We thank Reviewer #2 for their efforts in reviewing our manuscript. Responses below.

This paper presents a sensitivity study to evaluate the impact of the Criegee + SO2 reactions on H2SO4, CCN concentrations and the aerosol indirect effect. A global model, GEOS-Chem-TOMAS, is used for this work. The authors conclude that the sensitivities of CCN and aerosol indirect effect towards the Criegee + SO2 reactions were rather weak. Hence, an improved representation of these reactions would not result in an improvement of present-day CCN and aerosol indirect effect predictions. This paper is well written, presents new and original results, and the topic is clearly within the scope of the journal. Reviewer 1 has already submitted a comprehensive point-by-point review of this paper, which I second.

Thanks. Please see our response to Reviewer #1.

In addition I have one major comment that should be addressed before publication: An inherent weakness of the model framework used in this study is the coarse spatial resolution. The inability to resolve small-scale features may result in an apparent low sensitivity of the model, while the sensitivity in reality might be higher. So, while I agree with the authors' conclusion that "improvement in the modeled Cl+SO2 chemistry would not likely to lead to significant improvements in present-day CCN and AIE predictions", this does not mean that this chemistry is not important in reality. The authors do address this to some extent on page 33139, but I think great care needs to be taken to emphasize this issue throughout the manuscript (introduction and conclusion), including the title.

It is true that model resolution may bias the sensitivity high (e.g. it the change in [H2SO4] at Hyytiälä, Finland appears to be bias low, which would lead to a low sensitivity in CCN in these locations); however, the global sensitivity could also be biased low in the model since the large grid boxes instantly mix anthropogenic SO2 emissions within a grid box with biogenic alkene emissions in the grid (i.e. more SO2 will be exposed to CIs due to the instant mixing in the boxes), which could lead to a larger fraction of SO2 being oxidized via CIs.

Regardless, there are obviously uncertainties due to the course spatial resolution (as there are with any aerosol microphysics study in these models... just think about the emissions-plume microphysics we miss!).

To the conclusion, we have added "It is possible that the model sensitivity may be biased either low or high due to the coarse model resolution. At the two European sites investigated by Boy et al. (2012), the model-predicted sensitivity of H_2SO_4 concentrations to CI+SO_2 chemistry was biased low, which may have been due to not explicitly resolving the alkene-rich forested observation regions. On the other hand, the instant mixing of anthropogenic SO_2 emissions with biogenic alkene emissions in the coarse grid boxes could lead to a larger fraction of anthropogenic SO_2 being oxidized by CIs in the model than in reality, which could bias the model-predicted impacts of CI+SO_2 chemistry on CCN high (however, we have no evidence of this)."

We have not added anything to the introduction since we do not discuss our model or results in the introduction (rather we discuss the motivation and previous work, which has not been done with global models). However, in the methods sections, we have added, "Limitations due to the model resolution are discussed in the conclusions." We have changed the title to "Weak global sensitivity of cloud condensation nuclei and the aerosol indirect effect to Criegee+SO_2 chemistry" ("global" inserted) to

show that we're using a global model and that unresolved local-scale effects could be stronger.

Technical comments: Figure 4: The labeling of the color bar (non-integer exponents) is somewhat unconventional. I suggest adjusting this.

If we used only integer exponents, our resolution in OH concentration would be significantly coarser (limited to factor-of-10 jumps in colors). There would only be 3 colors for the entire plot. Switching to a non-exponential notation for the labels would take up too much space. If we used a linear color scale, every region that is currently shades of blue or green would all be a single shade of dark blue. Thus, we feel that the alternatives are far worse that the current colorbar scheme.