This study uses a time since convection algorithm operating on ERA5 reanalysis and ISCCP data from the entire satellite record to create fields of flags for the tropics that indicate, if there is cirrus, if it has originated from deep convection over land or over ocean, and if it was formed in-situ or detrained from deep convection. They compute cloud radiative effects (CREs) as a function of time since detrainment, using CERES, separately for land vs ocean origin cirrus, and in-situ vs detrained cirrus. They also artificially alter the ratio of in-situ to detrained cirrus and re-calculate the CREs to obtain an estimate for how much warming one could get by increasing the lifetime of detrained cirrus by various factors. This study is a standout in terms of its writing quality and clarity, and was a pleasure to read. The manuscript will be an asset to the cirrus community both because of its nice science results and its thorough and well-written literature review. I do not have major concerns but I do have a list of minor and medium recommendations below that I hope can help the authors improve the clarity and relevance of the manuscript even more.

We thank the reviewer for their very helpful comments on our manuscript. The minor and medium recommendations given are addressed below.

• Be more precise when discussing CREs in lines 4-5, 24 and 28. I recommend giving estimated ranges for SW and LW CREs in one or all of these places. I also recommend changing the word "large" in line 5 to substantial or significant given that the difference is still small compared to the other "large" numbers that you are talking about.

- 'Large' replaced with 'significant' on line 4.

• Lines 8-12: Mention somewhere here that positive numbers indicate warming.

- 'Warming' added when referring to CRE's in this section.

• Lines 18-19: Again, it is good to be more precise and put an estimated range of optical depth or ice water path after the word "thin" as many people in the cirrus community use that word to describe subvisual cirrus and would consider these outflow cirrus to be quite thick.

- We agree – we have included a sentence giving optical depth ranges of 'thin cirrus' on line 25.

• Lines 38-40: I'm not convinced that longer lifetimes of anvils definitely suggest some mechanism for sustaining water vapor. My instinct is that because detrained cirrus are typically thicker than in-situ cirrus, it might just take longer for them to be eroded by the same processes that act as sinks for both in-situ and detrained cirrus.

- This is a good point, we have removed the reference to longer lifetime being due to sustained water vapour, and mentioned that they are thicker than in situ on lines 40-41.

• Line 44: I believe that Sweeney et al. 2023 is about the QBO and not ENSO

- This reference has been removed

• Line 71: Suggest changing "is" to "has been"

- This has been changed.

- Line 89: Suggest changing “clearly” to “overall”
    - This has been changed.

- Lines 90-93: Do any of the cited studies on aerosol invigoration explicitly make connections to cirrus? If there is a study that makes this connection, I suggest citing it after “...leading to higher altitude longer lived anvil cirrus”. If there isn’t such a study, I think you should convey that this is speculative
    - This sentence has been changed to make it clear that although higher altitude cirrus is cited in the studies, any impact on lifetime is speculative.

- Line 98: Some typos here: double “is” and add “we” between “and” and “investigate”
    - These typos are resolved
- Line 100: move “is also investigated” to the end of this sentence
    - - These typos are resolved

- Line 123: The 10% threshold is rather arbitrary and the authors acknowledge and justify this in the discussion, but I think some acknowledgement of that should also go here. I also think the authors can be more precise in describing the sensitivity or insensitivity of their results to this threshold in the discussion.
    - A sensitivity analysis into the importance of the threshold of detrained lifetime used is included in the supplementary materials. It is shown that changing the threshold of detrained cirrus lifetime from 10% to 20% does not impact the results substantially. This is because the radiative contribution of the cirrus by the end of their lifetimes is small, and the shift from 20% to 10% happens rather quickly. We have also included in the discussion a paragraph that discusses the impact of the threshold used in this study, beginning on line 378:

      The second area of uncertainty in this work surrounds the definition of detrained cirrus. This work defines the end of a detrained cirrus lifetime, and the beginning of the in situ air parcels, as the point at which a cloud along a trajectory from deep convection moves below 10\% cirrus cloud fraction for the first time. Any cirrus that then appears along a trajectory after this point is defined as in situ in origin. This is similar to Luo and Rossow (2004) who define the end of their cirrus lifetime as the point at which the cirrus cloud reaches 1/5 of the maximum cloud fraction along the trajectory. Changing the definition of detrained cirrus would not change the overall high cloud CRE. However, it does change our calculated lifetime of detrained cirrus, which is shown in Figure S1 in the supplementary. There is no universal definition for ``detrained'' or ``anvil'' cirrus, and as such the lifetimes of these clouds vary depending on how they are defined. Nevertheless, our lifetimes fall within the expected ranges given in the literature Luo and Rossow (2004) and as shown in Figure S2, the final values for the change in CRE for a given lifetime extension are not particularly sensitive to the threshold used to define the convection.

- Line 198: Change fig. 3 to fig. 4
    - This has been changed.

• Fig. 4 and Fig. 5: I suggest adding vertical lines to these figures to indicate when the cirrus go from being predominantly detrained to being predominantly in-situ. I suggest this because the authors discuss the CREs of detrained cirrus being different over the cloud lifetime between land-origin and ocean-origin cirrus due to the amount of incoming solar being different at the time of their detrainment, and at first I thought that these figures contradicted that, but then I realized that the detrained cirrus are only existing at the far left side of the plot.

- This is a useful suggestion, and has been implemented.

• Lines 317-324: The authors state that their purpose isn't to obtain a concrete value of CRE for a given lifetime extension, but in fact, they do obtain a concrete value and reference it throughout the manuscript. So, more effort needs to be made here to connect this experiment to the real world. Do the studies suggesting that anvils will be longer lived in the future also suggest that the anvil properties will remain the same throughout the longer cloud lifetimes? One can imagine anvils being longer lived but resembling in-situ cirrus towards the ends of their extended lifetimes. Also, the in-situ cirrus are artificially removed to make space for the longer lived anvils, so the estimate here is sort of a lower bound. How do the CREs of the removed in-situ cirrus compare to the CREs of the added anvils? In general, it would be good to cite the literature here and argue more precisely for the plausibility of this experiment.

We thank the reviewer for this comment. Similar points were raised from other reviewers, particularly regarding how modelling a lifetime change as a shift in the distribution may compare to physical mechanisms for lifetime extensions. We have included an extra section in the discussion to try and address these points. The discussion begins on Line 388:

The method used to extend the lifetime of the detrained cirrus is relatively idealised, insofar as it models a lifetime extension as a change in the distribution of detrained cirrus at the expense of in situ cirrus. Moreover, the extension in the distribution modifies the distribution mostly at the tail end of the detrained cirrus lifetimes, meaning that the oldest detrained cirrus are the ones whose distribution gets artificially increased. The purpose of this work was not to assess the methods through which a lifetime extension would occur. Instead, we aim to provide an upper bound on the impact that increasing the lifetime of the detrained cirrus would have on the tropical high cloud CRE. By modifying the distribution to represent an increase in lifetime, particularly in a way that may impact the longer lived detrained cirrus more than the short lived cirrus, we do provide such an upper bound, since any modification to the shorter lived cirrus would not increase the CRE by as much, as they are already more cooling. In reality, any physical routes through which a lifetime extension will likely increase the total CRE by less than the values we provide here. Further work is needed to assess the mechanisms through which lifetime extensions might occur, and what the range of impacts this may have on the CRE. For example, the lifetime could change due to a stronger clustering of convective cores Jones et al. (2024) increased updrafts via aerosol invigoration Abbott and Cronin (2021). Each of these mechanisms may impact the lifetime in a distinct way from the idealised set up in this work. Investigating these mechanisms and the specific impacts they had on the lifetime would make for an interesting comparison study to the idealised extension proposed in this work, and would be a necessary addition to put these results into context, as well as developing a stronger constraint on the potential changes of the CRE.

- Line 338: too many m’s in “fromm”
    - This typo has been resolved
- Line 354: Missing parenthesis
    - This typo has been resolved