The manuscript presents a comprehensive study of INP concentration and size in soil and streams around Zackenberg, eastern Greenland. Further investigations point out members of the soil microbial community potentially having formed these INPs. Overall, Jensen et al. have managed to analyse and interpret their diverse results in a coherent, logically consistent way. I agree with Anonymous Referee #1 that the manuscript is interesting and should be published. In addition to their detailed review, I have two thoughts the authors may consider when revising their manuscript.

1.) When looking at Figures 1 and 2 placed next to each other, I get the impression that shorter streams on steep terrain tend to carry lower concentrations of INPs (e.g.: West 4, West 5) as compared with longer streams (e.g.: West 1, West 3). Longer streams also tend to have sections on less steep terrain, where drainage water likely percolates slowly through soil and, therefore, has time to accumulate INPs. For proper quantitative analysis one would have to estimate the time snowmelt or rain water has spent in soil before entering a stream. Of course, such an estimate is well beyond the scope of this already comprehensive study. More easily, the length or average slope of streams could be derived from Figure 1 and used to put this idea to the test.

We sincerely appreciate your insightful comment, which offered an exciting new perspective on our data. Your suggestion that shorter streams in steep terrain may have lower INP concentrations due to limited time for water to percolate through soils, while longer streams in less steep terrain may accumulate more INPs, aligns well with our interest in the processes driving INP transport. Inspired by your idea, we examined potential correlations between stream INP_{-10} concentrations, catchment area size, and slope. However, our analysis did not find significant relationships, suggesting that other factors such as hydrological dynamics, streamflow dilution, or variability in soil INP sources may play larger roles in modulating stream INP concentrations.
Nonetheless, your comment raises an exciting direction for future work to further investigate how terrain and hydrology interact to influence INP transport. This perspective significantly enriched our discussion and has been incorporated into the manuscript. Thank you for bringing this to our attention!

"If soil INPs are a major source of INPs in streams, we would expect to observe a positive correlation between soil and stream INP concentrations. Furthermore, in areas with steep terrain, less time is available for water to percolate through soil and accumulate INPs before entering the stream. Larger catchment areas, typically associated with longer streams, might also increase the potential for INP accumulation due to extended flow paths and surface interactions. Surprisingly, we did not observe significant correlations between INP_{-10} concentrations in streams and catchment area size, or the slope of the terrain. Only a weak, non-significant correlation between soil and stream INP_{-10} concentrations was found ($R = 0.23$, $p > 0.05$). These findings suggest that while soil may contribute INPs to streams, other factors such as local hydrology, and dilution effects likely obscure a clear relationship. "

2.) Although there is a general association of stream INP concentration with soil INP concentration, there is a striking difference in INP spectra between soil (Figure 2) and stream water (Figure 6). Whereas the former spectra are shallow above -10°C and mostly extend to above -5°C, the latter spectra show a steep decrease above -10°C and none extends to above -5°C. In other words, the most efficient INPs do not seem to be transferred from soil to stream water. One explanation could be that such INPs are too large to pass with draining water through the soil matrix. Another, that they lose their efficiency quickly after having been produced, more quickly than they are transferred to the stream.

We thank the reviewer for this insightful question.

The observation of a contrast between the INP spectra of soil and stream water, particularly in the efficiency of INPs active at higher temperatures, suggests two things:
One plausible explanation is the dilution effect. The INPs in soil are likely concentrated in specific, localized regions, while the transfer to stream water, through the drainage process, would involve significant dilution. This dilution would disproportionately affect the more scarce, highly active INPs that exhibit activity at higher temperatures (e.g., around -5°C and above). These INPs are less abundant than those active at lower temperatures (e.g., below -10°C) and are likely diluted to the point where their concentrations are too low to be detected without prior concentration. As a result, the direct measurement of stream samples without concentrating them may miss these more active, but rarer, INPs, thereby giving the impression that they are not effectively transferred from soil to stream water.
Another factor to consider is the size distribution of INPs. Larger INPs, which are often more efficient nucleators, may be less mobile and more likely to be retained within the soil matrix. These larger particles may not pass through the soil as easily, especially if the pore spaces are small or the soil matrix is compacted. Therefore, the most efficient INPs, which tend to be larger, may be physically excluded from the stream water during the drainage process as the reviewer proposes.

Lines 483 and 493: Instead of "$p > 0.05$" I would prefer to the exact p-value (e.g., $p = 0.08$).

Thank you for your comment. This has been implemented in the new version.