

Committing to the cause

Including thinning rates in Antarctic Ice Sheet simulations using CISM

Tim van den Akker¹

W.H. Lipscomb²

G.R. Leguy²

W.J. van de Berg¹

R.S.W van de Wal^{1,3}

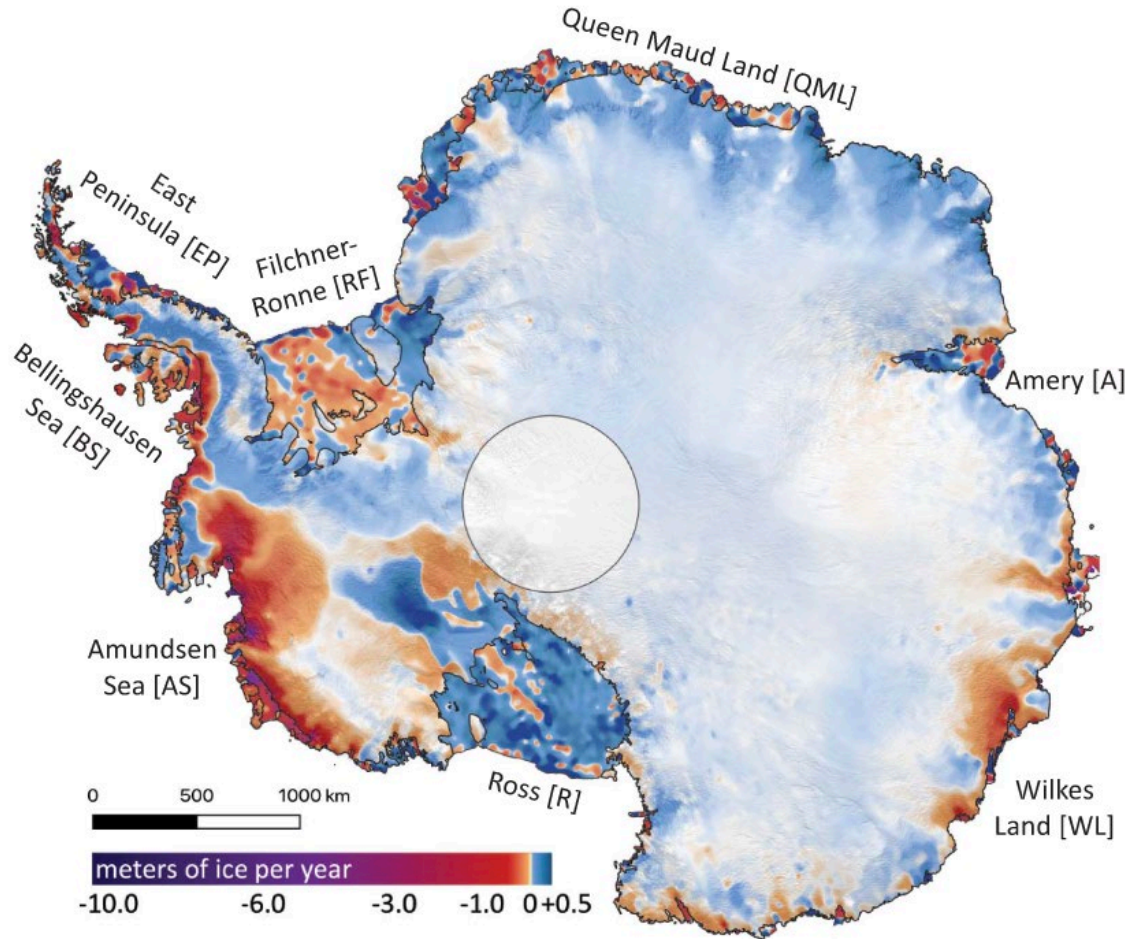
¹Institute for Marine and Atmospheric Research Utrecht, Utrecht University, Netherlands

²Climate and Global Dynamics Laboratory, National Center for Atmospheric Research, Boulder, CO, United States

³Department of Physical Geography, Utrecht University, Netherlands



Observed mass change Antarctica



Spinup

We tune for:

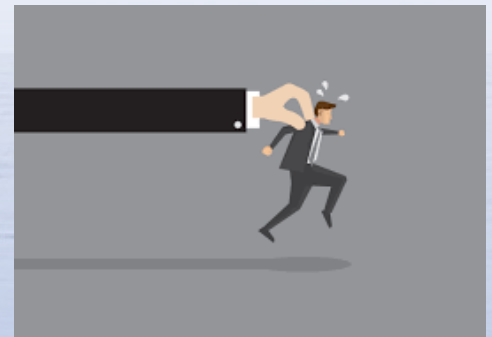
- Grounded ice thickness using the basal sliding law
- Floating ice using the ocean temperatures

We include:

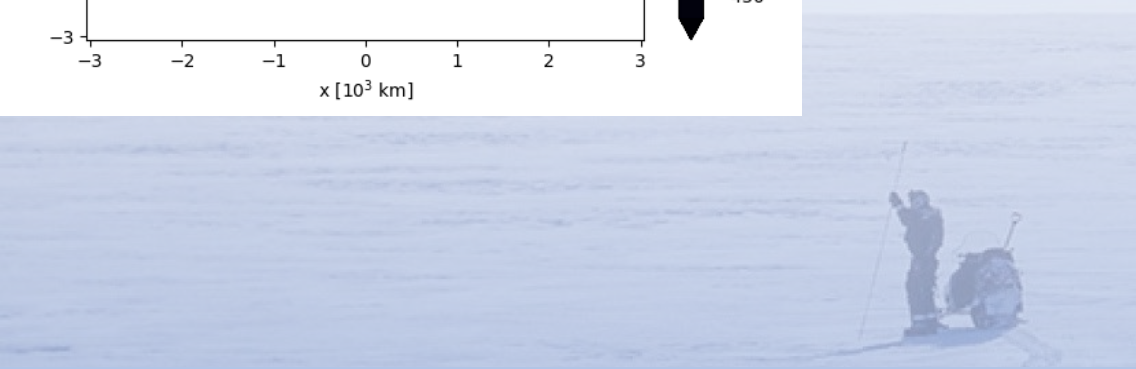
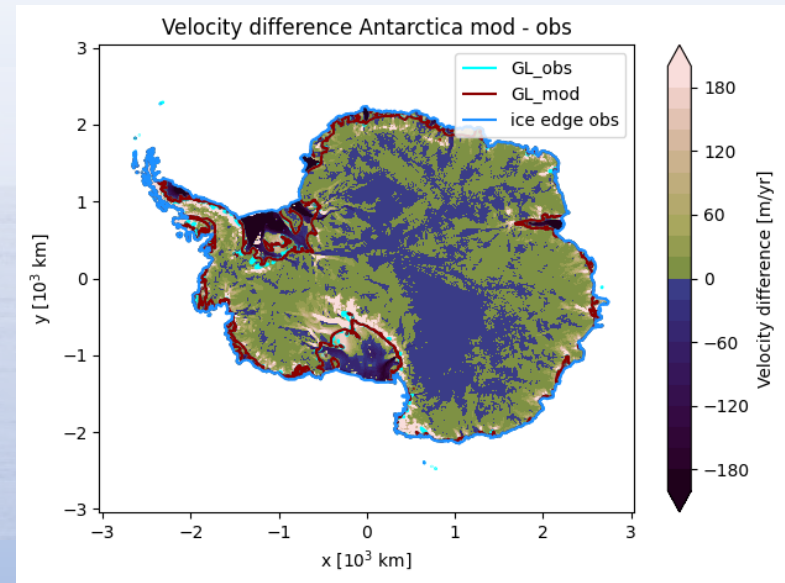
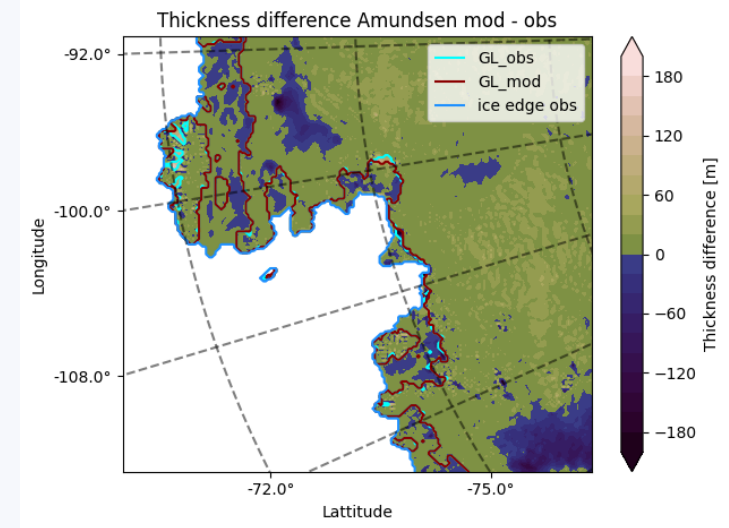
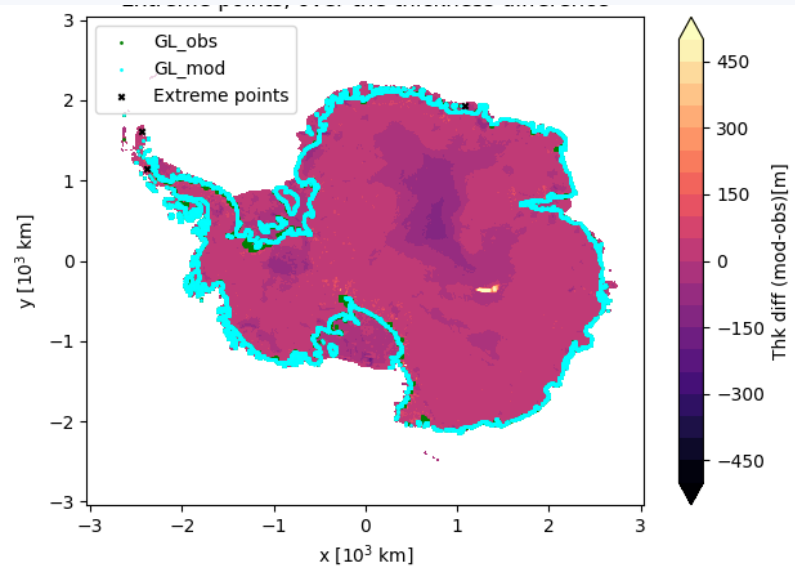
- Observed dh/dt from Smith et al (2020) into our SMB

We get:

- Well matching thickness
- As a 'bonus': well matching surface velocities!
- The exact observed dh/dt at $t=0$



Spinup



Spinup

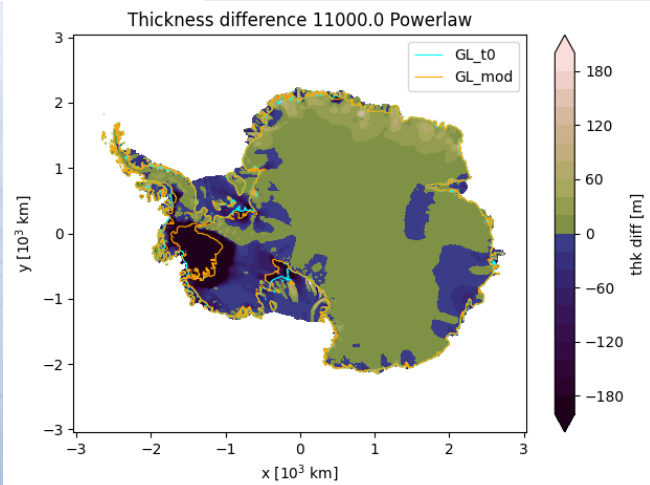
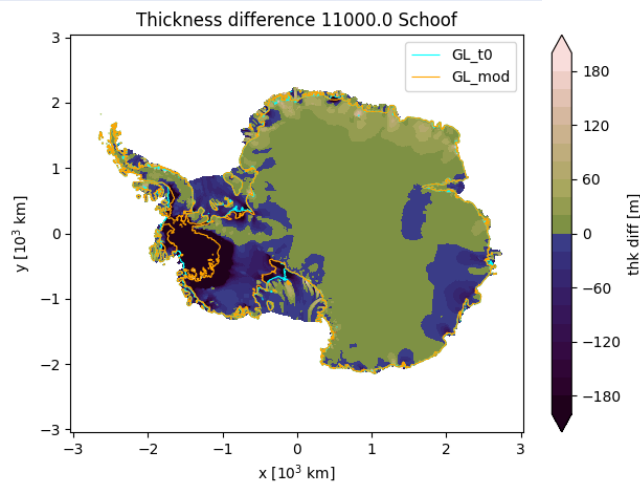
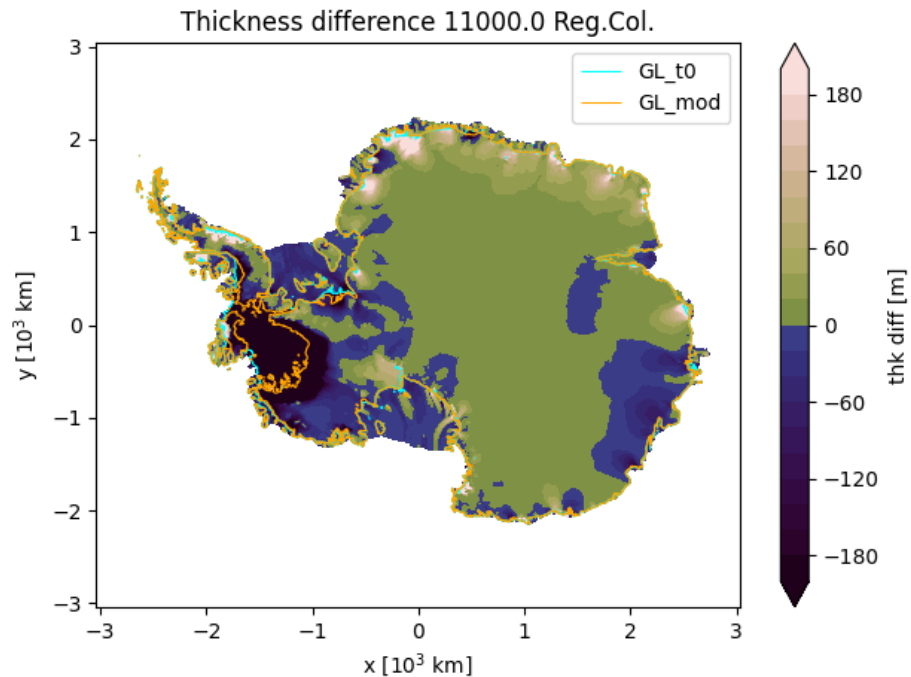
Velocity Bias/RMSE: 7.24 / 157.6 m/yr

Thickness Bias/RMSE: -3.3 / 34.7 m

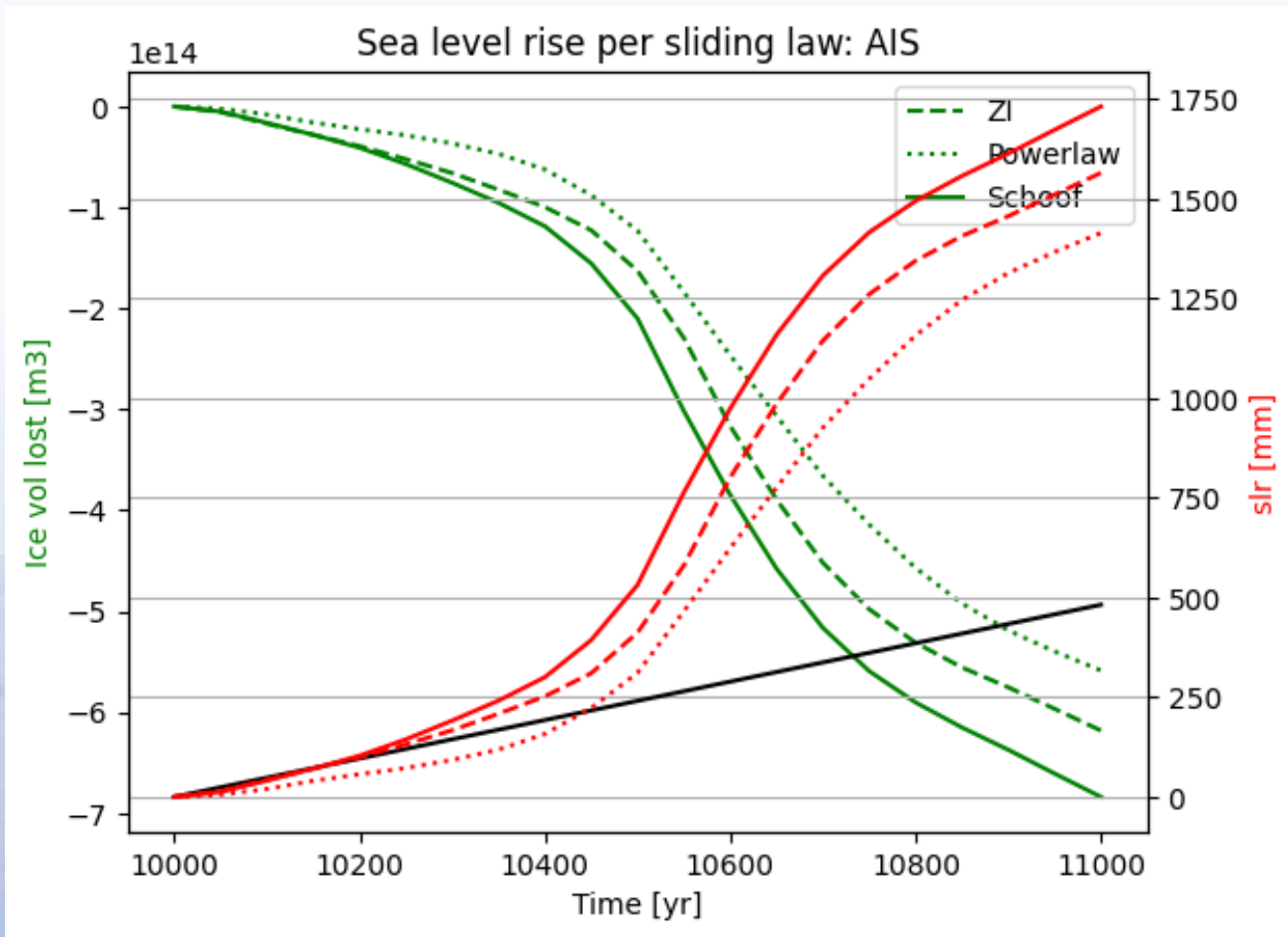
Average GL position difference wrt observations: 1.5 km (on 4km grids!)



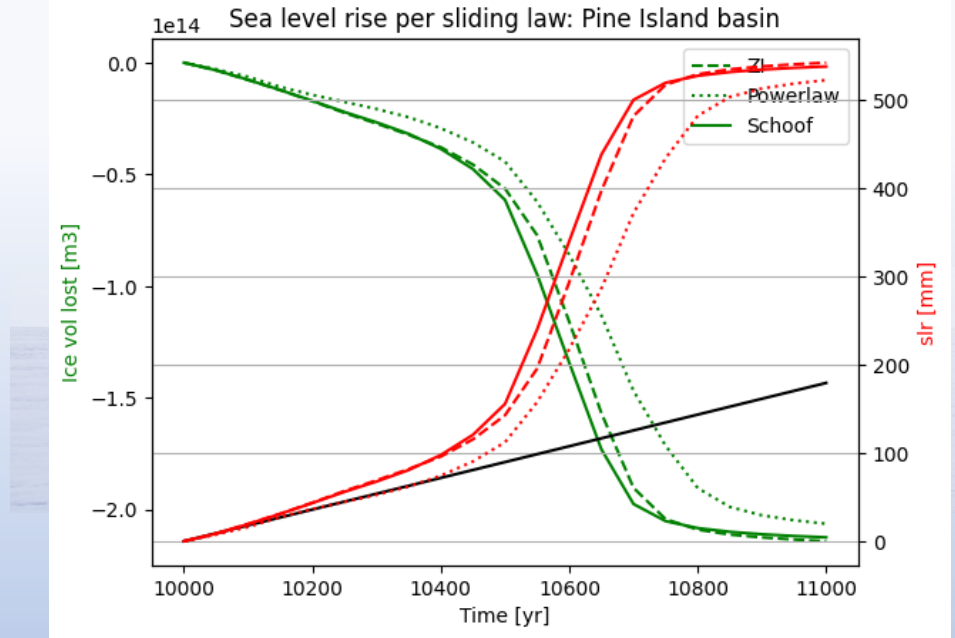
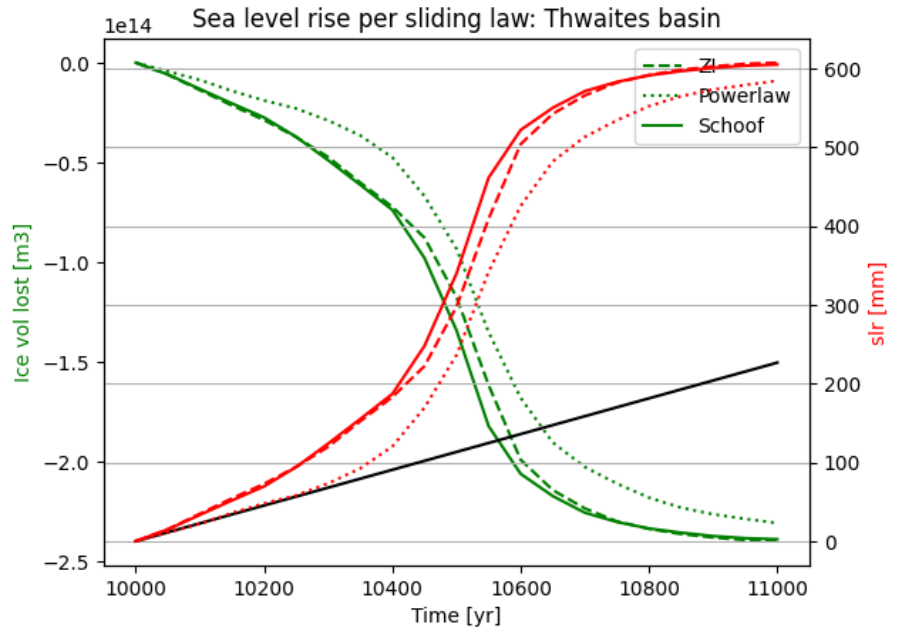
Some results



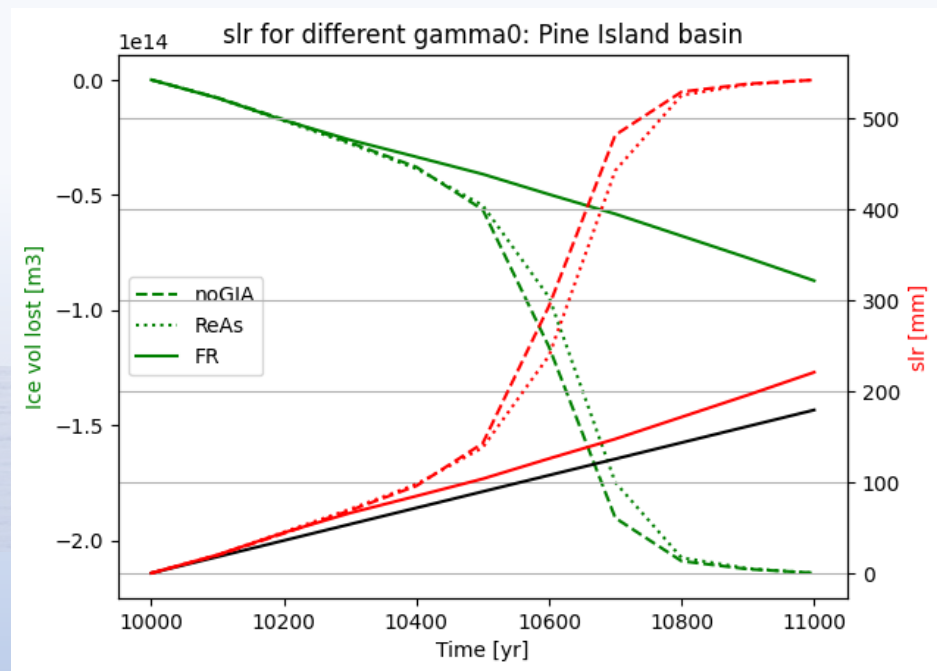
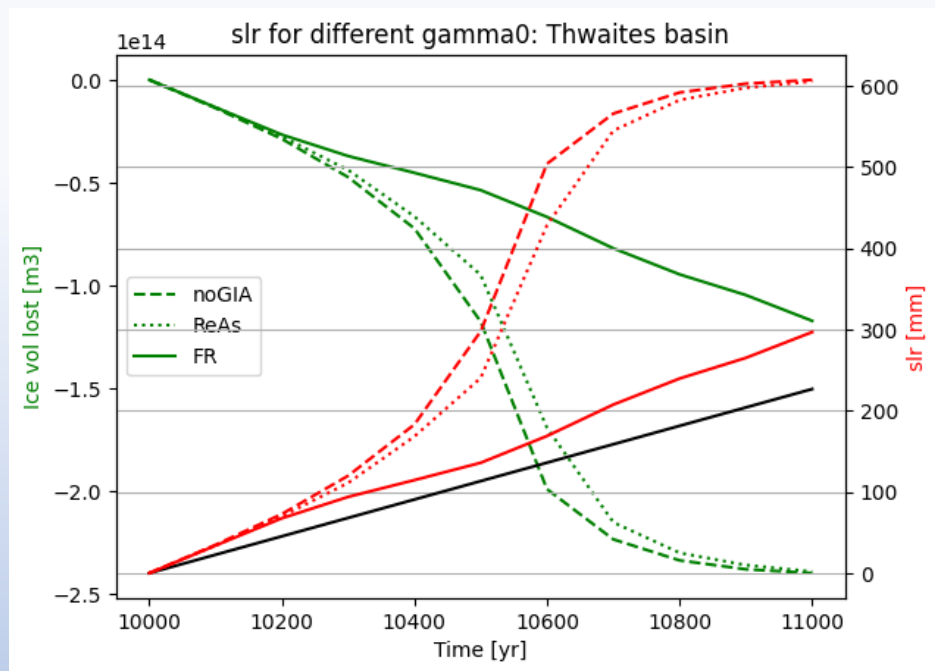
Initial experiment



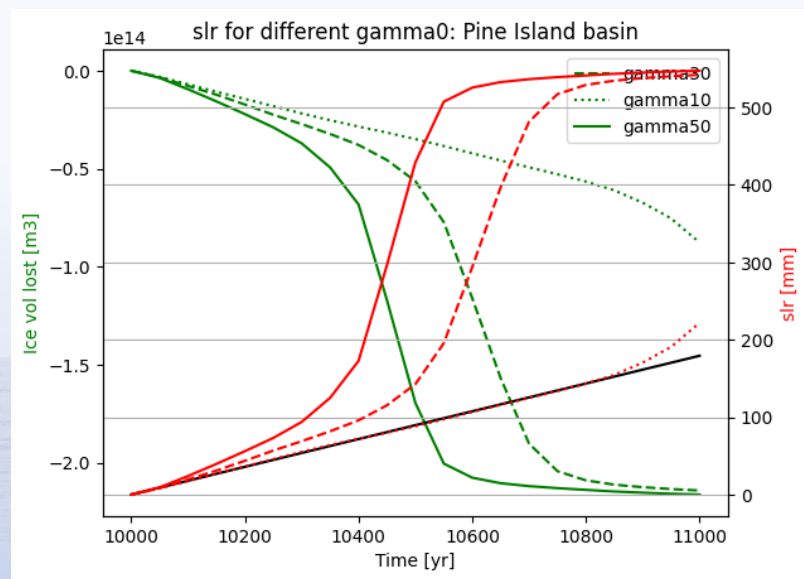
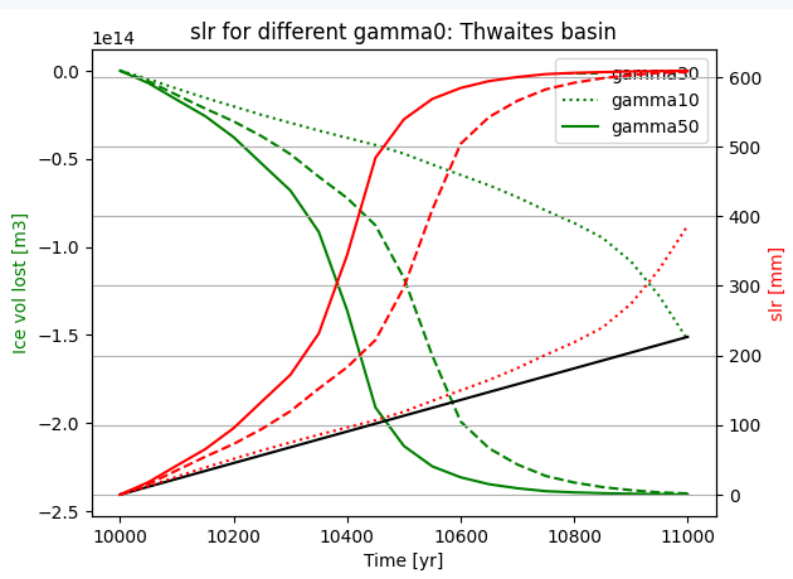
Initial experiment - Amundsen



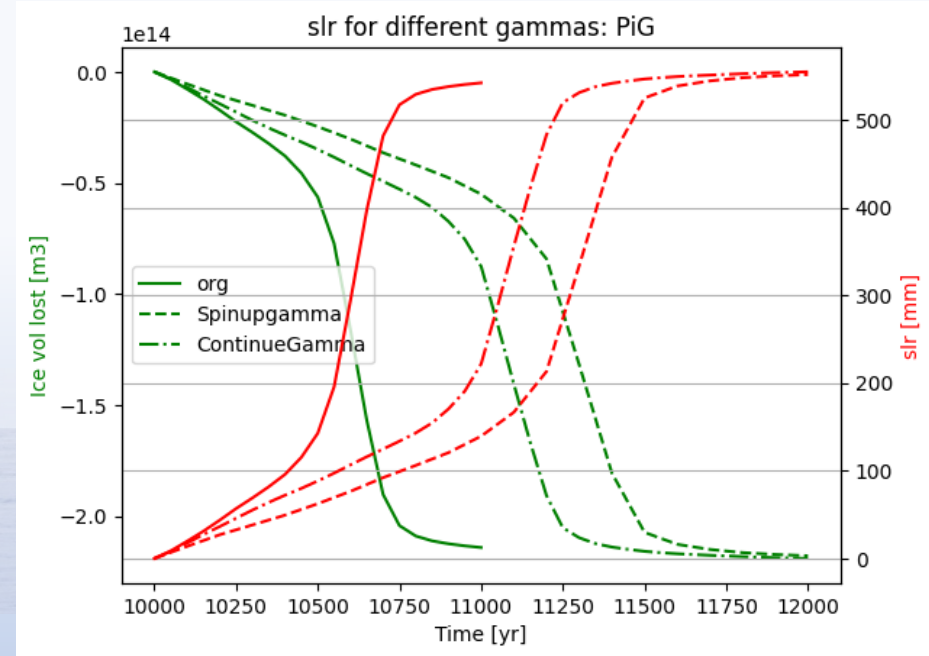
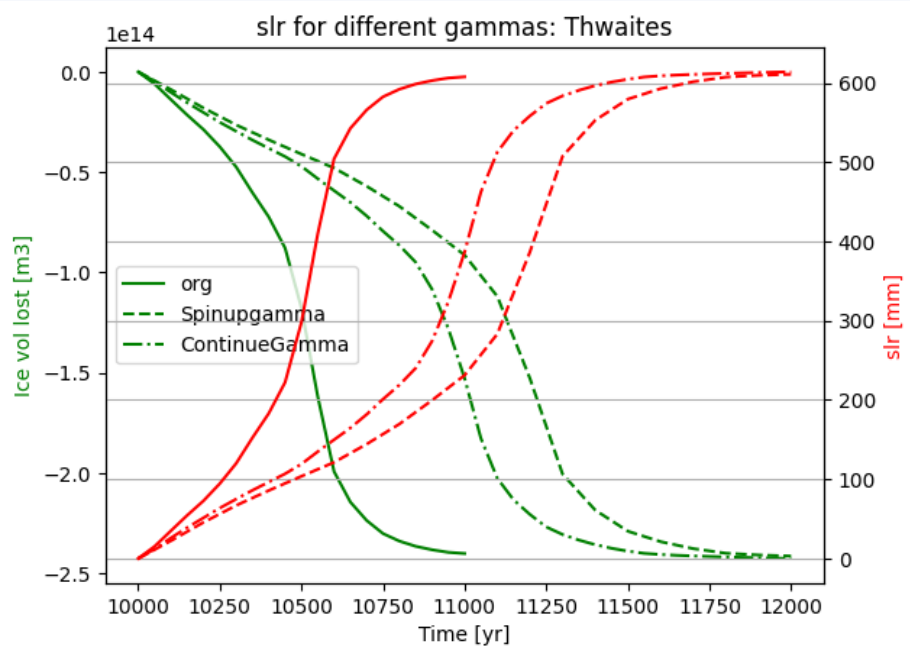
What about the GIA?



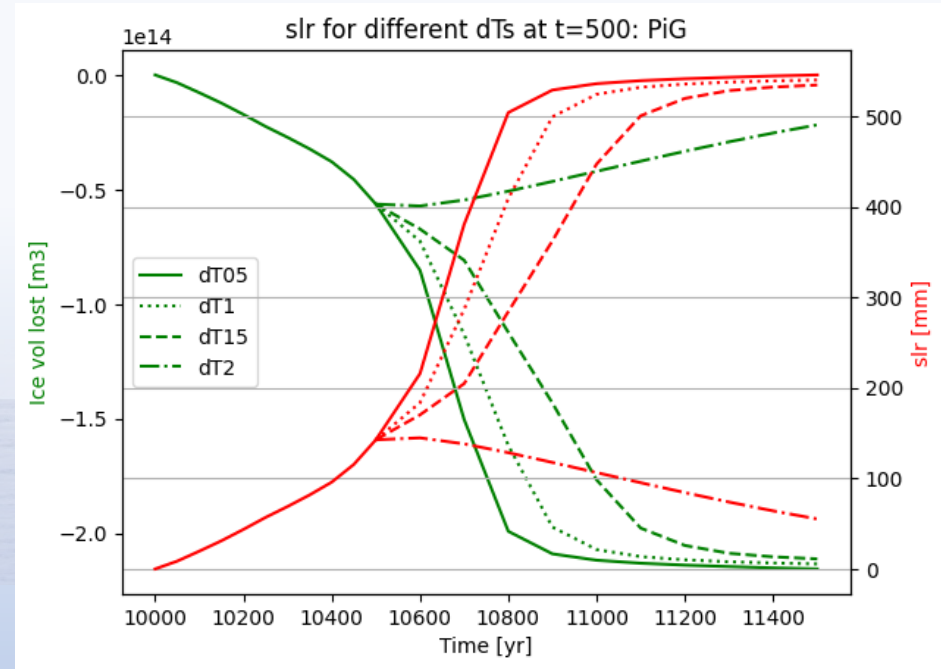
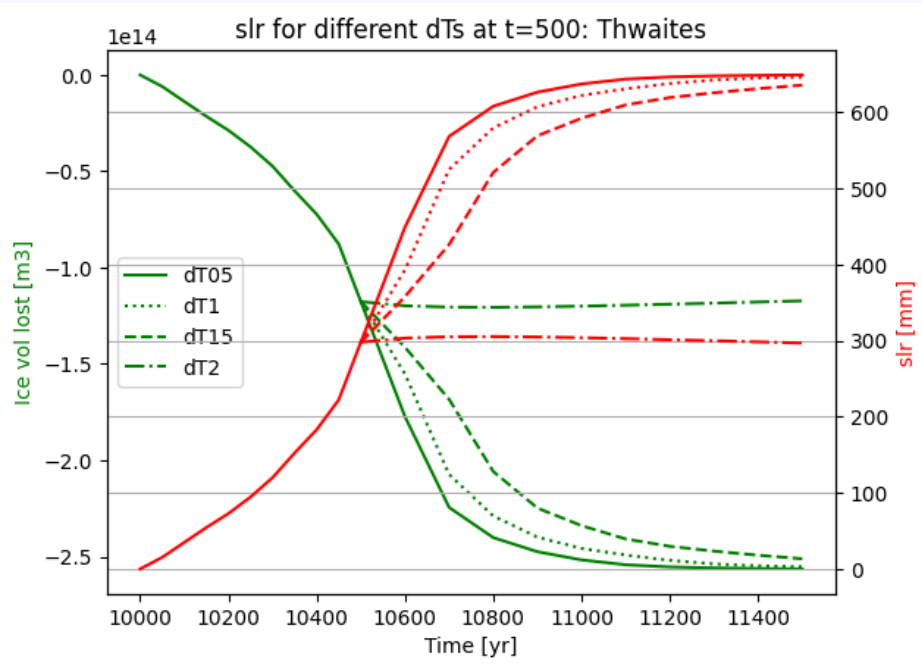
What about gamma0?



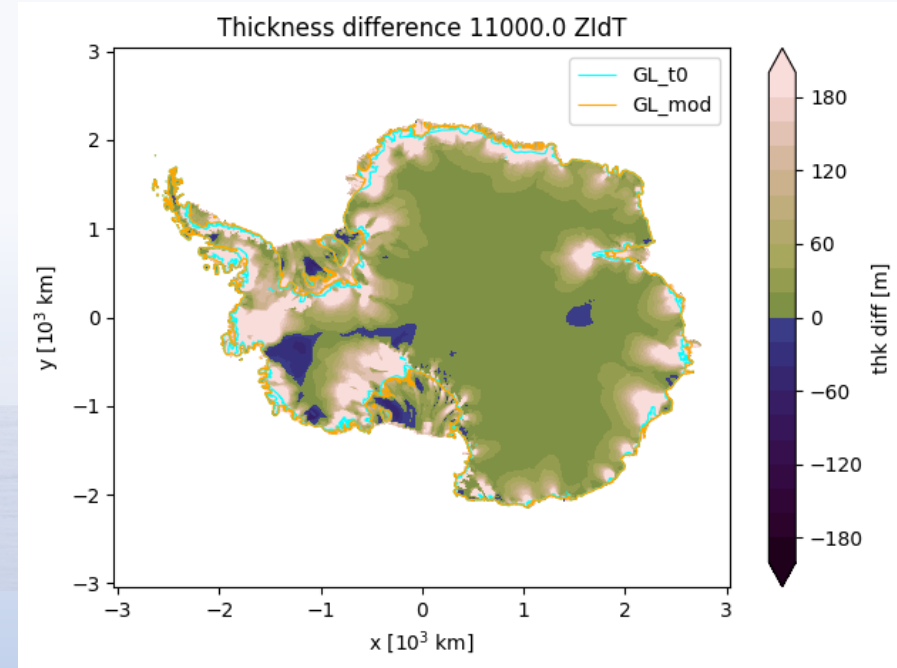
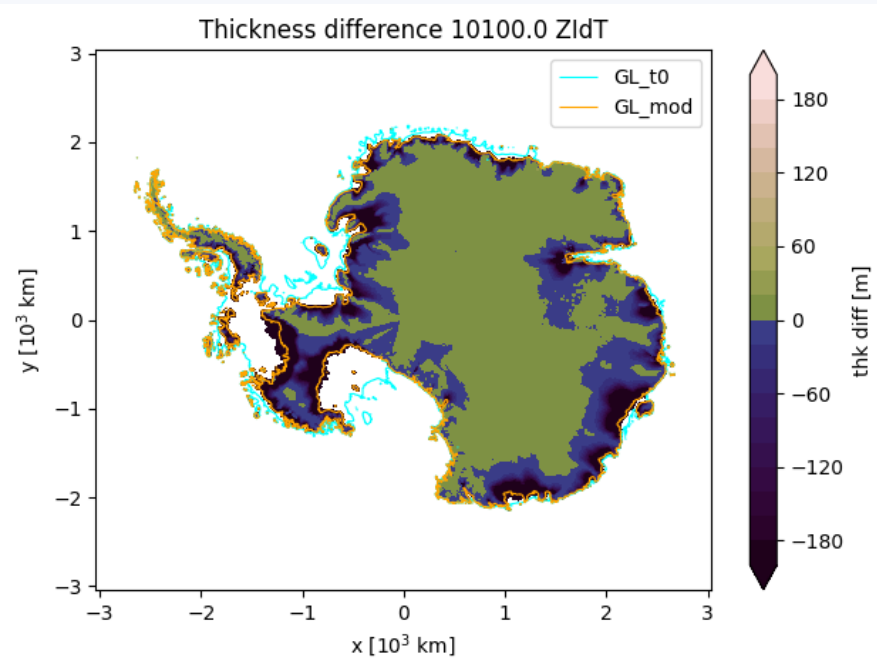
Wait! Is retreat not happening...?



Can it be stopped?



What about forcing?



Conclusions so far

- Given current dh/dt rates:
Thwaites and Pine Island Glacier will collapse according to CISM, using many different parameterizations
- (almost) not sensitive to:
Basal friction, GIA, increased γ_0 , ocean condition interpolation, spinup
- Sensitive to:
Low γ_0 values: slows down (but not stops!) collapse
Unrealistic direct upliftng: needs rebound rates of 0.1+ metres/year
- Once initiated:
An ocean temperature decrease of 2K can stabilize, but not regrow, WAIS

Thank you for your attention!

Want to talk? t.vandenakker@uu.nl

