Reply to CC2

General comments

The study effectively addresses a critical gap in understanding the micro-mechanics of snow cornice formation and its role in avalanche initiation. Due to the limited research on cornices, this work stands out as a highlight. Using wind tunnel experiments and high-speed photography, it achieves precise and reproducible observations. Systematic analysis supports its conclusions with robust statistical and theoretical methods.

Reply: We appreciate the reviewer's positive feedback on our work.

Specific suggestions

1) While the wind tunnel experiments provide controlled conditions, they do not fully replicate natural environments with variable wind speeds, temperatures, and snow particle compositions. Including a brief discussion on these limitations and how they affect the results would enhance the study.

Reply: Thanks for your suggestions. In the wind tunnel experiment, we have tested various environmental factors such as wind speeds, air temperature, and snow particle type effect on the growth process of snow cornices. We found that wind speed is the primary condition for cornice growth (Yu et al., 2023). Air temperature, snow particle type, and other factors such as topography are secondary conditions. Air temperature affects the cohesion rate of snow particles and the related work is still under analysis. In this work, we aim to investigate the micro-mechanism of snow cornice formation, therefore, we analyze the results in a constant and steady environment condition.

We 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. To distinguish the differences between spherical particles and dendritic particles, we change the cohesion force for dendritic particles in the mechanical model. Based on the previous experiment results (Eidevåg et al., 2022), we derived the magnitude of adhesion force for non-spherical particles is about 1.44 times that of spherical particles.

2) Discussing on how these findings could refine or enhance existing related or similar models would make the study more impactful.

Reply: Our experimental results analyzed the critical condition for particle stick on an edge or surface and concluded the distribution functions of impact velocity and impact angle. These results can be referred to splash functions of drifting snow dynamic models in the future, which could be helpful for researchers to simulate snow bed

features such as snow ripples, snow dunes, and snow cornices.

References:

Yu, H., Li, G., Walter, B., Lehning, M., Zhang, J., and Huang, N.: Wind conditions for snow cornice formation in a wind tunnel, The Cryosphere, 17, 639–651, https://doi.org/10.5194/tc-17-639-2023, 2023