

Dear Professor Michael Lehning,

Thank you once again for your thoughtful review and positive feedback on our manuscript. In this document, we have addressed your comments point by point. Your original comments are presented in blue italics, while our responses are in regular black text.

Minor comments:

Many thanks for the very careful and substantial reviews. I find review suggestions sufficiently addressed. The detailed discussion on the hydraulic jump setting in the review response is much appreciated as is the additional section on the influence of snow mass on katabatic forcing. I have only a few minor mostly technical points:

The rewritten introduction is very good. When you motivate the use of CRYOWRF, you can already then (line 111 approx.) also mention that first validation studies (Gerber) suggest underestimated model representation of blowing snow and its effects in simpler models.

Re: Thank you for pointing out the relevance of the recent validation study. We have revised the introduction to integrate the findings of Gerber et al. (2023). We now explicitly mention that the limitations of current regional climate models, specifically the lack of horizontal advection of blowing snow particles and the reliance on hydrostatic frameworks, result in a systematic underestimation of blowing snow mass fluxes. This addition provides a more robust scientific justification for choosing the CRYOWRF model for our high-resolution study in complex terrain. Relevant descriptions have been added as “Indeed, Gerber et al. (2023) demonstrated that these limitations, often coupled with simplified physical representations such as the omission of horizontal advection of blowing snow particles (e.g., in RACMO), lead to a systematic underestimation of blowing snow mass fluxes.” in lines 110-113 of the revised version.

l. 610: "Secondly, due to the long-term integration of the model, cumulative effects may occur as initial differences continue to amplify" is very generic and you could be more specific.

RE: We have revised this sentence to be more specific to the physical mechanisms of our experiment. The revised text clarifies that cumulative effects arise from initial perturbations in fluid density caused by blowing snow particles, which subsequently evolve and accumulate through the continuous feedback loop between the snow surface and the atmospheric boundary layer. We have revised this sentence to: “Secondly, due

to the long-term integration of the model, cumulative effects may occur because initial perturbations caused by the impact of blowing snow particles on fluid density evolve and accumulate through the continuous feedback loop between the snow surface and the atmospheric boundary layer” in lines 613-617 of the revised version.

l. 661: "which may lead to the overestimation of instrument observations" unclear; how can you overestimate observations?

Re: We apologize for the logical error in the original text. Our intended point was that the “total airborne snow” captured by instruments (e.g., FlowCapt) is a combined signal that includes contributions from local saltation, long-distance transport, and the preferential deposition of precipitation (Lehning et al., 2008). These sentences have been revised to “However, the results in this study suggest that the contributions from long-distance transport and preferential deposition of precipitation (Lehning et al., 2008) are also of non-negligible importance. Because instruments like FlowCapt actually measure the total airborne snow during high-wind events, misinterpreting these external contributions as part of the local saltation process may lead to biased parameterizations in blowing snow models; such phenomena deserve particular attention in the coastal margin regions of Antarctica” in lines 665-671 of the revised version.