

## **Melting Ice – Global Consequences Report**

### **1. Highlights for JSC**

- Several new activities were launched under this Grand Challenge (as laid out in the implementation plan). These are all focused on mobilizing the cryosphere research community's engagement in **CMIP6**. This focus provides for a very visible return on investment (given limited resources available), and reinforces the important role of WCRP activities in providing the underpinning model projections and observationally-based evaluation relied upon by the IPCC Assessment process.
- Specific activities are:
  - **ISMIP6** – ice-sheet model intercomparison which, for the first time, engages the ice sheet modelling community directly in CMIP via diagnostic analysis, coordinated off-line ice sheet model simulations, and where available, fully coupled ice sheet – climate models. This will contribute directly to improved quantification of ice sheet contributions to sea-level rise.
  - **SIMIP** – a diagnostic MIP in which the sea-ice observational and modelling communities are coordinating effort to carefully evaluate the Arctic and Antarctic sea-ice simulations in the CMIP6 multi-model ensemble
  - **ESMSnowMIP** – a component of a broader land-surface model intercomparison effort, this exercise will focus on evaluating snow-climate feedbacks and the various processes involved. As for SIMIP, this brings together the observational, process, and modelling communities to assess coupled model performance via analysis of targeted feedback experiments.
  - **glacierMIP** – though not formally a part of CMIP6, this intercomparison of global glacier mass balance models is the first of its kind, and will make use of CMIP6 model output to drive available glacier mass balance models to provide consistent projections of glacier melt that inform water availability and sea-level rise assessments.
  - **MISOMIP** – a joint effort with the sea-level grand challenge is focused on intercomparison of coupled marine ice sheet and ocean models and will improve understanding of important processes controlling ice sheet discharge and hence sea-level rise.
- The grand challenge also consolidates CliC's co-sponsorship of the **Permafrost Carbon Network (PCN)**, providing a more international focus and maintaining a vital link between the cryosphere and the global carbon cycle.

### **2. Early success and/or planned activities in 2017/2018**

- All of the cryosphere MIP activities have developed comprehensive data requests as part of the CMIP6 process and published papers in the CMIP6 collection of papers in Geosci. Model Dev. (see list at end of report).
- As CMIP6 model results become available in the coming year, analysis will begin in earnest.

### 3. Partners for GC implementation (within and outside WCRP community)

- The Permafrost Carbon Network is co-sponsored by the International Permafrost Association (IPA), the International Arctic Science Committee (IASC), and several US funding agencies through SEARCH.

### 4. Overall GC timeline (include any milestones)

- Most of the initiatives listed above are closely integrated with CMIP6, and aimed at producing published results that will feed into the IPCC 6<sup>th</sup> Assessment Report (papers would have to be published by summer, 2019).

### 5. Issues and challenges, for example:

- These activities are being organized and led by a motivated and efficient group of international scientists who are devoting considerable time and effort. The actual work is self-funded (through resources available to the individual teams from their institutes or from funded proposals).
- WCRP resources have been effectively used to hold meetings to plan and initiate these activities (bringing together the teams), and to maintain momentum and international coordination. **This is the essential role of WCRP**, and without it there is a risk that projects will falter or devolve into sub-critical, non-integrated individual efforts.

### Some key papers over the past year:

#### *SIMIP*

Notz, D., et al.: The CMIP6 Sea-Ice Model Intercomparison Project (SIMIP): understanding sea ice through climate-model simulations, *Geosci. Model Dev.*, 9, 3427-3446, doi:10.5194/gmd-9-3427-2016, 2016.

#### *ISMIP6*

Nowicki, S. M. J., et al.: Ice Sheet Model Intercomparison Project (ISMIP6) contribution to CMIP6, *Geosci. Model Dev.*, 9, 4521–4545, 2016 doi:10.5194/gmd-9-4521-2016.

#### *ESMSnowMIP*

van den Hurk, B., et al.: LS3MIP (v1.0) contribution to CMIP6: the Land Surface, Snow and Soil moisture Model Intercomparison Project – aims, setup and expected outcome, *Geosci. Model Dev.*, 9, 2809-2832, doi:10.5194/gmd-9-2809-2016, 2016.

#### *GlacierMIP*

Slangen, A.B.A., et al.: A Review of Recent Updates of Sea-Level Projections at Global and Regional Scales. *Surv. Geophys.*, 38: 385. doi:10.1007/s10712-016-9374-2, 2017.

#### *MISOMIP*

Asay - Davis, X. S., et al.: Experimental design for three interrelated marine ice sheet and ocean model intercomparison projects. *Geosci. Model Dev.*, 9, 247 - 2497, 2016.

#### *PCN*

Olefeldt D, et al.: Circumpolar distribution and carbon storage of thermokarst landscapes. *Nature Communications*, 7, 13043. doi:10.1038/ncomms13043, 2016.

Schädel C, et al.: Potential carbon emissions dominated by carbon dioxide from thawed permafrost soils. *Nature Clim. Change*, 6, 950-953. doi:10.1038/nclimate3054, 2016.