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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of future land use and land cover change on mid-21st-century surface ozone air quality: Distinguishing between the biogeophysical and biogeochemical effects" *by* Lang Wang et al.

Anonymous Referee #3

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Wang et al. aimed to address the impact of future land use and land cover change (LULCC) on surface ozone. They authors differentiated between the role of biogeochemical effects and biogeophysical effects by conducting fixed-dynamics simulations and coupled chemistry-climate simulations using a 3-D global model. They found that the biogeochemical effects are relatively small due to the counteracting impacts of isoprene emission and ozone uptake by plants. The biogeophysical processes likely play a more important role both at local scale through albedo effects and surface energy redistribution, and at regional scale through teleconnections. The manuscript is well

structured and clearly written, and fits well into the scope of ACP. Below are some minor issues to be considered before publication.

Throughout the manuscript, I do not see a discussion on whether the changes in ozone are significant, compared to the perturbations caused by natural climate variability. E.g. Fig 3 needs to include a confidence level. I see some dots in other figures but there are no explanations. The authors may also add some explicit discussion on ozone changes induced by anthropogenic emissions under RCP4.5 and RCP8.5, to give the readers a clearer idea what the LULCC impacts are compared to emissions and climate.

L130, L131 and many other places: LULC should rather be land use and land cover change (LULCC). Land cover itself cannot 'induce' anything. I'd suggest to check through the manuscript and use LULCC instead of LULC.

L221: CAM4 should be "On-line mode of CAM4-Chem-CLM".

L225: I think you prescribed anthropogenic emissions, biomass burning and long-lived species CO2, CH4 and N2O for ALL simulations, not just the 5 coupled simulations, right? Combine L224-225 with L212-213 together and provide more details, e.g. what inventories/values you used.

Fig. 3g, k, h, l: these plots are not clear. Perhaps change the scale of color bars.

L408-409: Shouldn't the tropical region (e.g. the Amazonia) be the same regime as the southeast US? With increases in isoprene emission that consumes more ozone and increases in dry deposition, I assume ozone will decrease as in the southeast US. This is not shown in Fig 3g, why? Again, change the color bar may improve the visualization, and adding a map showing relative changes in percentage in the supplement would help.

L432: Give a rough number/range of ozone responses to changes in anthropogenic emissions and climate here.

L452-458: This paragraph is not clear. It reads like the changes in isoprene emis-

sion and dry deposition are due to meteorological changes (warmer temperature, drier/wetter conditions), but actually you cannot differentiate whether the changes are directly caused by LULCC or LULCC-induced meteorological changes, right? You mentioned that isoprene emission changes are smaller than the off-line values, suggesting meteorology partly offsets the direct LULCC impacts. But intuitively, reforestation leads to warming (mid-latitudes in Fig 4d) and then more isoprene emission, so the LULCC-induced meteorology changes add on to the direct LULCC impact on isoprene?

L462-463: Avoid using the terms “biogeophysical” and “biogeochemical” here. You are referring to impacts on isoprene emission, not ozone.

L508-514: How will the anomalous high with low-level divergent wind in RCP4.5 experiment influence ozone advection and transport?

L538: What’s the meaning of “a positive tendency” for the energy budget?

L576-578: Also add Unger 2014 Nat. Clim. here for the cooling of deforestation.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-824, 2019.