We would like first to thank the Reviewer #1 for his/her constructive and positive review which will help to improve our manuscript.

This study estimates and discusses how the Greenland ice sheet (GrIS) surface mass balance (SMB) will be able to change under the future warmer climate if people in the world attempt to slow down the on-going global warming by employing the so-called geoengineering methods. The data and study methods employed are reliable. At present, there are two types of geoengineering methods (see below). In this study, the authors consider the solar radiation management technique that attempts to control mainly the instantaneous downward shortwave radiation and the outgoing longwave radiation, where the stratospheric aerosol geoengineering technique is recognized as C1 the most feasible approach to achieve the purpose. In the CMIP6 climate simulations, some global climate models (GCM) provide future climate simulation results considering the effects of the solar radiation management. The authors utilize such a GCM simulation result and force the polar regional climate model (RCM) MAR. Although some GCMs can simulate the GrIS SMB, the accuracy is still not so high compared to physically based polar RCMs. These imply that readers can know reliable quantitative information about the effects of the solar radiation management on the future GrIS SMB for the first time. In addition, the authors conduct some numerical sensitivity simulations where snowfall is artificially increased: this process, which can artificially increase the surface albedo of the GrIS, can also be considered as another solar radiation management technique although this is not so feasible as the stratospheric aerosol geoengineering technique. Overall, this study is an interesting new challenge, so that this reviewer would like to recommend its publication in the journal The Cryosphere as a brief communication.

Thanks!

In the following part, I list only a few minor issues. I hope the authors consider these points and update the manuscript. Specific comments:

L. 38 ~ 39: Before introducing solar geoengineering, I think it is better to introduce there are two types of geoengineering methods: 1) Carbon dioxide removal techniques which remove CO2 from the atmosphere; and 2) Solar radiation management techniques that reflect a small percentage of the sun's light and heat back into space (Shepherd et al., 2009; already cited in this paper).

Excellent suggestion. We will add this one in our introduction.

L. 72: What do the authors mean by "biases" here? "Biases" of a model are often indicated with respect to in-situ measurements. In this case comparing two model simulation results, I think it is better to use the word "anomalies" or "differences".

Indeed, the word "anomaly" is better here as we compare a model to a model. We will correct this and we will extent the comparison between MAR forced by ERA5 vs MAR forced by CNRM-ESM2 as requested by both reviewers.

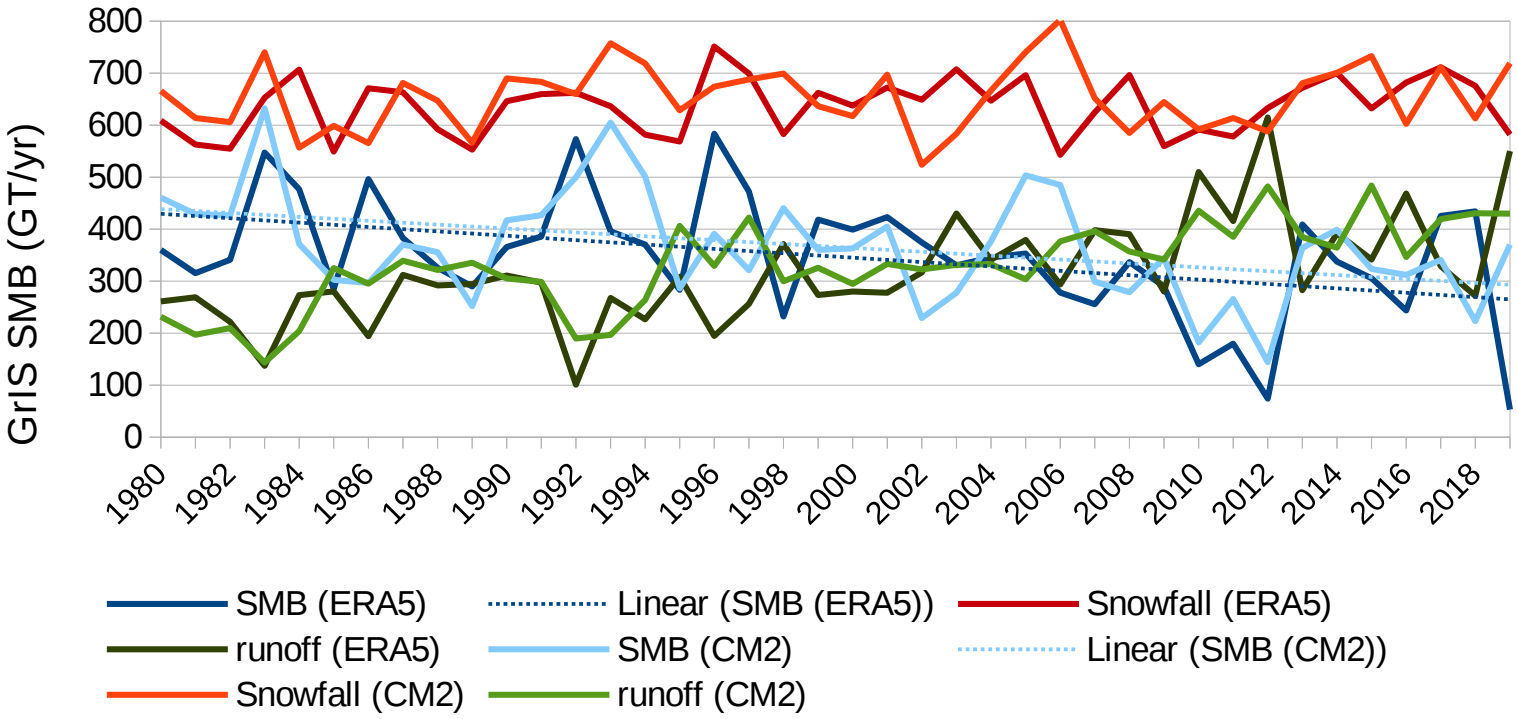
L. 72 ~ 73: "MAR forced by CNRM-ESM2-1 using the historical simulation" I would like to see temporal evolution of simulated GrIS-integrated SMB together with that from MAR forced by ERA5 and/or ERA-Interim like the Figure 6 by Fettweis et al. (2020; C2 cited in this paper). I believe this information can assure reliability of the model simulation results presented/discussed in this study.

We suggest to add this table in the supplementary material:

	SMB (GT/yr)	Snowfall	Runoff	Meltwater	JJA T2m (°C)	JJA SWD (W/m^2)
MAR_ERA5	369±101	633±57	293±83	464±106	-7.8±0.9	282±6
MAR_CNRM-ESM2	381±104	650±66	308±72	452±95	-8.3±0.8	282±6

listing integrated values and standard deviation (i.e. the interannual variability) around this mean of SMB, snowfall, runoff, meltwater (in GT/yr) as well as mean summer temperature (in °C) and solar radiation (in W/m²) as simulated by MAR forced by ERA5 and CNRM-ESM2 over 1981-2010.

Showing the time series is less relevant as the climate variability is different between ERA5 and CNRM-ESM2 and only mean climates simulated by ESMs over 30 years can be compared with reanalysis. Nevertheless, we have plotted below the time series showing the good agreement between the different curves in average over the 4 last decades.



L. 74 ~ 75: "~ are not impacted by significant biases over the current climate": This part is too technical to understand the intention precisely. Please detail more about meanings of the description.

We will give more details about this sentence in the revised version. This sentence refers to Fettweis et al. (2020) who concluded that: "*meltwater runoff biases that operate under current climate could strongly impact the models' ability to simulate future melt acceleration as the present-day runoff bias should increase in absolute value in the same proportion as runoff under warmer climates, independently of the physics used in the models*".

L. 98: "the melt-albedo positive feedback": In Fig. 1a, discrepancies between the temperature anomaly from ssp585 and that from G6solar (and ssp245) becomes large after 2030 ~ 2040. However, the runoff difference becomes large after 2050 and the SWA (absorbed shortwave radiation at the surface) difference becomes large after 2050 ~ 2060. I think the differences in these timings are related to the melt-albedo feedback and should be discussed more in detail.

There is indeed a delay of ~ 10yrs between the temperature forcing and changes in runoff. This delay is linked to the melt-albedo feedback but also in large part to the meltwater capacity retention of the ice sheet which is able to retain at the beginning the excess of meltwater as highlighted in van Angelen et al. (2013). The explanation of this delay as well as this reference will be added in the revised version of our manuscript.

Reference: *van Angelen, J. H., Lenaerts, J. T. M., van den Broeke, M. R., Fettweis, X., and van Meijgaard, E. (2013), Rapid loss of firn pore space accelerates 21st century Greenland mass loss, Geophys. Res. Lett., 40, 2109– 2113, doi:10.1002/grl.50490.*

L. 130∼132: “As proposed by Feldmann et al. (2019), another solution to mitigate the ice sheet melt could be to artificially increase snowfall, bringing additional solid mass over the ice sheet in winter and reducing the surface melt in summer by increasing albedo.”: Suggest to add a sentence something like “This solution can also be recognized as another geoengineering technique that controls solar radiation.” By the sentence, readers can fully understand why the authors conducted such a numerical sensitivity simulation.

Excellent suggestion. We will add it.

Technical corrections:
L. 20: The definition of “ssp” should be indicated, because this technical abbreviation is new for the community.

OK

L. 24, L. 31. L. 126: “Global Warming” -> “global warming”

OK

L. 56 ∼ 57: “despite ssp585 GHG emissions (∼8.5 Wm-2 in 2100, O’Neill et al.; 2016).” -> “despite ssp585 GHG emissions (∼8.5 Wm-2 in 2100, O’Neill et al.; 2016) are assumed.”?

OK