Authors' comments to Anonymous Referee #1

We thank the Anonymous Referee #1 for their valuable feedback on our manuscript, which improved the quality of the manuscript significantly, and we address the raised points below in blue.

The authors conducted large-eddy simulations to explore the impact of seeding on boundary layer supercooled clouds. The model setup is based on observations in the CLOUDLAB project. They first demonstrated the capability of the model to simulate and reproduce the seeding experiments at different environmental conditions. Then, they investigated the WBF process in the model by changing the INP emission rate. One conclusion is that the WBF process seems to be less efficient in the model than in the field. The conclusion is striking and interesting. One inconsistency is that the seeded cloud is expected to be above the site at 10:30 UTC (see Fig.6). However, in-situ measurements show that ice particles exist at around 10:35 UTC (see Fig. 9). So the apparent less efficient WBF process in the model might be due to some other reasons, e.g., underestimation of the growth time or advection time.
See explanation to Line 149.

In general, the manuscript is well written and easy to read. I have some minor comments listed below.

Line 113: "both experiments are identical in their setup". Since both seeding experiments are at the same location, is there any physical reason why there are two seeding experiments on that day? For example, I can understand S25-2, S25-2.5, S25-3 can test the impact of distance (growth time), but what about S26-2.5a and S26-2.5b? What can we learn from these two experiments?
In the field we conducted experiments using an identical setup to test the validity of the signal we observe in the radar and in-situ observations (similar to doing exact replicates in laboratory experiments). Here, we use both again to show that the model can reproduce the seeding signal consistently in the two experiments, but also when changing the seeding distance (other three experiments).

Line 149: “The frequency of model output was set to 5 min”. The ice growth time is between 6 and 9 min (Table 1). Please comment on whether the relatively low output frequency would affect the comparison between observation and simulation.
In the table below we show the times of the expected arrival time and the closest model time step. The plume arrives at the field site almost always at a 5 min time step. We also tested 1 min output frequency for the simulation S26-2.5 and the results are similar. Hence, we follow here the 5 min output frequency. With the expected arrival time at the field site we also chose our model time step which may disagree with the time period of the observations given the differences / uncertainties in wind speed.

Name	Seeding start (UTC)	Growth time (min)	Arrival at field site (UTC)	Closest model time step (UTC)
S26-2.5a	10:22	8.0	10:30	10:30
S26-2.5b	10:48	7.1	10:55	10:55
S25-2	10:50	6.1	10:56	10:55
S25-2.5	10:28	8.0	10:36	10:35
S25-3	11:15	9.1	11:24	11:25

Table 1: Please also add the seeding height in the table. It is difficult to accurately read the seeding height from Figure 4.
We’ve added the seeding heights from the field and the model to Table 1.

Line 178: “seeding particle emission rate”. Please add more justification of the choice of emission rate. For example, is it based on the estimation of the real seeding experiments, or is it chosen to match the ice number concentration. I find some discussions about it in the later part of the manuscript, but it is better to add some justifications here.
We added the following at the end of the paragraph (Line 201): *“The seeding particle emission rate and thus seeding setup were constrained by the ice crystal number concentrations observed by HOLIMO and tuned in such a way that they match for the seeding simulation S26-2.5a (Sect. 3.3.1).”*

Line 235: “There is a good qualitative agreement between …” What is the scanning frequency of the radar? How does reflectivity from the scanning radar look like e.g., 5 min before and 5 min after 10:30 UTC? Can the radar observation show the impact of cloud seeding?
In Henneberger, Ramelli et al., (2023), we show that the seeding signal can be observed by a vertically pointing radar (their Fig. 6) for several minutes and in sector scans (their Fig. 9). The seeding signal is clearly distinguishable from the background due to increased reflectivity values (background: -25 dBZ, seeding: -10 dBZ). The scanning frequency of the radar shown in the manuscript is 90 s with a scan speed of 1° per second allowing for several scans of a single seeding plume including parts of the background as well. We added the scanning frequency to the figure caption: “**Figure 6.** Comparison of the radar reflectivity measured by a scanning cloud radar with a scanning frequency of 90 s per scan (Mira-35, Metek, (a)) …”.

Line 296, 345 “(not shown)” is not accepted nowadays. Please consider adding the figure in the supplementary material or rephrase the sentence.
We added the figure for the cloud droplet number concentration comparison to the supplement (Fig. B1) and removed the second “(not shown)” in Sect. 3.3.1 as it is not needed.

Line 296. “The ice crystal number concentrations are in good agreement (within +-0.3 cm-3) with observations in 4 out of 5 simulations.” What I see is that the simulated median ICNC is one order of magnitude smaller than the observation, while the maximum value is similar. Even if the median ICNC is 0 from the model, the uncertainty is still within 0.3 cm-3. So I think this statement is not accurate.
We adapted the text as follows (Line 326): “*The maximum ice crystal number concentrations are in good agreement (within ± 0.3 cm^{-3}) with observations in 4 out of 5 simulations. Only the S25-2 simulation strongly underestimates the maximum ice crystal number concentration by 1 cm^{-3} (see Sect. 3.2.1 and Sect. 3.2.2), whereas its median ice crystal number concentrations match well with the observations. This is not the case for the other four simulations, where the median concentration is underestimated by an order of magnitude. When we also consider the mean values, we see that the model in general has only a few grid cells showing the high ice crystal number concentrations, while a lot of grid cells have very low ice crystal number concentrations. Even though the seeding plume spreads out over several levels (see Fig. 5), the internal mixing inside the plume seems to be inefficient leading to this discrepancy. Regarding the changes in cloud droplets, the model fails to reproduce the maximum cloud droplet reductions, where 4 out of 5 simulations show almost no reduction. Only in the simulation S26-2.5a a stronger reduction is notable. However, for all simulations the median and mean cloud droplet reductions are strongly underestimated.*”