REVIEW#1

This is the author's reply to RC1. We kept the general comments from the referee in original and added answers for each aspect directly below in blue.
The detailed comments will be addressed when preparing the revised manuscript.

General Comments:
The authors present an extended high-emission scenario run with the coupled climate – ice sheet model NorESM2-CISM2.1. The study is the first to use NorESM with an interactive ice sheet model and adds nicely to other coupled climate – ice sheet and extended future warming scenario studies. Uncertainties in future projections of the Greenland ice sheet and its effects on the climate system are large. Therefore, it is desirable that more Earth system models include interactive ice sheet components. Multi-centennial simulations are necessary to account for the long time-scale processes in the land ice system.
The text is well-written and clearly structured.
The figures are good.
Thank you for this summary and feedback!
We see the manuscript improving by including and addressing your comments.

However, the text sometimes refers to fields (e.g. barotropic stream function or precipitation) for which no figures are included.
It would be helpful to include such figures, maybe in the appendix.
L230-232: You may consider including a figure for salinity at depth.
L257: It would be helpful to include figures for ice velocity.
The barotropic stream function is shown in Figure 1h as a minimum of an area. We will include a reference to the subplot in the text and try to make it more clear that the first part of the results is explaining evolution of globally averaged values, and not about local, spatial distributed changes.
We are considering if additional figures for spatial precipitation patterns, salinity at depth and ice velocity add to the story and comprehension. We might add more figures.

The text becomes a bit repetitive sometimes, especially in the discussion. The low climate sensitivity of the model and the corresponding small amount of land ice melting are pointed out too often. I think it is sufficient to do this in the introduction and then in the discussion again when necessary.
We fully agree. We will go through the document and combine the mentions of low climate sensitivity where it is important and remove the other appearances.

With respect to the low melt rates, it may be useful to add some words about the relative cooling around Greenland compared to the uncoupled simulation (Fig2) and the potential implications of this relative cooling for the ice sheet melting in the discussion.
This is a very valid point. We will include some words about this in the manuscript.
The difference in surface air temperature stems here from the additional freshwater influx around the coast of Greenland. This increases ocean stratification and reduces vertical heat exchange leading to surface cooling.
This does not explain the initial lack of melting (which is due to the cold initial bias (discussed in Goelzer et al., (Disc.)).

This study provides results with a newly coupled climate – ice sheet model. Substantial conclusions are made. The methods are clearly outlined and the results are sufficient to support the conclusions. Focusing on climate – ice sheet interactions, the manuscript should be suitable for publication in ESD, with minor revisions to be made.
Thank you for this summary. We hope we can address your comments appropriately.

Detailed Comments:
We will include all minor comments and only address more detailed comments in the reply here.

L94f: Why is the orography updated every 5 years but surface types are updated annually? I understand that this publication focuses on the model results and that a detailed model description is done separately. However, I find it difficult to understand the workflow of the coupling procedure.
These are two separate processes in the model. The update of surface types happens in the land model CLM (at runtime) as soon as an update is available from the ice sheet model (yearly). Update of the surface topography and surface roughness for the atmosphere model CAM is an asynchronous process by modifying the restart files.
We will add a sentence here to make this point more clear.

L104f: How is the horizontal and vertical spreading of freshwater done? Could you elaborate more on this or provide a reference? A second question: is there a heat flux associated with the solid and liquid runoff?
Yes, the energy needed to melt ice is taken from the ocean heat reservoir.
We will describe the treatment of freshwater fluxes in more detail in the revised version, including the spreading function, conversion to salt fluxes and energy conservation.

L159: How is ice discharge treated differently in NorESM2fixed compared to the control simulation? I understand the different treatment between NorESM2 and NorESM2fixed but thought that the treatment in NorESM2 is the same as in the control simulation. Please clarify.
Exactly. NorESM2 and control have the same discharge treatment due to the additional ice sheet model coupling. NorESM2fixed is different. We will rephrase the sentence to avoid confusion.

L182-184: Where does the cooling around Greenland come from?
We addressed this in a reply to one of the general comments - see further up.

L310: “lack of calving” – Do you mean an actual calving scheme with an iceberg model? In the method section you mention a calving parametrization for the ice sheet model.
Yes, we mean a more physical or complex calving scheme that would e.g. respond to ocean warming, increased runoff or ice thinning. There is only a simple scheme applied to keep the ice margins within present day ice boundaries and to remove all floating ice.
We will revise this statement accordingly.

L353: For comparison it would be helpful to add the SAT increase in NorESM2 between 2015 and 2100.
True. We will add this value for NorESM2

Goelzer, H., Langebroek, P. M., Born, A., Hofer, S., Haubner, K., Petrini, M., Leguy, G., Lipscomb, W. H., and Thayer-Calder, K.: Interactive coupling of a Greenland ice sheet model in NorESM2, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-3045, 2025.