Reply to second round of reviews for 'The stability of present-day Antarctic grounding lines — Part B.'

Reese, R., Garbe, J., Hill, E. A., Urruty, B., Naughten, K., Gagliardini, O., Durand, G., Gillet-Chaulet, F., Gudmundsson, G.H., Chandler, D., Langebroek, P. M., Winkelmann, R.

March 10, 2023

Reply to editorial comment by Florence Colleoni

Dear authors,

many thanks for submitting your revised manuscript. As you saw, both reviewers are happy with your revision. Though, reviewer 2 mentioned the importance of inserting a coupkled of sentences about the freshwater feedback in the discussion. I agree with him that mentioning it is worthwhile. I would therefore ask you to do this last modification before publication.

Best,
Florence

Dear Florence,
Many thanks for handling the review process of our manuscript! We added this point to the discussion as detailed below. Please find a a track-changes manuscript attached in which we highlight these changes and some minor edits we made for consistency with Part A.
Best,
Ronja et al.

Reply to Anonymous Referee 2

I would like to give a small remark about the omission of feedbacks in the discussion of the manuscript. The authors note the negative feedbacks arising from gravity changes and glacial isostatic adjustment, but nothing is mentioned about the potentially important feedback arising from meltwater fluxes. It is thought that subglacial meltwater could (locally) strongly enhance ice shelf melting close to the grounding line (Wei et al., 2020; Nakayama et al., 2021) and on the long-term, freshwater fluxes could alter Antarctic bottom water formation and hence ocean temperatures (Swingedouw et al., 2008; Van Breedam et al., 2020), being respectively positive or negative feedbacks. I believe the influence of freshwater as a feedback is worth a note, aside from the other negative feedbacks discussed.

First of all, many thanks for taking the time and effort to review our manuscript!

We have added a discussion related to meltwater processes as requested. Wei et al. (2020) and Nakayama et al. (2021) both show that subglacial discharge increases melt rates - a process that is not included in our melt parameterisation PICO. We added a discussion on this in lines 416. Furthermore, we mention the studies that show that enhanced meltwater from the ice sheet may cause cooling in the Southern hemisphere as requested. Interestingly, recent work has also shown that at the same time this causes additional heat to be trapped at depth around the Antarctic continent, leading to a positive feedback on ice sheet mass loss (Bronselaer et al., 2018; Golledge et al., 2019). We added this, see lines 417 and following of the latest version of the manuscript.

References

Bronselaer, B., Winton, M., Griffies, S. M., Hurlin, W. J., Rodgers, K. B., Sergienko, O. V., Stouffer, R. J., and Russell, J. L.: Change in future climate due to Antarctic meltwater, Nature, 564, 53–58, 2018.

Golledge, N. R., Keller, E. D., Gomez, N., Naughten, K. A., Bernales, J., Trusel, L. D., and Edwards, T. L.: Global environmental consequences of twenty-first-century ice-sheet melt, Nature, 566, 65–72, 2019.

Nakayama, Y., Cai, C., and Seroussi, H.: Impact of subglacial freshwater discharge on Pine Island Ice Shelf, Geophysical research letters, 48, e2021GL093 923, 2021.

Wei, W., Blankenship, D. D., Greenbaum, J. S., Gourmelen, N., Dow, C. F., Richter, T. G., Greene, C. A., Young, D. A., Lee, S., Kim, T.-W., et al.: Getz Ice Shelf melt enhanced by freshwater discharge from beneath the West Antarctic Ice Sheet, The Cryosphere, 14, 1399–1408, 2020.