

# Review of Holmes et al. ‘Sea-level rise contribution from Ryder Glacier in Northern Greenland varies by an order of magnitude by 2300 depending on future emissions’

## General comments

This is my second review of the manuscript by Holmes et al. which presents numerical modelling simulations of Ryder Glacier to project sea level rise contribution by the year 2300. The manuscript is substantially improved over the previous version and I greatly appreciate the authors efforts to address my comments, in particular improving the abstract, introduction, and including a more thorough presentation of the model relaxation and control simulations. On a second read through I have a few remaining line comments prior to publication that are detailed below.

## Specific comments

**Line 6:** change “to Ryder Glacier” to “of Ryder Glacier”

**Line 8:** “degree” would be better with a temperature, suggest changing to “amount of ocean warming”

**Line 17:** Suggest removing second instance of “current” in this sentence

**Line 25:** This sentence would be more concise as “...uncertainties on the future behaviour of this region are considered larger than other sectors of the ice sheet”

**Line 40:** It’s slightly confusing to the reader that you say “reasonably stable” here and then in a couple of lines say it has “periods of both advance and retreat”. Suggest rephrasing here, to make it clear there has been little net retreat over the past 15 years.

**Line 52:** I think “knock-on impacts” could be clearer, or just removed to be “and the potential impact on sea level rise projections”

**Line 57:** Consider adding a reference to Rückamp et al. 2019: *Calving Induced Speedup of Petermann Glacier*

**Line 67:** Suggest removing “rather puzzling”, it is a bit of a vague statement

**Line 76:** I suggest labelling Sherard Osborn fjord on Figure 1 so the reader knows where it is.

**Line 130:** You state “CESM2” and “RACMO” datasets, but do not mention these again when you introduce the specific datasets. In the rest of the methods make it clear where you use SMB from RACMO and CESM2 (e.g. line 139). I also think this sentence would be better at the start of this paragraph, when you first introduce SMB forcing in the model. Then go onto detailing the SMB-elevation feedback.

**Line 243:** Heading might be better as “Terminus” retreat.

**Line 246:** Change “spin-up” to “relaxation”, spin-up hasn’t been used anywhere in the text before.

**Figure 7:** This figure is much improved and easier to interpret. I suggest making the circles a bit bigger and making the text (especially the SMB Gt/yr) less cramped to improve readability. The legend font could be smaller.

**Line 324:** The statement here “Ryder Glacier is not expected to follow the same trajectory as the

Greenland ice sheet as a whole” makes me wonder why you have compared the exact values for your simulations to those of previous Greenland wide studies in the earlier part of this paragraph. It is of course interesting to compare the impact of atmospheric versus oceanic forcing and SMB versus discharge between your study and Greenland wide ones, e.g. ISMIP6, but direct comparison of mm SLE might be less useful.

**Line 359:** Be careful here, marine-ice sheet instability is not just acceleration and thinning over a retrograde slope, but rather than this ice loss is irreversible. I would rephrase to something along the signs of “may be an indication of marine ice sheet instability”

**Line 378:** “This trend of an acceleration” reads a bit awkwardly, suggest rephrasing.

**Lines 447-455:** I was also expecting a statement in this paragraph about how the bathymetric sill in Ryder fjord prevents warm water intrusion, perhaps you could include this and add something about how you think this may play a role in future projections. - update - I see this statement about the sill appears further down in the model limitations section, but I’m not sure it is a model limitation really, just a potential control on melt rates. I would suggest moving into Section 4.3 (here).