Dear Dr. Godderis,

We appreciated the constructive criticisms of the Editor and reviewers. We have addressed your comments below, and have addressed the comments of the reviewers in separate responses. Changes in the manuscript have been made to address these comments and we would be pleased to submit a revised version.

Before addressing each comment individually we note that we found an error for some of the numerical values given in the paper. We had incorrectly converted from ppv to bar using a 1:1 ratio. However, this should be performed by multiplying the volume mixing ratio by the ratio of molar masses ($M_{component}/M_{air}$). This has been corrected and does not effect any of the qualitative results of our paper.

1. **Your study encompasses a large number of greenhouse gases. As you did not calculate the possible abundance of these 28 greenhouse gases (I fully understand that this is not the objective of your contribution), it would be useful for the readers to identify which of those gases have been suggested as potential key factor for the Archean climate. This could be easily done in the form of a table with the references from the literature.**

   In our revised manuscript we have created a table giving values for the modern flux, concentration, and lifetimes of the gases examined in this work as well as a description of their modern sources of sinks as well as any relevant notes for the Archean. This table is quite extensive and includes an additional ~60 references.

2. **Given the bias in the geological record, it is probably not true to state that glaciations were almost absent in the Archean.**

   We may have overstated this point. We have revised this to:

   "Glaciations appear rare in the Archean (Young, 1991), thus, it is expected that surface temperatures were likely as warm as today for much of the Archean. Therefore, modern day surface temperatures are a reasonable assumption for our profile."

3. **The discrepancy with the study of Ueno et al. must be explained.**

   We have been in contact by email with Dr. Ueno about how their calculation was performed. Quoting from our email conversation, their calculation of the OCS radiative forcing was described as follows:

   "The "60W/m^2" is not the radiative forcing defined by Pinock et al. I would rather simply calculated total IR adsorption in a 10 km column of our model Archean atmosphere for comparing the effect from OCS, CO2 and CH4.

   In the lowest 10 km of the atmosphere, 10 ppm of OCS would absorb approximately 60 W/m2 of the 300 K thermal emission in the window region, which is roughly the same as that of 1 % CO2 or 100 ppm CH4."

   We are not able to discern exactly what they did from this description and have asked for further clarification but are still awaiting a reply. He did note that he was not surprised that our result

yielded a value that differed by a factor of 3. We are uncomfortable with explaining this discrepancy in the manuscript until we are clear on how they performed their calculation.