Reply to RC1

General comments

This paper presents a detailed observation of snow particle motion in order to understand the process of snow cornice formation. It also investigates the conditions under which snow particles adhere to snow cornices through particle-level force analysis. There are few cases where snow cornice formation has been observed, so even though this is a very small-scale experiment in a wind tunnel rather than a full-scale snow cornice, this study is very informative. In addition, it is expected that the detailed force analysis will lead to the construction of a model for the snow cornice formation process, making this work worthy of publication.

Reply: We appreciate the reviewer's recognition of our work, and we will delve into the impact of dendritic snowflakes on force analysis in the next version of the manuscript.

Specific comments

There is a big question about the force analysis, which is the main topic of this paper. The wind tunnel experiment in this paper uses dendritic snow particles. Although it is not clearly stated in the paper, my personal experimental experience and personal communications with researchers suggest that snow cornices can only form when dendritic snow particles are used, whereas they do not grow when spherical particles are used. The reason for this is not entirely clear, but it is thought that the large contact surface of dendritic particles makes it easier for snow particles to adhere to each other than for spherical particles. **However, this paper discusses the balance of forces assuming that the particles are spherical, so it is possible that the contribution of the contact area of dendritic snow particles is sought in other forces when considering adhesion.** To make this paper fruitful, I recommend that the author re-examine whether there are differences in **snow cornice formation** and **adhesion forces** between spherical and dendritic particles. Of course, it may not be easy to discuss adhesion forces between dendritic particles, but I expect that the contribution of dendritic shapes can be estimated from the parts that cannot be explained by considering spherical particles.
We are grateful for the valuable feedback provided by the reviewer. In the next iteration of the manuscript, we will explore the impact of dendritic snowflake structures on our force analysis in more detail.

Reply: Thank you for the valuable suggestions. We do have tested the fresh snow particles and aged snow particles (by keeping the fresh snow for a few days, the particle shape becomes near-spherical), and found that: 1) both of them can form a snow cornice; 2) fresh snow particles are much easier to form a snow cornice than the aged ones.

The adhesion forces subjected on spherical particles are greater than that on dendritic particles, i.e., F_c(dendritic) = F_c(spherical) $\times$ C, where the coefficient $C \approx 1.44$ is derived from the previous experiment results (Eidevåg et al., 2022). The ratio of cohesion force to gravity $\frac{F_C}{F_g}$ determines the value of α, which is related to the cornice angle. Dendritic particles therefore have greater values of α, indicating that they have a wider range of balanced positions at the edge, and therefore they are more prone to adhere to the edge.

Moreover, it can also be inferred that smaller-sized particles or particles with lower-impact velocity particles tend to have greater values of α. This is because smaller particles are subjected to lower gravity, while particles with lower impact velocity have greater cohesion force (Eidevåg et al., 2022). The higher $\frac{F_C}{F_g}$ ratios for both smaller-sized and lower impact velocity particles lead to greater values of α, making them more prone to adhesion. This explains the phenomenon observed in the experiment – that snow particles with smaller size and lower impact velocity are more prone to adhesion on the edge.

The above discussion will be added to the new version of the manuscript.

Technical corrections

Line 19: micr-mechanism -> micro-mechanism?

Reply: Thanks for pointing it out. We have revised it in the new version of the manuscript.

References:

Eidevåg, T., Thomson, E.S., Kallin, D., Casselgren, J., Rasmuson, A. Angle of repose of snow: An experimental study on cohesive properties. *Cold Reg. Sci. Technol*. 2022, 194, 103470. doi: 10.1016/j.coldregions.