Review of "Interaction of katabatic wind and local surface mass balance at Scharffenbergbotnen Blue Ice Area, Antarctica" by T. Zwinger et al.

This manuscript presents the application of a direct numerical simulation to a katabatic wind event around an East Antarctic blue ice area (BIA). The results show that wind speeds are highest on the BIA, underlining the importance of katabatic wind events in effectively removing snow from the BIA. The paper also shows that the marked present-day topography, with the BIA surrounded by nunataks, is a necessary condition for the high wind speeds on the BIA.

This is an original approach of a high-resolution numerical model, to explain the existence of a high-elevation BIA in Antarctica. The subject is well suited for publication in The Cryosphere, the methods appear well described (although I am not particularly experienced in DNS setups), and the manuscript is well written. However, my overall impression is that the authors could expand on the analysis of the results; the results section is rather short compared to the methods. The authors should analyse of the vertical wind profiles on/around the BIA, analysis of the wind direction, temporal variability etc. Furthermore, I have some general and some textual comments, which hopefully assist the authors in further strengthening the paper.

Title: the title does not at all cover the content of the paper, as it does not analyse the interaction between wind and SMB, rather just presents the simulation of a strong katabatic wind event.

Abstract:
L1: We model… I would start with a more general sentence: "We simulate the near-surface wind distribution during a katabatic wind event on a blue ice…"
L2: high-resolution (50-200 m)
L5: enhanced wind-impact = high wind speeds
L13: later than the = after the

Introduction:
L20: remove "on the Antarctic… clear of snow"
L23: are sufficiently high to
P2233, L1: occur, not even in summer,

Perhaps other examples of DNS solutions of katabatic winds should be added here, see e.g. Axelsen and Van Dop, 2009.

Section 2:
Does the model only resolve wind speed, or also other atmospheric variables? Give a broader introduction of the DNS methodology and its relevance for cryospheric research.

P2235, L3-5: mention units
P2236, Equation 3: the symbols are unclear, what do they represent? Since there is no further mentioning of these in the text, I suggest removing this equation.

P2237,L3: At each time step,
P2238, L8: Why is the wind introduced at the eastern boundary? Is there any observational evidence that the strongest katabatic winds are in in fact originating from the east? I miss an analysis and figures of the wind direction; along with wind speed gradients, wind direction determines the atmospheric flow divergence, ultimately controlling the drifting snow distribution.
L32: mention units. Is there any observational/theoretical evidence for the choice of these distributions?

Sections 4.2 and 4.3:
I suggest adding figures showing vertical profiles of wind speed for the different sensitivity runs. Perhaps it might be interesting to spatially average the wind speeds for the BIAs to see the overall effect of changing the topography. Moreover, the spatial figures and animated gifs are useful, but I would suggest enlarging the figures and marking the location of the BIA more clearly.

Section 5:
This is an interesting section, but it should be better linked to the other results; for instance, this section could be moved to the first part of the results, and be used as a motivation to study/simulate (in absence of observations) katabatic wind events.

References

Axelsen, S. L. and H. van Dop, 2009: Large-eddy simulation of katabatic winds. Part 1: Comparison with observations. Acta Geophysica, 57, 4, doi: 10.2478/s11600-009-0041-6