

1 We thank the reviewer for their considerate comments.

2 **Main comments:**

3 The comments of the reviewers have, on my view, mostly been addressed well. There are, however,
4 two related ways in which I think the paper still needs work. These relate somewhat to reviewer 1's
5 worries about the methodology of the paper. According to the paper's introduction, the paper aims
6 to "understand why decisions made by the snow modelling community over the past decades have
7 led to little or no progress in the representation of Arctic snowpack processes, i.e. in the part of the
8 planet that warms faster than anywhere else." No mention is made of further goals of the paper in
9 either the introduction or the methodology section. But section 4's aim is to draw conclusions from
10 the study about what snow modelling should continue to do and what it should start to do. While
11 the issue with the paper here is partly structural, in that the reader needs advance notice about
12 section 4, the issue is also methodological.

13 In order to avoid confusion, we have clarified that Section 4 is the discussion section and, as such,
14 renamed it "Discussion and moving forward". We also changed the introductory text to Section 4.
15 Some of the purposes that a discussion serves are to discuss and synthesize the findings, to situate
16 the findings within a broader research context and to recommend future research: this is exactly
17 what we did in Section 4 (also the answer below). As such, we do not agree that the issue is
18 methodological – on the contrary, we followed the well-established conventions of the structure of a
19 research paper.

20 As requested by the reviewer, we now mention in the Introduction that "*The underlying premise of*
21 *th[e] aim is rooted in the belief that comprehending the cause of a problem – if indeed the absence of*
22 *an Arctic snowpack is one – provides a foundation for addressing it and recommending ways to move*
23 *forward, which we will do in the Discussion section.*"

24 What exactly is the basis for the recommendations in section 4? How do the recommendations
25 relate to the material in earlier sections? What are the limitations of the recommendations?* What
26 is novel about the recommendations?* See below (*) for responses to these questions. These
27 questions are hard for the reader to answer, partly because of the absence of information in the
28 methodology section, partly because the arguments offered in section 4 are quick,

29 We hope that the changes mentioned above will have partly addressed these questions. All the
30 recommendations and "*arguments offered in section 4*" are, as they should in any discussion, drawn
31 from the findings. This is made clear throughout as every subsection in Section 4 clearly references
32 which findings they draw from and reflect on. Please see the full text, but a selection of quotes from
33 each subsection can be found below:

- 34 • Section 4.1: "*As mentioned in Section 3.2.3, values have contributed to deciding priorities...*";
35 "*As mentioned in Section **Error! Reference source not found.**, SMC, FS, and RSS were*
36 *interviewed to provide a broad picture of the range of Arctic snow applications...*"
- 37 • Section 4.2 "*The different opinions expressed throughout this paper suggest that the*
38 *participants support different strategies*"; "*As noted in Sections 3.2.2 and 4.1, collaborations*
39 *are drivers for model developments...*"
- 40 • Section 4.3: "*if a tundra SnowMIP is to advance snow modelling, the obstacles that limit the*
41 *implementation of Artic tundra snow processes (see subsections **Error! Reference source not***
42 ***found.***.x) should be directly addressed". MIPs and SnowMIP are also mentioned multiple
43 times during the manuscript.

44 • Section 4.4: *“Participants in this study have provided various reasons for not having*
45 *prioritised the development of an Arctic snowpack model”*; *“This was reflected in the*
46 *interviews during which more participants referred to Richard’s model, Glen’s model or*
47 *Marie’s model rather than to FSM, SnowModel and IVORI respectively”*. This section also
48 reflects on the methodology used and discussed in Section 2.

49

50 * What are the limitations of the recommendations? What is novel about the recommendations?

51 The entire Conclusion explicitly addresses these questions, but below is a summary: *“As per more*
52 *conventional review papers, the novelty in this paper is not in its content, but in the medium it*
53 *chooses to present that content.(...) In fact, the medium is not novel either. Science and technology*
54 *studies examine the context within which science is constructed and philosophers of science have*
55 *long debated the decision-making process of scientists. (...) Therefore, the novelty here is that it is an*
56 *insider’s job. It is a reflective exercise which, we hope, will be the start rather than the end point of*
57 *the conversation”*.

58 and partly because the authors suggest that they do not assume the correctness of the opinions of
59 those interviewed while some arguments seem to rest on these opinions (see the detailed
60 comments on lines 583-591, 609-610, and 613-622).

61 *What we wrote was “none of the quotes are endorsed by all authors and, by extension, it is expected*
62 *that readers will also inevitably disagree with some quotes”*. This remains true throughout the paper
63 and if *“none of the quotes are endorsed by all authors”*, inevitably some quotes will be endorsed by
64 some authors. Given the breadth of opinions provided by the participants, it is inevitable that *“some*
65 *arguments [do] rest on these opinions”*. By continuing to quote the participants in the Discussion
66 section, we aim to give credit to their contributions and to show how their perspectives have,
67 inevitably, informed this part of the manuscript.

68 The structural issue should, I propose, be addressed in the introduction. The methodological issue
69 should be addressed in the methodology section. The conclusions should also include some
70 clarification relating to the scope of the claims and their basis. I was particularly unclear about the
71 argument for a plurality of modelling approaches. *These points are individually addressed in other*
72 *parts of this response.*

73 **Detailed comments:**

74 Line 98: ‘i.e.’ seems inappropriate here. More importantly, the claim that perhaps no progress has
75 occurred in modelling snowpack seems too strong because the previous paragraph does describe
76 some progress and only states that there has been no progress in ESMs. Perhaps an additional
77 sentence is needed in the previous paragraph to make it more explicit that most models still
78 represent no snow processes (as recognised on the next page). This would help understand the
79 claim that perhaps no progress has been made.

80 *As suggested by the reviewer, we added text to an existing sentence, to make it more explicit that*
81 *most models still do not represent Arctic snowpack processes:*

82 *Original sentence: “No ESM, so far, does”.*

83 *New sentence: “However ,no ESM, i.e. none of the state of the art models that are used by*
84 *researchers and policymakers globally to understand the complex interactions in the Earth’s climate*
85 *system, so far, simulates Arctic-specific snowpack processes”.*

86 Line 154: Could you be more explicit about how the expertise of the extra four participants helped to
87 address the existence of overlap in expertise? [Done](#).

88 Lines 208 and 238: The references are not entered properly here.

89 Line 286: "Everything always start at..." Missing 's'. [Done](#)

90 Line 340: The reference is not entered properly here. [Thank you](#).

91 Line 440-441: it is stated that the paper argues that anchoring is an important reason for the
92 absence of Arctic snow processes in existing models. This seems out of place here, given that all you
93 are doing in this section is reporting on the interviews. I would suggest deleting this sentence. [We](#)
94 [removed the sentence and made the start of the section clearer](#).

95 Lines 467-469: this sentence is hard to parse. I suggest reformulating. [The sentence was](#)
96 [reformulated](#).

97 Line 569: the statement about being sick of certain modellers is mentioned for the second time. This
98 is a bit jarring because it is presented as if it is mentioned for the first time. [The version of the quote](#)
99 [in this section is longer than the version used earlier, which is why it was not referenced. We added](#)
100 ["as mentioned in Section 3"](#).

101 Line 583-591: the argument here for a plurality of modelling strategies was hard to follow and seems
102 too quick. Is the idea just that the system is complex so multiple perspectives are needed? I would
103 have expected more detail than this.
104 [There is more detail. L583-591 are the conclusion to the entire section, which explains the history to](#)
105 [the plurality of modelling strategies \(indeed, the "idea \[is\] that the system is complex so multiple](#)
106 [perspectives are needed"\), how epistemologists have related it to climate science and finally, how](#)
107 [the concept relates to our findings. We have rewritten this paragraph to make this clearer](#).

108

109 Lines 609-610: the paper here seems to be appealing to the opinions gathered in the interviews
110 (reported in section 4.1) to make proposals for future modelling. Is this correct? Why is this appeal
111 allowed here? My impression was that the paper was not supposed simply to endorse these. [Please](#)
112 [see L60-66 above](#).

113 Lines 613-622: the argument here about running future MIPs seems partly to appeal to the opinions
114 of those interviewed. Is this permitted here? [Please see L60-66 above](#).

115 Line 616: reference not entered properly here. [Thank you](#).

116 Line 676: "written it" should be "written". [Done](#)