Comment on esd-2021-72
Anonymous Referee #2

Referee comment on "Impact of bioenergy crop expansion on climate–carbon cycle feedbacks in overshoot scenarios" by Irina Melnikova et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2021-72-RC2, 2021

Major comments:

The manuscript focuses on an important scientific problem and draws some enlightening conclusions. The authors estimated the impacts of large-scale land-use change (LUC) on the carbon cycle feedbacks under the Shared Socioeconomic Pathway (SSP) overshoot scenario. They used five ESMs of CMIP6 to estimate the global β and γ contributions to the changes in land carbon pools in LUC/noLUC areas and found that BECCS areas lose their β-driven carbon uptake potential but do not escape γ-driven carbon losses even though the SSP5-3.4-OS scenario is designed for bioenergy crops expansion to utilize already low-carbon areas.

However, the following issues need to be figured out before the manuscript is published:

- It is difficult for me to understand the biophysical meaning of a negative β value. From the perspective of the land and ocean reservoirs, β is positive, and β-feedback reduces the impact of CO₂ emissions on atmospheric CO₂ concentrations and then global warming (Zhang X, Wang Y P, Rayner P J, et al. A small climate-amplifying effect of climate-carbon cycle feedback[J]. Nature communications, 2021, 12(1): 1-11). When the decline of carbon uptake (ΔC_{BGC}) is mainly driven by LUC rather than the change in atmospheric CO₂ concentration, is it still appropriate to use ΔC_{BGC} to calculate the feedback of land carbon uptake to the change in CO₂ concentration? Please clarify this.
- The result section is not easy to read. Although the results and discussion can appear in the same section, they should be as separated as possible. It is suggested that the result comparison between different methods, data, and studies should be placed at the end of the section.
- The line charts (Figure 2, 3, and 4) need to be simplified. There are so many lines in each subfigure that readers cannot clearly distinguish all lines and colors.
Minor comments:

- Line 67~70: Please divide this sentence into two sentences.
- Line 102: Please give the full name of “fLuc”, such as forest land-use change.
- Line 191~192: Please modify this sentence. For example: Under the SSP5-3.4-OS pathway, the cropland area increases by $8.1 \times 10^6$ km$^2$ ($\sim 50\%$) from the 2010 level in the 21st century to 2100 (Hurtt et al., 2020).
- Line 198~200: It is suggested to revise this sentence like “global cropland area in A dataset is larger/less than in B dataset by X km$^2$ in XXXX, and $\sim$ “.
- Line 276: Please add [under the "cropland threshold" approach] at the end of the sentence.
- Line 675: It is recommended to keep only the average and range of land carbon uptake in LUC and noLUC in Figure 3.