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Ice Sheet Model Intercomparison Project for CMIP6

Ice Sheet Model Intercomparison Project

Welcome to the Ice Sheet Model Intercomparison Project for CMIP6 (ISMIP6) and CMIP7 (ISMIP7) wiki

You are encouraged to use the wiki pages to alter the formulation of numerical experiments, point out any inconsistencies or inaccuracies you find in the data sets, and post results and figures that you'd like others see and discuss.

New Updates

The planning for ISMIP7 has started! Let us know at contact -at- ismip.org if you want to be involved! We will be revisiting every aspect of the ISMIP6 protocol and see how it can be improved… Of course, we are also tied to the CMIP7 protocols and IPCC AR7 schedules, which are themselves being worked on… We transitioned from Climate and Cryosphere (CliC) wikis to Ghub. Please reference resources from this group, as they reflect the latest materials.

We have new mailing lists too for ISMIP7, if you would like to be included please fill in this form and notify us at contact -at- ismip.org.

Latest Activity

ISMIP6 Antarctic 2300 projections. These projections focus on simulations of the Antarctic Ice Sheet extended to year 2300. These new experiments were launched in February 2022. Analysis of this data is on the way and our first paper, Seroussi et al., was published in September 2024! More details are available on the ISMIP6-Projections2300-Antarctica wiki.

Meetings

The ISMIP Meetings wiki indicates when and where our next meeting will be! In 2024, we are planning meetings in June near Washington CD, in August linked to IGS in Northumbria and Fall AGU in Washington DC.

Accessing Wikis

To access all wikis, resources, and datasets, please refer to the Index tab in the top right corner.

What is ISMIP6?

The overall framework for ISMIP6 is designed to deliver projections of ice sheet contribution to sea level rise. ISMIP6 brings together for the first time a consortium of international ice sheet models and coupled ice sheet-climate models. This effort thoroughly explores the sea level contribution from the Greenland and Antarctic Ice Sheet in our changing climate and assess the impact of large ice sheets on the climate system. Together with the new glacier **Climate and Cryosphere** (CliC) targeted activity and projections of thermal expansion within the **Coupled Model Intercomparison Project** (CMIP) framework, sea level is now part of the family of variables for which CMIP can provide routine IPCC-style projections.

ISMIP6 is explicitly designed to

(1) Ensure that ice sheet (hence sea level) projections are fully compatible with the CMIP6 (Coupled Model Intercomparison Project-Phase 6) process, and

(2) Provide the basis for investigating the feedbacks, impacts, and sea level changes associated with dynamic ice sheets and for quantifying the uncertainty in ice-sheet-sourced global sea level change.

Our contributed experiments to CMIP6 (Nowicki et al., 2016) both use and augment the **Diagnostic Evaluation and Characterization of Klima** (CMIP6-DECK), Historical and

ScenarioMIP experiments. ISMIP6 uses the standard CMIP **Atmosphere General Circulation Models** (AGCM) and **Atmosphere-Ocean General Circulation Models** (AOGCM) experiments for analysis of the climate over and surrounding the ice sheets, and as forcing for the standalone ice sheet models (ISM) projections. Additional sensitivity experiments were performed with the ISM to investigate the uncertainty associated with these projections arising from ice sheet models.

The **key output** is an ensemble of historical and future estimates of ice sheet contribution to sea level. To address the climate feedbacks introduced by interactive ice sheets, we proposed that a small number of selected DECK experiments are repeated with coupled AOGCM-ISM, where the ice sheet is an interactive component of the AOGCM. Our assessment of the state of existing AOGCMs is that coupled models including an interactive Greenland ice sheet can realistically be expected for CMIP6. However, including the Antarctic ice sheet in the aforementioned models remains a challenge due to the inherent complexity of its response to climate forcing, and the issues associated with simulations of the Southern Ocean). It is for these reasons that ISMIP6 (Nowicki et al., 2016) **heavily relies on standalone ice sheet models driven offline by CMIP6 climate models for projections of sea level.**

Refer to the sections below for more information on ISMIP6 experiments, model simulations, modeling center, and participants

ISMIP6 Primary Experiments

Standalone Ice Sheet Experiments

These pages describe the **experimental setup** for the standalone ice sheet model simulations. ISMIP6 standalone ice sheet modeling focuses on:

- Gaining insight into the uncertainty in ice sheet evolution resulting from the choice of initialization methods (the **initMIP** efforts for the Greenland and Antarctic ice sheets)
- Understanding the response of the Antarctic ice sheet to a total loss of the ice shelves (ABUMIP), as well as
- Projecting ice sheet evolution for the 21st century

ISMIP6 managed its goal of delivering projections from dynamic ice sheet models in time for IPCC AR6. Because of the delay in CMIP6 and the availability of dataset from CMIP6 climate models, many of the core simulations for the Greenland and Antarctic ice sheet had to use CMIP5 datasets.

Greenland

initMIP-Greenland	focuses on detailed description of the ISMIP6 Standalone Ice Sheet experiments for the initialization for Greenland.
ISMIP6-Projections-Greenland	focuses on detailed description of the ISMIP6 Standalone Ice Sheet experiments protocols for projections of the Greenland ice sheet evolution.

Antarctica

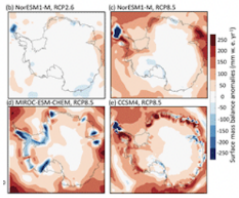
initMIP-Antarctica	focuses on the more detailed description of the ISMIP6 Standalone Ice Sheet experiments for the initialization for Antarctica.
ABUMIP-Antarctica	focuses on understanding the response of the Antarctic ice sheet to weakening and loss of the shelves.
ISMIP6-Projections-Antarctica	focuses on detailed description of the ISMIP6 Standalone Ice Sheet experiments protocols for projections of the Antarctic ice sheet evolution.
ISMIP6-Projections2300-Antarctica	focuses on detailed description of the ISMIP6 2300 Projections experiments protocols for projections of the Antarctic ice sheet evolution extended to 2300.

Coupled Ice Sheet Climate Experiments

ISMIP6-Coupled-Ice-Sheet-Climate-Experiments	describes the experimental setup for the coupled ice sheet-climate model simulations.

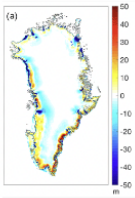
Datasets and Publications

The **CMIP5 and CMIP6 climate datasets** used by ISMIP6 for its projections are distributed via Ghub. A quality controlled dataset on the standard ISMIP6 grids for the initMIP Greenland and Antarctica efforts, the ABUMIP, and the 21st century Greenland and Antarctica projections are all available and described in detail on our Browse Data page.



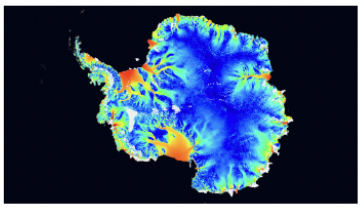
ISMIP6 21st Century Forcing Datasets

These datasets contain the 21st century atmospheric and oceanic forcing datasets used for Greenland and Antarctic standalone ice sheet model simulations as part of the ISMIP6 project.



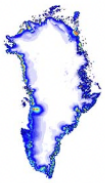
ISMIP6 21st Century Greenland Projections

This dataset provides the Greenland ice sheet model output produced as part of the ISMIP6 Project (Eyring et al., 2016; Nowicki et al. 2016).



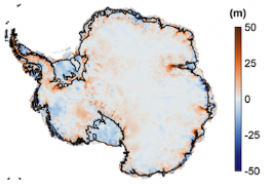
ISMIP6 21st Century Antarctic Projections

This dataset provides the Antarctic ice sheet model output produced as part of the ISMIP6 Project (Eyring et al., 2016; Nowicki et al. 2016).



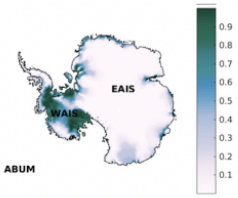
ISMIP6 initMIP-Greenland simulations

This dataset contains the initMIP-Greenland model simulations from the ISMIP6 Project.



ISMIP6 initMIP-Antarctica simulations

This dataset contains the initMIP-Antarctica model simulations from the ISMIP6 Project.



ISMIP6 ABUMIP Simulations

These datasets contain the ice sheet model simulation from the ABUMIP (Antarctic BUttressing Model Intercomparison Project) effort.

ISMIP6 datasets are distributed via the 'Ghub Globus endpoints. These datasets are from all ISMIP6 activities, such as the initMIP, ABUMIP, or projections to 2100 and 2300. ISMIP6 and GHub is partnered with UB CCR to provide access to large datasets. The Datasets-for-whole-ice-sheet-models page provides suggestions for datasets that are used in the initialization of ice sheet models, but you can use different datasets and still participate in ISMIP6.

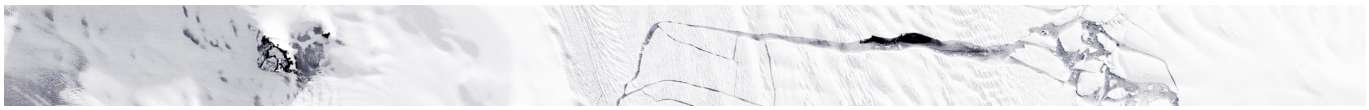
These ISMIP6 datasets are freely available, however, we ask that ISMIP6 and its participants are acknowledged in publications and presentations. Suggestions on how to do this can be found in the for ISMIP6 publications Guidance for ISMIP6 publications. **This page also contains Publications arising from ISMIP6**. Please contact us if you would like to receive a publication number and have your work be listed.

ISMIP6 and Richardson Medal

In March 2023, ISMIP6 was recognized for its outstanding service to the field of glaciology and sea level projection by the **International Glaciology Society** via the first Richardson Medal ever given to a team. The award announcement reads:

“We recognize the entire ISMIP6 team for its academic and leadership activities in the design and production of future sea-level projections. The ISMIP6 team, consisting of over 80 members, has provided outstanding service to the field of glaciology by planning and coordinating projections of ice-sheet change. The ISMIP6 team has been instrumental in providing a community-led response to two WCRP Grand Challenges: “Melting Ice and Global Consequences” and “Regional Sea Level Change and Coastal Impacts”. Although ice-sheet model comparisons have a long history in the field of glaciology, dating back to the EISMINT experiments in the 1990s, the atmospheric, oceanic and other climate communities have made significant advances through the suite of CMIP simulations that form the basis of sections of the IPCC report. The ISMIP6 team was responsible for collaborative design and interpretation of the ensemble of model runs used for projections of future ice-sheet change and bringing the ice-sheet community under the auspices of the international CMIP community. As part of this, the ISMIP6 team has been instrumental in building international collaborations that span career stages and nations. Their projections have had a wide impact on the global community, serving as the basis for policy and adaptation discussions. We recognize the impact and leadership provided by the entire ISMIP6 team and its service to the glaciological and wider communities.”

ISMIP6 accepted the award during the IGS International Symposium on Verification and Validation of Cryospheric Models held at Northumbria University, 4-9th August 2024.



ISMIP6 and ISMIP7 Participants

ISMIP6 is a community effort that involves scientists interested in the polar regions, ranging from experts in polar remote sensing to modeling. If you would like to be involved in ISMIP6 or ISMIP7, please email contact-at-ismip.org or ssc-at-ismip.org.

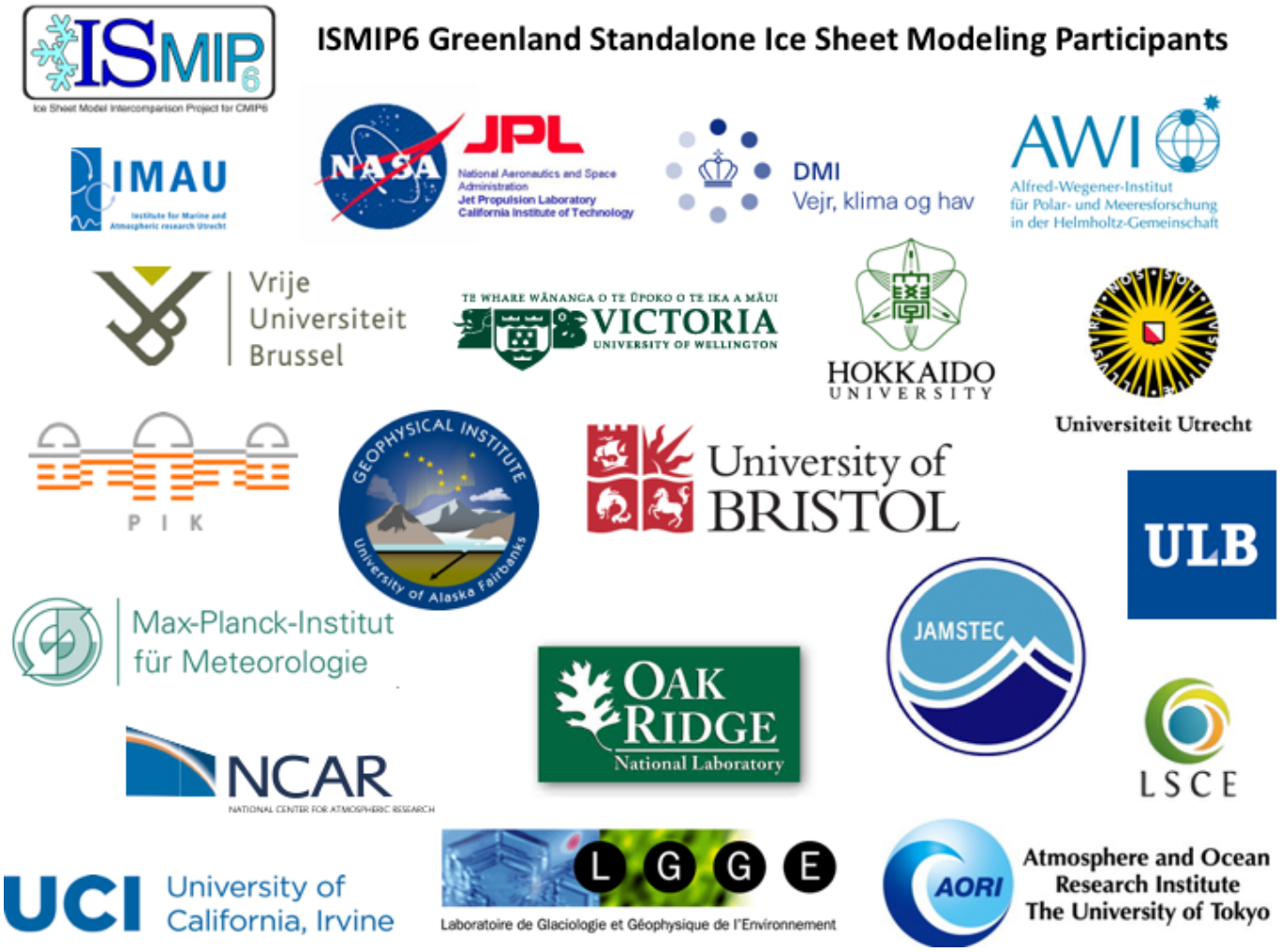
The co-chairs of steering committee for ISMIP6 includes Sophie Nowicki, Eric Larour, and Tony Payne. The steering committee members are Helene Seroussi, Heiko Goelzer, Andrew Shepard , William Lipscomb, Jonathan Gregory, and Ayako Abe Ouchi. A big thank you to our members contributing to the numerical simulations!

The co-chairs of steering committee for ISMIP7 are Sophie Nowicki, and Tony Payne. The steering committee members are Ayako Abe Ouchi, Xylar Asay-Davis, Bea Csatho, Heiko Goelzer, Helene Seroussi, and Robin Smith. The steering committee can be contacted via: ssc-at-ismip.org. A big thank you to many members!

Greenland Standalone Ice Sheet Modeling

Contributors	Model	Group ID	Group
Nick Golledge	PISM	ARC	Antarctic Research Centre, Victoria University of Wellington, NZ
Martin Rückamp, Angelika Humbert	ISSM	AWI	Alfred Wegener Institute for Polar and Marine Research, DE /University of Bremen, DE
Victoria Lee, Tony Payne	BISICLES	BGC	University of Bristol, Bristol, UK
Christian Rodehacke	PISM	DMI	Danish Meteorological Institute, DK
Ralf Greve	SICOPOLIS	ILTS	Institute of Low Temperature Science, Hokkaido University, Sapporo, JP
Ralf Greve, Reinhard Calov	SICOPOLIS	ILTS_PIK	Institute of Low Temperature Science, Hokkaido University, Sapporo, JP / Potsdam

Heiko Goelzer, Roderik van de Wal	IMAUICE	IMAU	Institute for Climate Impact Research, Potsdam, DE Utrecht University, Institute for Marine and Atmospheric Research (IMAU), Utrecht, NL
Helene Seroussi, Nicole Schlegel	ISSM	JPL	NASA Jet Propulsion Laboratory, Pasadena, USA
William Lipscomb, Joseph H. Kennedy	CISM	LANL	National Center for Atmospheric Research, Boulder, CO, USA / Oak Ridge National Laboratory, USA
Fabien Gillet-Chaulet, Olivier Gagliardini	Elmer	LGGE	Laboratoire de Glaciologie et Géophysique de l'Environnement, FR
	GRISLI	LSCE	Laboratoire des sciences du climat et de l'environnement, FR
Fuyuki Saito, Ayako Abe-Ouchi	IcIES	MIROC	Japan Agency for Marine-Earth Science and Technology, JP / The University of Tokyo, Tokyo, JP
Florian Ziemen	PISM	MPIM	Max Planck Institute for Meteorology, DE
Andy Aschwanden	PISM	UAF	Geophysical Institute, University of Alaska Fairbanks, USA
Helene Seroussi, Mathieu Morlighem	ISSM	UCIJPL	NASA Jet Propulsion Laboratory, Pasadena, USA / University of California Irvine, Irvine, USA
Sainan Sun and Frank Pattyn	FETISH	ULB	Laboratoire de Glaciologie, Université Libre de Bruxelles, Brussels, BE
Philippe Huybrechts, Heiko Goelzer	GISM	VUB	Vrije Universiteit Brussel, Brussels, BE



Antarctica Standalone Ice Sheet Modeling

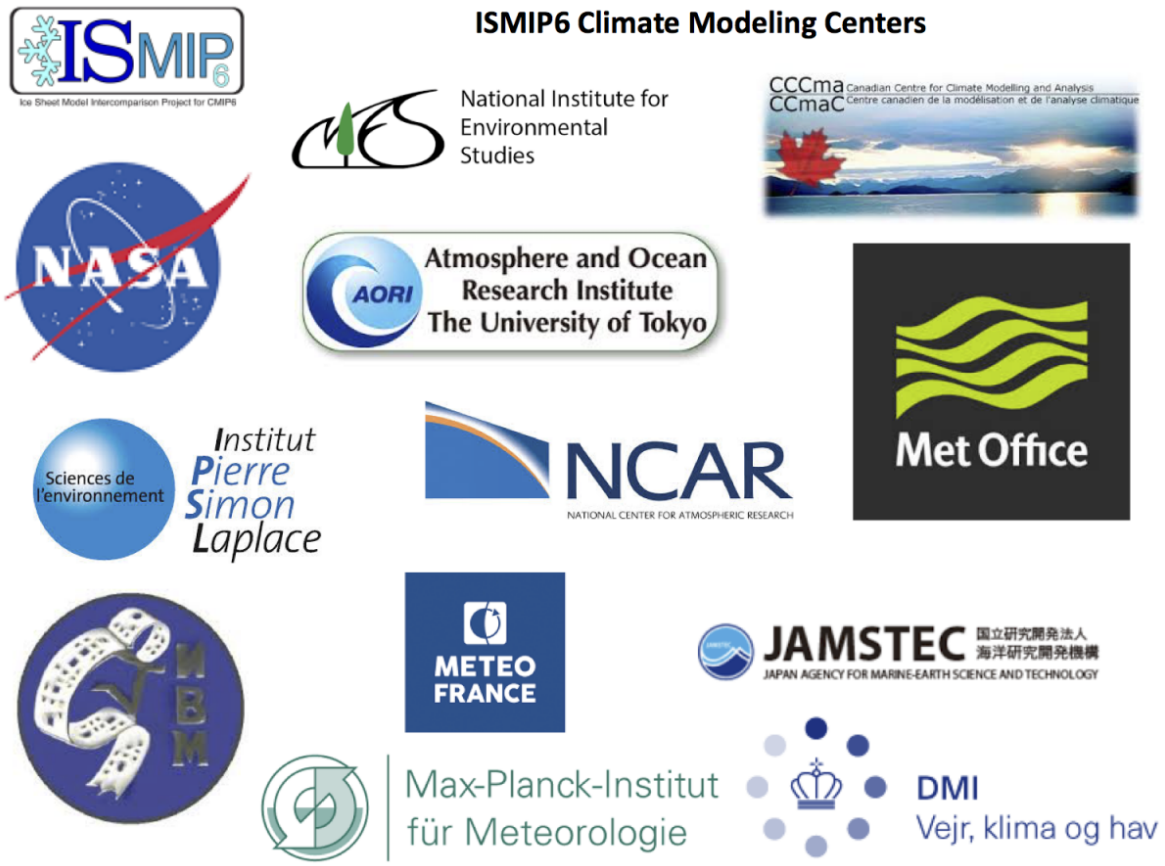
Contributors	Model	Group ID	Group
Nick Golledge	PISM	ARC	Antarctic Research Centre, Victoria University of Wellington, NZ
Thomas Kleiner, Johannes Sutter, Angelika Humbert	PISM	AWI	Alfred Wegener Institute for Polar and Marine Research, DE /University of Bremen, DE
Stephen Cornford	BISICLESPRELIM	CPOM	University of Bristol, Centre for Polar Observation and Modelling, UK
Christian Rodehacke	PISM0	DMI	Danish Meteorological

			Institute, Arctic and Climate, DK
Fabien Gillet-Chaulet	ELMER	IGE	Laboratoire de Glaciologie et Géophysique de l'Environnement, FR
Ralf Greve	SICOPOLIS	ILTS	Institute of Low Temperature Science, Hokkaido University, Sapporo, JP
Heiko Goelzer, Roderik van de Wal, Thomas Reerink	IMAUICE64	IMAU	Utrecht University, Institute for Marine and Atmospheric Research (IMAU), Utrecht, NL
Nicole Schlegel, Helene Seroussi	ISSM	JPL	NASA Jet Propulsion Laboratory, Pasadena, USA
Stephen Price, Matthew Hoffman, Tong Zhang	MALI	LANL	Los Alamos National Laboratory, Los Alamos, USA
Aurélien Quiquet, Christophe Dumas	GRISLI	LSCE	Laboratoire des Sciences du Climat et de l'Environnement,Université Paris-Saclay, France
William Lipscomb, Gunter Leguy	CISM	NCAR	National Center for Atmospheric Research
Torsten Albrecht	PISM3PAL	PIK	Potsdam Institute for Climate Impact Research, DE
David Pollard	EQNOMEC,GLNOMEC	PSU	Pennsylvania State University EMS Earth and Environmental Systems Institute, Pennsylvania, USA
Helene Seroussi, Mathieu Morlighem	ISSM	UCIJPL	NASA Jet Propulsion Laboratory, Pasadena, USA / University of California Irvine, Irvine, USA
Sainan Sun and Frank Pattyn	FETISH	ULB	Laboratoire de Glaciologie, Université Libre de Bruxelles, Brussels, BE
Jonas Van Breedam, Philippe Huybrechts	AISMPALEO	VUB	Vrije Universiteit Brussel, Brussels, BE

Climate Modeling Centers

Climate modeling centers that have expressed an interest in ISMIP6.

Climate mode	Ice-sheet model	Institute/country
CanESM	None	CCCma/CA
CESM2	CISM	NCAR-LANL/USA
CNRM-CM	GRISLI	CNRM/FR
EC-Earth	GrIS	DMI/DK
GISS	PISM	NASA-GISS/USA
INMCM	VUB	INM/RU
IPSL-CM6	GRISLI	IPSL/FR
MIROC-ESM	IcIES	AORI-UT-JAMSTEC-NIES/JP
MPI-ESM	PISM	MPI/DE
UKESM	BISICLES	MetOffice/UK


ISMIP6 Climate Modeling Centers
ISMIP6
Ice Sheet Model Intercomparison Project for CMIP6
National Institute for Environmental Studies
CCCma Canadian Centre for Climate Modelling and Analysis
CCmaC Centre canadien de la modélisation et de l'analyse climatique
NASA
AORI
Atmosphere and Ocean Research Institute
The University of Tokyo
Met Office
Sciences de l'environnement
Institut Pierre Simon Laplace
NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH
METEO FRANCE
JAMSTEC
国立研究開発法人 海洋研究開発機構
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY
Max-Planck-Institut für Meteorologie
DMI
Vejr, klima og hav