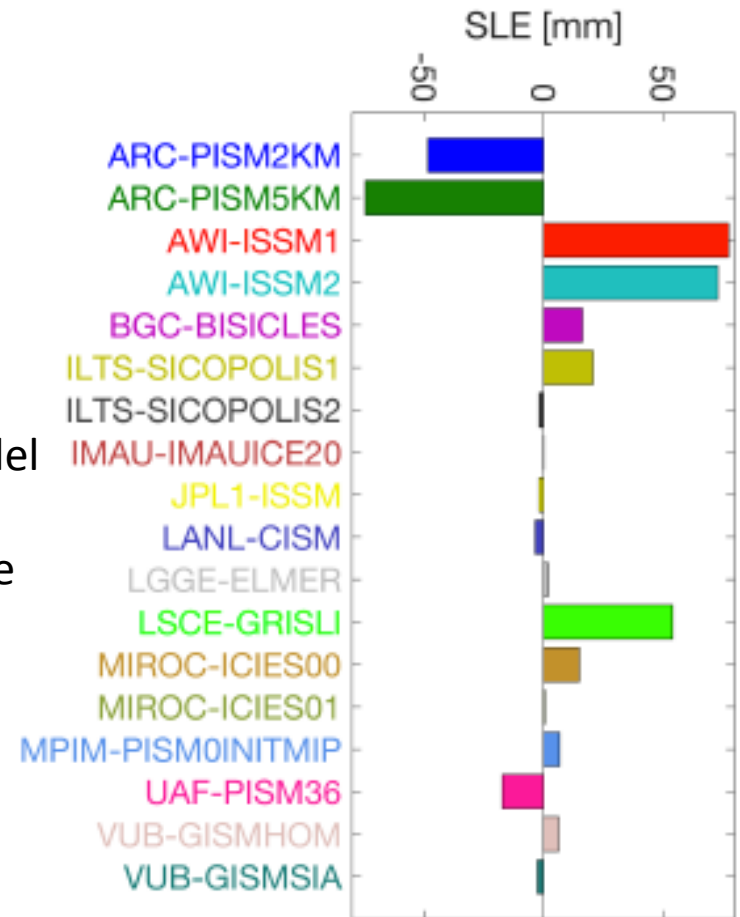


*Transient global glacier projections of two global glacier mass change projections, updated from Slangen et al. (2011, solid) and from Marzeion et al. (2012, dotted). Shading indicates one ensemble standard deviation. Projections by 2100 are compared to 3 other published studies. Thick lines including, thin lines excluding peripheral glaciers (Slangen et al., 2016).*

## Another example: ISMIP6

- First time in which the ice sheet modelling community has been engaged directly in CMIP
- 3 complementary components:
  1. 'diagnostic', comprises a data request that will allow targeted analysis of coupled model performance over the Greenland and Antarctic ice sheets, particularly the surface energy and water balance.
  2. Offline modelling of the ice sheets, using forcing obtained from CMIP5/6.
  3. Fully coupled ice-sheet-climate models
- More a MDP than a MIP

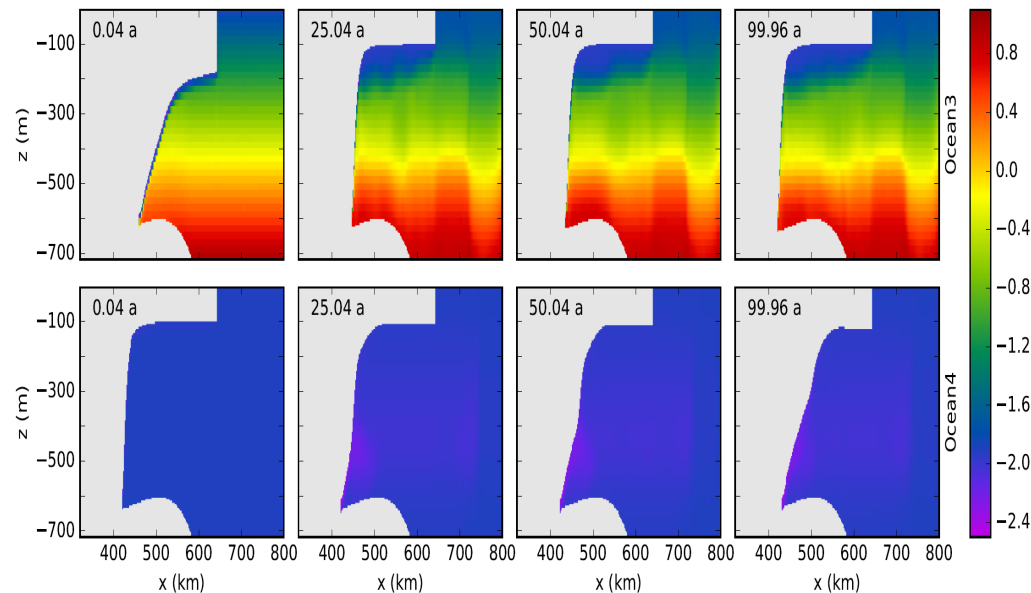
*Contributes to “Melting Ice” and “Sea Level” Grand Challenges*



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

## Another example: MISOMIP

- Coupled marine ice sheet and ocean models
- Large recent progress in process understanding
- Will improve understanding of important processes controlling ice sheet discharge and hence sea-level rise



Cross sections of ocean temperature (colored) and ice topography (gray) evolving in time in one of the three interrelated MIPs for marine ice-sheet models and ocean models with sub-ice-shelf cavities (Asay-Davis et al, 2016).

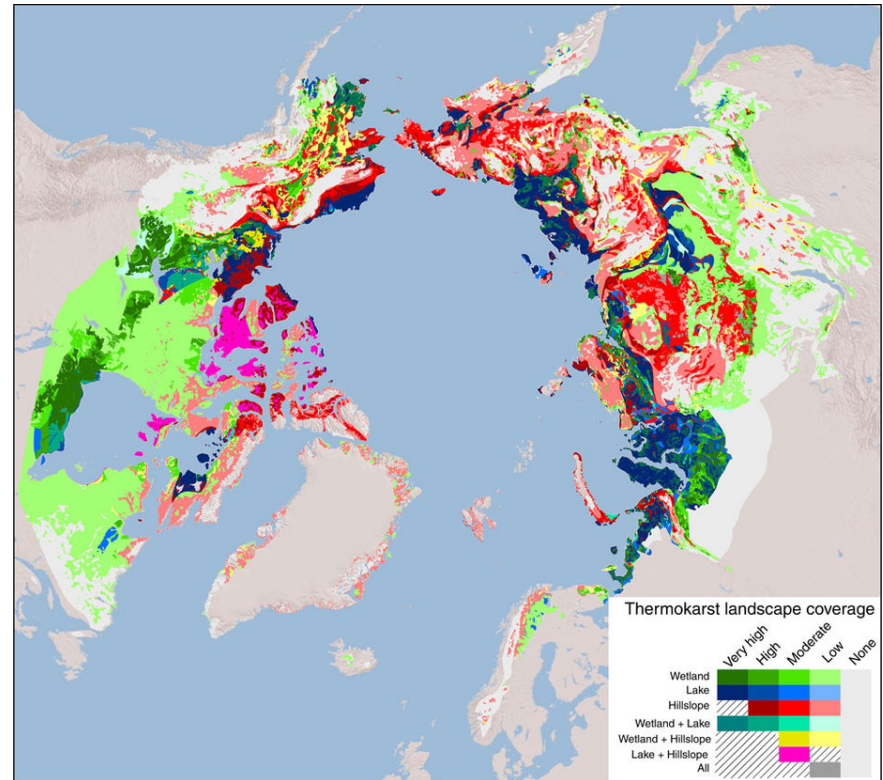
# Permafrost

PCN: Syntheses on permafrost carbon, vegetation, coordinated model experiments (offline)

CliC's role: Link to large-scale climate community

(Modest) contribution to Permafrost Carbon Network

**Coordinate with  
Biogeochemistry Grand  
Challenge: CMIP6 analysis**



Thermokarst landscape coverage  
(Olefeldt et al., 2016)