Reply to RC1

We thank the anonymous referee for taking the time to review our manuscript and for her/his comments. In the text below, we respond point by point to the comments and provide the proposed changes to the manuscript. The referee comments are written in black, our response is written in blue, and the proposed changes to the original manuscript are highlighted in red.

General comments:

This is a well-written manuscript on a topic that is important for Arctic climates. I only have a few minor comments that should be addressed:

Minor comments:

Line 54 and the Figure 1 caption: You should mention that the K in “K-transect” is for “Kangerlussuaq”

Thank you for your addition. We will mention this both in line 54 and in the caption of Figure 1:

Line 54:

(…) Kangerlussuaq (K) transect (inset of Fig. 1; Lenaerts et al., 2014), well-suited for (…)

Caption Figure 1:

(…) and an inset of the Kangerlussuaq (K) transect including the location of S10 and KAN_U (…)

Line 227-228: Coddington et al. (2016; doi:/10.1175/BAMS-D-14-00265.1) updates the solar constant to be approx. 1361 W/m^2 - rather than 1366 W/m^2.

Thank you for pointing this out. The solar irradiance has indeed been updated in RACMO2.4p1 from 1366 W m^{-2} to a variable value of around 1361 W m$^{-2,}$ depending on the distance between the Sun and Earth and on an approximate solar cycle. However, the reference run on the Greenland domain by Van Dalum et al. (2024; https://doi.org/10.5194/tc-18-4065-2024), which we use to force the offline PIEKTUK-D and ecRad-1.4.1 models, still used a constant solar irradiance of 1366 W m^{-2}. To enable direct comparison between the radiative fluxes of this reference run and our offline ecRad-1.4.1 simulations, we use the same solar irradiance. We propose to add the following sentence to clarify this:

Line 227:

While the solar irradiance has been updated to a variable number around 1361 W m^{-2} in R24, it has been set to 1366 W m^{-2} for the R24 Greenland run, which is used throughout this study (Van Dalum et al., 2024). Therefore, we keep the downwelling solar radiation at the top of the atmosphere constant at 1366 W m^{-2}, use the broadband albedo of R24 instead of the spectral albedo, and set the surface emissivity to 0.98, the value used in R24 over ice sheets.

Lines 360-366. It is a good first approximation to use cloud ice optics. To improve on this, the modelled optical diameter of snow (e.g. Decharme et al. 2026; doi:10.5194/tc-10-853-2016) could be used. This will typically be higher that cloud ice particles since snow particles -

particularly in Arctic climate - has longer lifetimes during which they can break off smaller crystals, and melt and refreeze.

Thank you for your comment. In this work, we propose a formulation to calculate the effective radius of blowing snow particles (see Eq. 9) from the output of the blowing snow model PIEKTUK-D. However, this effective radius only depends on the modelled size distribution of blowing snow particles at a certain height, and not on the properties of the snow particles, such as snow age. Moreover, it must be noted that the current ice optics model of R24 (Baran et al., 2016; https://doi.org/10.1175/jcli-d-15-0821.1) does not use effective radius as an input. We agree that it would be interesting to investigate the influence of different approaches in modelling the effective radius of blowing snow using a different ice optics model in a future study. Therefore, we propose to add the following sentence:

Line 366:

(...) blowing snow layer (Vignon et al., 2026) and investigate more sophisticated formulations of the effective radius of the blowing snow particles, for example, depending on snow properties such as snow age.