The reviewer's comments are in black, and responses are in blue.

Glaciogenic cloud seeding is studied through numerical simulations of a case study of a shallow, stratiform cloud comprised of supercooled liquid water. WRF LES is employed for these simulations with a fast spectral bin microphysics scheme. Four simulations are undertaken to test the relative importance of turbulence generated by vertical winds shear (control vs enhanced) and the concentration of the released AgI seeding agent (control vs enhanced).

The primary conclusion highlights the importance of enhanced turbulence in accelerating glaciogenic seeding in comparison to enhanced AgI concentrations.

The paper is, in general, well-written with appropriate figures laid out in the logical manner. The literature review/introduction was particularly well done. I did find the writing to be fairly repetitive, especially with respect to the effect of turbulence through the results, enough so that I am specifically commenting about it. At other points, I thought some material was missing, as detailed below.

I respect and appreciate that the author readily acknowledges the inherit sensitivity of weather modification to the specific meteorology/event, what works in this case study may not work for a different event.

The majority of my comments pertain to further clarification of the work and assumptions rather than making new simulations. As such I consider the comments to be minor in nature.

Reply: We appreciate your insightful comments. The paper has been revised accordingly and has been improved. Please see our point-by-point response below.

Why do you want to run in two different times, with the case study being in UTC and the simulations being in model time? This made it more difficult to go back and forth between the two. Does seeding at 2:00 MT correspond to ~ 8:00 UTC? Does this mean the simulations are spun up for two hours, rather than one? Given that 8:45 UTC is 16:45 CST, would the local time be around local dusk for January, which is why the visible image has no colour?

Reply: Yes, the simulations are in model time. Unlike realistic LES, the idealized LES does not follow actual world time but rather represents the internal temporal framework of the model. The input is a single sounding measurement rather than real 3D data such as reanalyses. Therefore, the modeled time cannot be synchronized with field observations. Yes, the model spun up for two hours before seeding, this is now clarified in the revised paper.

Figure 1: Given that the simulations only go up to 3 km, I'd rather see the MSLP and surface temperature rather than the 500 hPa geopotential height. In particular, I'd like to know more about the boundary layer stability and boundary layer dynamics, beyond "quiescent and stably stratified". Do we have warm air advection or cold air advection? The satellite imagery suggests that this solid SLW cloud layer is moving up from the south, as discussed in the manuscript.

Reply: We appreciate your comment. Fig.1b is modified to show the MSLP, surface temperature, 10-m wind and BV frequency of cloud layer (Fig. R1b). Yes, there was warm air advection as suggested by the wind veering. The cloud layer BV frequency was positive, indicating stably stratified environment. This also can be seen from the sounding measurement which shows the boundary layer height was low, and the cloud layer was stable.

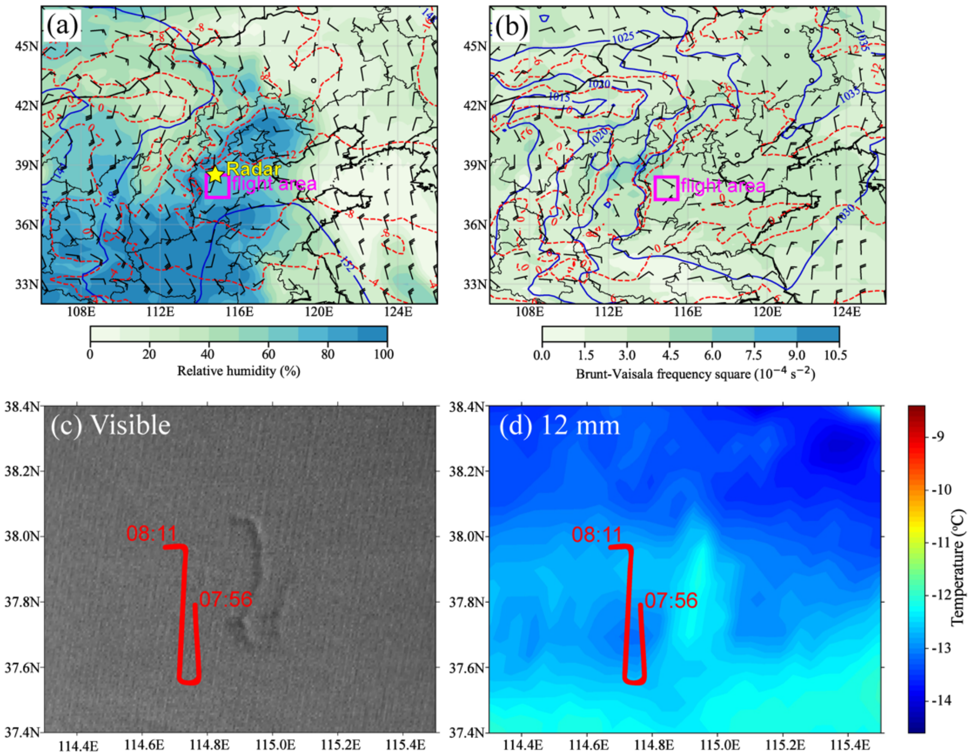

Figure 1. (a) Synoptic conditions at 850 hPa in North China at 06:00 UTC on 20 Jan 2022 obtained from ERA5 reanalysis data, including the geopotential height (dam, blue contours), isotherms (°C, red contours), wind barbs, and relative humidity (shaded).

The yellow star indicates the location of radar and the magenta box is the flight area. (b) Map of sea-level pressure, surface temperature, 10-m wind and BV frequency squared at cloud layer (1.3-1.8 km above ground level). (c) Visible image and (d) brightness temperature at 12 μm obtained from FY4A satellite at 08:45 UTC. The red lines indicate the seeding trajectory.

Figure 3: When and where was the sounding taken? Was this from the seeding aircraft or an upper air sounding?

Reply: It was an upper air sounding, launched at the Luancheng station (which is located in the research area shown in Fig. 1) at 00:00 UTC on 20 Jan 2022.

I am confused between Figure 5, which has a steady cloud comprised of SLW, and Figure 7, which has ice going to the surface and Figure 8, which has the cloud water mixing ratio diminishing through the simulation. That is directly at odds with Figure 5. I assume that this is a consequence of this being 'the control simulation without natural ice simulation' while Figures 7 & 8 allow natural ice nucleation. This needs to be explained in much greater detail. Would a true 'control' run (i.e., no enhanced shear and no seeding at all) glaciate just like the NOSEED areas in Figure 7? Is the reflectivity in Figure 7 being caused by ice failing below the cloud deck? I assume this does not match reality. What does this suggest about the formation of ice in the simulations? It would be best not to gloss over this.

Reply: We appreciate your comment. In the revised paper, we changed the names of the experiments to avoid such confusion (Table 1). Now, the "control" run is exactly the same as the field measurement: no natural ice nucleation, no enhanced wind shear, but seeding is performed. The comparison between the control run and observation (Fig. 5 in the paper) indicates the model can well capture the characteristics of the seeding effect. The radar reflectivity outside of the seeding plume in Fig. 7 is the result of natural ice nucleation and the changes in radar reflectivity indicate the falling snow (below the cloud base). We turned on natural ice nucleation because other than the seeding effect, we also want to investigate how enhanced turbulence would affect the natural ice microphysics and precipitation (outside of the seeding plume), and we see enhanced ice growth and precipitation by stronger turbulence (Fig. 7 and 8).

Table 1. Design of numerical experiments.

Experiments	Natural ice nucleation	Enhanced wind shear	Enhanced AgI concentration
Control	No	No	No
NI	Yes	No	No
NI_WS	Yes	Yes	No
NI_AgI	Yes	No	Yes
NI_AgI_WS	Yes	Yes	Yes

Line 245: magenta lines? The magenta line is at the inversion and is clearly visible at 4:00 MT.

Reply: Sorry for the misunderstanding. Here, we mean the magenta lines (liquid layer top) disappeared above the seeding plume at 4:00 MT, indicating the supercooled liquid water was consumed by the seeding. In areas unaffected by seeding, the liquid layer persisted and the magenta lines are still present. This is now clarified in the revised paper.

I am 90% confident that SEED area refers to the two primary red streaks in Figure 7 and NOSEED refers to everything else. I think, however, a couple of arrows pointing to what you are calling SEED would be very helpful.

Reply: We appreciate your comment. A couple of arrows are added to point to the SEED plumes in Fig. 7 in the revised paper.

Given that there is no source of water (latent heat flux) in the simulations, it seems obvious to me that any enhancement of precipitation upwind will require less precipitation at some point downwind. (I.e., robbing Peter to pay Paul.) This is just a statement of the conservation of water. If the simulation was run longer and the domain was bigger, I would expect to see the same thing for the non-shear cases. Am I mistaken? Ultimately, I don't think you can really address this questions using LES simulations with periodic boundary conditions. Once the precipitation reaches the surface, it's gone.

Reply: We appreciate your comment. In fact, within the model domain, we do not see a "robbing Peter to pay Paul" effect in the non-shear case. Although the ice concentration is enhanced by seeding, the formation of supercooled liquid water was still faster than its consumption by ice growth in the downwind areas. We agree that it is possible that the precipitation may decline somewhere out of the model domain, which may require a much larger domain in a real-case simulation. This is out of the focus of this study, which primarily shows turbulence can accelerate the seeding effect. It would be interesting to study the downwind effect in a larger domain in real cases in the future.