Dear Referee,

Thank you for your response, and pass our great thanks to you for fruitful comments and advises. We tried to consider all mentioned comments and hereafter explain every change made point by point. The comments are in black, and our answers are in red. After addressing the comments raised, we believe that the manuscript would be sufficiently improved and reach the standards of TC.

Comments from referees:

- Referee #2:

How were the cutters sharpened for this study? Was the rake surface polished? I expect cutter sharpness and rake surface finish to impact cutting performance and cutting force.

This has been modified. In section of 2.2, we have explained the machining methods of cutters and the surface treatment methods of cutters after machining, and discussed the measure taken to avoid the impact of cutter roughness and grinding on experimental results.

I would like to see a wider range of rake angles investigated that include existing drills. Negative rake angles are not discussed in this paper but could provide an interesting comparison.

In the process of studying the influence of the bit geometry on cutting force, the angle of the cutter should include or even exceed the angle range already exists in the stage as much as possible. In this paper, we are committed to exploring the establishment of mechanical models during the ice cutting and drilling process, and verifying the correctness of the mechanical models within a certain range. And, the various angles of the cutters are interrelated, as the rake angle increase, the relief angle or wedge angle needs to be decreased. When the relief angle is fixed at 15°, as the rake angle increases, the wedge angle will decrease, while as the wedge

angle decreases, the strength of the cutter will decrease, as shown in Figure 1. Conducting experiments with different cutting depths may require apply a large drilling pressure on the cutter. Therefore, in order to prevent damage to the cutter during cutting and drilling process, we did not select a wider range of rake angles in this study. In the future, we will conduct more extensive research, and during the research process, the rake angle range of cutter will be wider and negative angles will be considered.

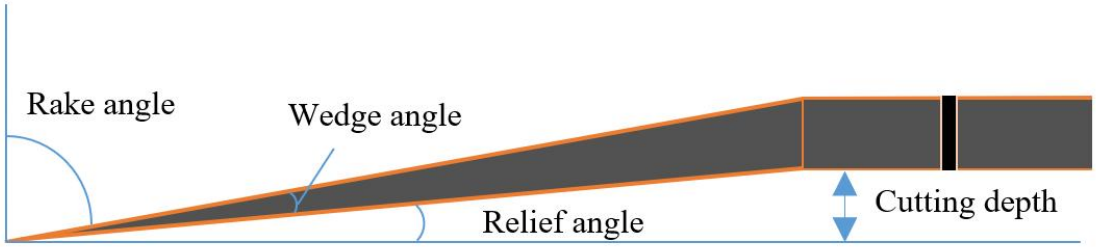

Figure 1. Schematic diagram of cutter structure

I would like to see a more detailed analysis of how the ice fracture mechanics change with depth of cut. High speed imagery is only provided for one set of parameters. At a minimum, I would like to see a comparison of imagery between different depths of cut.

This has been modified. In Figure 6, we added images of ice cutting process at different cutting depths and conducted a comparative analysis of the cutting and drilling processes under these two conditions.

The force diagrams in Figure 7. does not account for the presence of a cutter shoe which limits depth of cut. During cutting, I expect Fp to shrink to zero once the shoes are fully contacting the bottom of the borehole behind the cutter.

This has been modified. In Fig.7, we have added a schematic diagram of the relationship between the shoe and the cutting depth during the drilling process. In

the following text, we have provided a detailed explanation of the relationship between the shoe and F_p: "During the cutting and drilling process, the cutter comes into contact with the ice sample before the shoes. Only when the cutter is inserted into the ice layer with designed cutting depth, the shoes will fully contact the the bottom of the borehole. Prior to this, there will be continuous F_p on the cutter. As the drill bit rotates, the cutter always inserts the ice sample before the shoe, and the F_p on the cutter will continue to exist".

I would like to see a comparison of the cutting force trace (Figure 9) for different depths of cut. It would be interesting to compare the resulting frequency as chip size changes.

This has been modified. In Figure 9, we add a comparison of the cutting force generated at different cutting depths. And in the following text, a comparative analysis was conducted on the trace of the cutting force for different cutting depths.

On behalf of co-authors,

Rusheng Wang