We thank the reviewers again for the careful reading and the suggestions that helped us improve our manuscript. The answers to the reviewers will be given after each comment in bold font.

Reply to Referee #1

The authors have addressed some of the concerns but major questions still remain. In addition, the presentation of the work could be further improved.

 - I would suggest to point out that the effect investigated here falls under what is also known as non-CO2 effects of aviation.

We included this in the introduction.

- The abstract reads more like an introduction. Please revise to provide all the major findings, i.e. specific results, of your study.

We include now the major findings of this study and modified the abstract accordingly: *"… In-situ measurements for both cloud types (high mode PLDR -aviation effected- and low mode PLDR -pristine- cirrus) can be reliably compared in a temperature range between 210 K and 215 K. Within this temperature range we find that high mode PLDR cirrus clouds tend to show larger effective ice particle diameters with a median value of 61.4 µm compared to 50.7 µm for low mode PLDR pristine cirrus clouds. Larger effective ice particles in aviation influenced (high mode PLDR) cirrus are connected to lower ice particle number concentration with a median value of 0.05 cm^{-3} compared to 0.11 cm^{-3} (low mode PLDR), which evolved in more pristine regions with only little impact from aviation. We suspect that a suppression of homogeneous ice formation by the heterogeneously freezing soot aerosol particles included in the areas affected by air traffic is the cause of the reduced ice crystal concentrations."***. However, we decided to not change the first part of the abstract as it was an outcome from the first review process to make a direct link to the study of Urbanek et al., 2018 already in the abstract.**

- INP is introduced for what should be ice nucleating particles but later in the text the authors still use IN.

We changed that and use only INP in the revised version.

- Please double-check the list of references. Some names are spelled incorrectly (e.g. Majani, line 38; Theo, line 67)

Thank you! We checked and corrected that.

- line 72: Please be specific as to how much of the AOD decline can be attributed to air-traffic reductions and regarding the amount of change to the radiative forcing.

We modified the paragraph accordingly: *'An integrated study, using aircraft, satellite and modelling data, showed a reduction of the aerosol optical depth (AOD) over Europe in May 2020 (Voigt et al., 2022). Although it is not clear whether the decrease in AOD was caused mainly by anthropogenic or meteorological influences, the authors suggest, that it was partly caused by the 80% decline in air traffic, as the aerosol number concentration decreased at flight altitudes compared to the reference years. In addition, comparisons of the measured black carbon mass concentration with model results from EMAC indicated a 40% reduction related to lockdown effects*

(Krüger et al., 2022). The reduction in air traffic over Europe furthermore led to a reduction in contrail cover and as a consequence in radiative forcing from contrails. Contrail radiative forcing was calculated with the contrail cirrus prediction model (CoCiP; Schumann 2012) for April 16, 2020 for two scenarios; using air traffic data from 2019 and for 2020. For the same meteorology, the simulated contrail radiative forcing decreases by about 80% for the reduced air traffic in 2020 compared to 2019.'

- line 107: development or formation?

We changed that to 'formation'.

- While I like colourful lidar plots as much as anybody, I cannot see the added value of the ones on Figures 1 and 3. The reply letter also gives no justification why those plots are needed.

We prefer to keep these lidar plots, as they nicely show the distribution of the PLDR values within the cloud and, especially, that the PLDR does not show any altitude or time separation.

- The two case studies can be presented more comprehensively by combining the frequency distributions of Figure 1c and d (3c and d) with those in Figure 2 (4) into a single figure with a homogenized design of the frequency distributions.

As we prefer to keep the lidar plots, we also prefer to keep the distribution of the PLDR together with the lidar plots instead of combining them with the frequency distribution of the in-situ measurements.

- line 198: measurement = meteorological?

We changed that to 'meteorological'.

- line 198 - 201: Redundant, this is now stated in the section on data and methods.

We removed that.

- line 220 and following: This should be part of the methods section.

We moved that to the methods section.

- It seems that measurements of RHi are available. Why are these not used in the results section? Temperature alone doesn't seem to cover the full picture. This becomes particularly clear in the discussion when the authors argue that RHi can provide information regarding the likelihood of homogeneous and heterogeneous nucleation.

We did not include measurements and analysis of RHi in this manuscript, as a detailed discussion on RHi distribution for high mode and low mode PLDR clouds was already included in the publication by Urbanek et al., 2018.

- The authors make an argument, that the suitable range for comparison is between 210 and 215 K. Therefore, I don't see the need to show plots for data outside that temperature range. The authors should show only data for the temperature range from 210 to 215 K, i.e. omit the left column of

Figure 5 and the corresponding lines in Figure 6. The conclusion of using all data can be provided in the text.

We followed that advice and changed that.

Reply to Referee #2

The vast majority of my initial comments have been addressed in the revised manuscript, which is significantly improved.

My main comment is that both the abstract and the conclusion should reflect that in situ measurements for both types of clouds (high and low PLDR) could be reliably compared between 210-215 K and that clouds with higher PLDR "tend to" show larger mean effective ice particle diameters connected to smaller ice particle number concentration than the cirrus clouds with lower PLDR.

We added the temperature range in which in-situ measurements for both cloud types can be reliably compared in the abstract and in the conclusion. Further, we discuss in more detail the differences between the high PLDR, aviation affected, and low PLDR, pristine cirrus clouds, in the abstract.

Other comments
Line 58: do you confirm that "The measurement study by Urbanek et al. (1998)" should be replaced with "The measurement study by Urbanek et al. (2018)"?

Yes! We corrected that.

Line 69: this recent publication could be cited: Duda, D. P., Smith, W. L., Bedka, S., Spangenberg, D., Chee, T., & Minnis, P. (2023). Impact of COVID-19-related air traffic reductions on the coverage and radiative effects of linear persistent contrails over conterminous United States and surrounding oceanic routes. Journal of Geophysical Research: Atmospheres, 128, e2022JD037554. https://doi.org/10.1029/2022JD037554

We added this publication.

Line 145 and line 199: I see again that the authors mention missing CIP-UniM data on 7 March 2014 whereas it seems that it was on 7 April 2014.

Sorry! We changed that.

Line 184: "26 April" should be "26 March" I believe. Median PLDR = 0.52 but is 0.51 in Table 1. Please explain this difference or correct.

We changed that.

Line 185: I see in the text that the mode of the PLDR distribution = 0.34 and median = 0.29, but looking at the plot, it seems that both values are actually larger, perhaps 0.44 and 0.39, respectively. Median PLDR in Table 1 is 0.39, which seems correct. Can you verify?

You are right, thank you for pointing this out. We corrected the values in the text.

Line 251: "…mean value of 225 K for the flight track of 11 April". I see 226-227 K in Table 1. Can you clarify?

We corrected that.

Lines 268 to 274: it seems that these results are for all flights, because the temperature range is from 206 to 238 K, whereas temperature range in Table 1 is from 208 to 227 K. Please clarify. Perhaps these first sentences are not relevant anymore.

You are right, these first sentences are not relevant anymore. We removed them.

Line 307: looking at Fig. 6 and at the values next to the distributions, it seems that "The corresponding values for the low mode PLDR clouds are 28.8 µm and 67.2 µm, respectively" should read "The corresponding values for the low mode PLDR clouds are 38.8 µm and 67.2 µm, respectively".

We corrected that.

Lines 315-318: I do not see light blue N_{par} (low PLDR) larger than dark blue N_{par} (high PLDR) at all temperatures. What are "all considered temperature ranges"? At 208 K, I see indeed 0.48 cm-1 for the low mode PLDR cirrus but 0.23 cm-1 for the high mode PLDR cirrus.

Following the advice of the second reviewer we now include only the temperature range from 210-215 K in our comparison. However, we made clear in the text following Figure 6, that N_{par} (low PLDR) is not larger than the corresponding N_{par} (high PLDR) for all temperature steps.

Lines 318-320: I suggest to be more specific and to modify the sentence, which could read: "However, as can be seen from the number of datapoints for each comparison given in Fig.6, these last results have to be treated with care, as we tend to have a larger number of high mode cirrus cloud cases in the lower temperature ranges (except at 208 K and 210 K) and a dominance of low mode cirrus cloud cases in the higher temperature range, namely at 216 and 217 K.

We followed your advice and changed the sentence accordingly.

Line 330: I strongly suggest specifying that this temperature range with sufficient contribution of both cloud types is 210-215 K. I also think that a more accurate statement would read for instance: "the high PLDR mode clouds tend to show lower ice particle number concentrations with larger effective diameters compared to low PLDR mode clouds".

We followed your advice and changed the statement accordingly.

Technical comments
Line 20: PLRD => PLDR **- Done**
Line 23: PLRD => PLDR **- Done**
Line 262: "Unfortunately, now lidar measurements…" => "Unfortunately, no lidar measurements…" **- Done**
Line 284: "as now significant comparison is possible" => "as no significant comparison is possible" **- Done**