Linear Antarctic Response to basal melting – Model Intercomparison Project

In order to compute the linear response of Antarctic ice sheet models to basal ice-shelf melting we would like to redo the analysis from 2014 (see ref. below) with the newest line of models. We hope that this page contains all the information that you need. We would be very happy if you would join. Find all necessary material at **www.pik-potsdam.de/larmip** . The simulations are very short and very simple:

The 5 core simulations:

- Start from a spin-up run that you deem appropriate for the year 2000. Feel free to use a "pre-industrial equilibrium" if you have it or your initMIP spin-up.
- Do 5 simulations with an additional spatially uniform 2 m/a of basal melt underneath each of the ice shelves of the 5 sub-regions of Antarctica (see file LARMIP_regions.nc). The additional basal melt should be switched on instantaneous and kept constant in time and uniform in space for 200 years. Each sub-region should be done separately if possible.
- The regions are defined in the file LARMIP_regions.nc with the following variables:
    - longitude
    - latitude
    - mask (ocean = 0; grounded = 1; floating = 2)
    - regions (EAIS = 1; Ross = 2; Amundsen = 3; Weddell = 4; Peninsula = 5)

Desirable additional simulations if possible (the list is ranked according to importance):

ADD1. Add 5 additional simulations with 1 m/a basal melt rate.
ADD2. Add 5 additional simulations with 4 m/a basal melt rate.
ADD3. Add a simulation with all regions forced together.
ADD4. Add 5 additional simulations with 8 m/a basal melt rate.
ADD5. Add 5 additional simulations with 32 m/a basal melt rate.
ADD6. Add 5 additional simulations with 16 m/a basal melt rate.

Output until 28th February 2018:

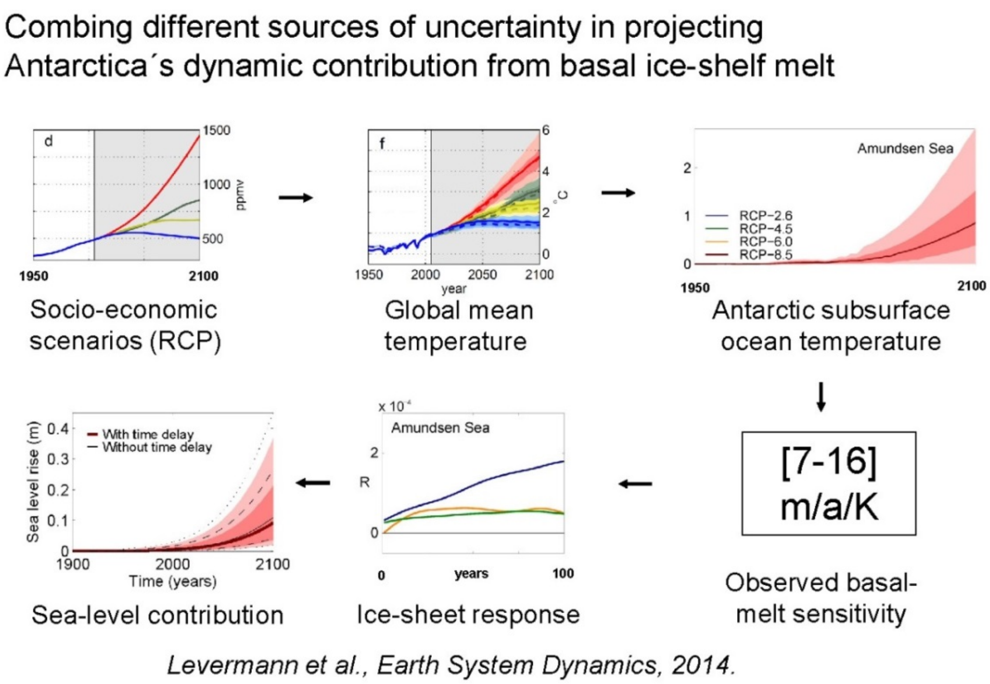
- The only output that each modeling group is required to submit is five time series of 200 years. These time series should contain the sea-level contribution of Antarctic for the five forcing experiments.
  (Please do NOT send fields! Just send time series in plain text or netcdf !)
- Additionally the same kind of sea-level times series for ADD1, ADD2 and ADD3 can be provided.

Important note: It is important to us to note that we do not claim that this is the best way to do projections of Antarctica's contribution to future sea level. We would like to put these computations out for comparison with the previous study to inform the IPCC-AR6 with some continuity and in order to be able to compare the linear response to the "proper projections".

Best wishes, Anders & Ricarda

Reference paper: A. Levermann, R. Winkelmann, S. Nowicki, J. Fastook, K. Frieler, R. Greve, H.H. Hellmer, M.A. Martin, M. Meinshausen, M. Mengel, A.J. Payne, D. Pollard, T. Sato, R. Timmermann, W.L. Wang, R.A. Bindschadler: *Projecting Antarctic ice discharge using response functions from SeaRISE ice-sheet models*; Earth System Dynamics, 5 (2014), 271-293, DOI:10.5194/esd-5-271-2014. Link to paper: https://www.earth-syst-dynam.net/5/271/2014/

Schematic summary of the procedure:



Another schematic summary of the procedure (as of fig. 1 in the paper):

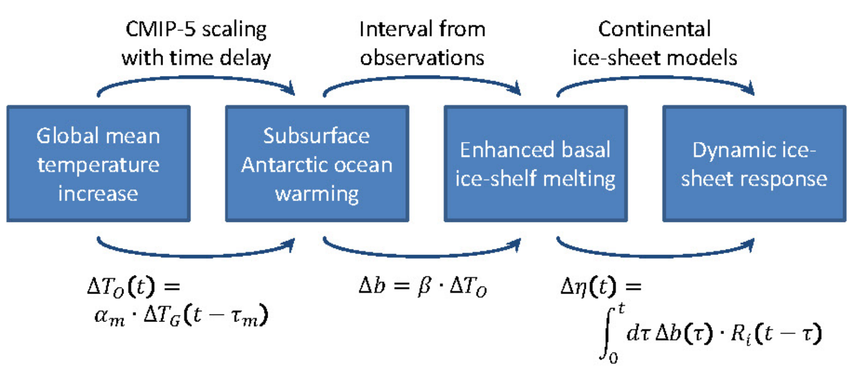


Figure 1. Schematic of procedure for the estimate of the uncertainty of the Antarctic dynamic contribution to future sea-level change. At each stage of the procedure, represented by the four boxes, a random selection is performed from a uniform distribution as indicated in the following. This procedure was carried out 50 000 times for each RCP scenario to obtain the uncertainty ranges described throughout the study. First, one time evolution of the global mean temperature, Δ_{T_G}, was selected randomly out of an ensemble of 600 MAGICC-6.0 simulations. Second, 1 of 19 CMIP-5 climate models was selected randomly to obtain the scaling coefficient and time delay between the global mean temperature surface warming, Δ_{T_G}, and the subsurface oceanic warming, Δ_{T_O}. Third, a basal melt sensitivity, β, was selected randomly from the observed interval to translate the oceanic warming into additional basal ice-shelf melting. Finally, one of the ice-sheet models is selected randomly to use the corresponding response function, R_i, to obtain an ice discharge signal which is given in sea-level equivalent. The formulas describe the corresponding signal transformation at each step.