Review of Hofsteenge et al. (2022): The surface energy balance during foehn events at Joyce Glacier, McMurdo Dry Valleys, Antarctica

Overall

This study investigates the foehn and surface energy balance (SEB) over the Joyce Glacier, where receives less attention in the previous research. This paper use SEB model simulations that driven by the AWS observation and AMPS forecast outputs. Authors suggest that SWnet is the dominant driver during the daytime with a continuous contribution from sensible heat flux. Surface sublimation offsets the positive SEB, and reduced albedo further enhances the melting. This paper also highlights the important of solar radiation penetration for the accurate estimation of SEB. This paper includes several novel findings, and the scientific part is solid. A few results will be more convincing with more data or better explanations. The Discussion section might need some reorganizations. Thus, I would suggest a **minor revision** for this paper.

General

A. Structure:

The conclusion and discussion part includes lots of interesting and novel findings. I think the reader will appreciate that if it is better organized. Authors first talked about SEB, then back to foehn (which contributes to the increase SWD via foehn clearance, SH via turbulence/downslope wind on the leeside, etc). The comparison between Joyce Glacier and AP is great. However, the connection between each topic is kind of loose.

B. Data:

AMPS provides reliable forecast data for operational use. However, it has difficulties simulating the cloud conditions partially due to the microphysical scheme it is using (WSM5). This can lead to cold bias on the surface and compromise its ability to describe the SEB. Has author evaluated AMPS data with reanalysis data like ERA5 (31km) or ERA5 Land (9km)? It is not a serious problem, since this paper mainly analyzes SEB based on the SEB model. The surface variable (2mT, 10m Wind) needs a brief evaluation observation or reanalysis data. Also, can author explain why using a 12-h spin up instead of 24-h (more common)?

The cloud condition is important to back up some conclusions in this paper. I would suggest author include cloud observation from satellite or simulation from reanalysis data (e.g., MODIS, ERA5, CERES, etc.) to better explain the SEB conditions (e.g., Ln 366).

Minor:

1. Echoing another reviewer's suggestion. Need more labels for the local topographic features in Fig. 1. Plus, the current labels are also hard to see.
2. Terms like foehn warming, isentropic drawdown, internal melting might need some brief description.
3. I would suggestion authors use forecast output/forecast for AMPS, and simulation for SEB model outputs.
4. Are you able to differentiate the foehn wind with katabatic wind in your study?

Ln 300: Have authors checked the vertical wind profile or calculated the Fr number to confirm the low-level blocking? How strong the blocking is?

Ln 385: Some satellite or reanalysis data can be used here to provide some cloud information, such as cloud cover, phase, height, and thickness. Also, I am curious if there is any cloud formation, where is the moisture source?

Ln 425: Does the solar radiation penetration associated with the duration of the clear-sky conditions? Will the accurate description of the changing surface (wet snow, melting pond, refreeze) benefit the estimation of solar radiation penetration?

Ln 475: I think whether the downslope wind is able to reach the ice surface is highly associated with the mountain waves on the leeside, stationary orographic gravity, hydraulic jump, or breaking waves? This is not only associated with the magnitude of foehn, but also the detailed mechanism.

Fig. 5 the wind vector reference is hard to see. Which AMPS domain is used here (02?) at what resolution (15km)? what is the baseline for the anomaly? I would suggest including those info in the caption.

Fig 10&C1. Just a suggestion. Will that be better to use wind barbs to indicate the direction instead of different colors?