Author response to referee comments on "Feedbacks and timescales in the modelled transient response of debris-covered glaciers" (egusphere-2025-5997)

We thank the referee for the short constructive comments that we address here.

In the following, referee comments are in black, responses red, and revisions blue.

Direct line mentions in the revisions in reference to the revised manuscript are denoted as RML123, while line references to the initially submitted manuscript are denoted as L123.

L193: missing point

Done.

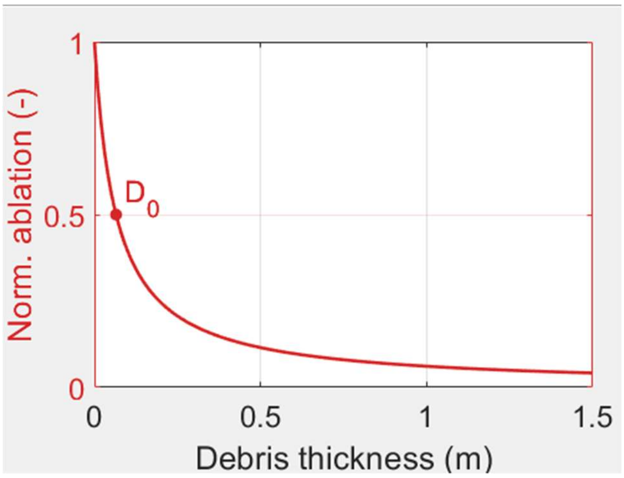
Table 1: how is this input flux d_in defined? Is it the total debris volume flux divided by the total depositional area on the glacier?

Yes, the debris input rate d_in is the total debris volume flux divided by the debris input area. Here, we decided to choose the local rate (rather than the total flux) as the forcing parameter.

We added a few words on RML156 to clarify that this is a locally applied rate.

Figure 2d: I'd like to see the y-axis extended to see for which debris thickness the melt modification asymptotes towards zero.

The subfigure is cut at h_D = 0.3 to match subfigure 2c. An extended plot is shown below. Melt does not approach zero very quickly in this inverse relationship (compared to, for example, an exponential).



We have extended the vertical axis from 0.3m to 0.5m and adjusted the vertical size of the subfigures 2c and 2d to ensure the relevant debris thickness patterns in Fig. 2c are still apparent.

L407: this behavior was also seen in the recently published study by Verhaegen & Huybrechts (2026).

Correct, Verhaegen & Huybrechts (2026), who published their recent study during the writing of this study, observe a very similar re-advance effect.

We changed the sentence to "…a behavior that has only recently been observed in a similar modelling approach (Verhaegen & Huybrechts, 2026)."

L626: space after point.

Done.

L761: Can you check the statement about the flow parameter and glacier length? I would expect that a glacier with softer ice spreads downstream more efficiently, indeed becoming thinner but also extending farther?

Intuitively, we would agree. After doing some reading on this, increased A does in fact lead to a thinner and shortened glacier state. To put it simply, the glacier does not turn over more mass in case of a high value of A but transports the same mass to the ablation area more efficiently, leading to a thinner and, ultimately, just slightly shorter glacier.

Our model output (see Figure below) confirms this for both debris-free and debris-covered glaciers, with the effect being slightly stronger for debris-covered glaciers, as debris is exported from the system more efficiently.