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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of changes in land use and land cover on atmospheric chemistry and air quality over the 21st century" *by* S. Wu et al.

Anonymous Referee #1

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The paper by Wu et al. examines the impacts of climate and CO2-induced changes in vegetation and anthropogenic land use on atmospheric chemistry, focusing on the impacts on ozone and SOA. The modeling approach couples the output of a dynamic global vegetation model to an atmospheric chemistry model. The main impacts are from changes to isoprene emissions when considering how their emissions change owing to changes in plant speciation and CO2-driven increases in vegetation density. The authors recognize that they are testing a very specific set of interactions, as the inhibition of CO2 uptake by ozone-damage to plants or the inhibition of isoprene emissions by CO2 are not accounted for here. Overall, the manuscript is clear and concise. However, it does seem to be a bit thin with regards to scientific impact and

assessment of uncertainties. The values predicted for future concentrations aren't really put in context with regards to other drivers of atmospheric chemistry (e.g., changes to anthropogenic emissions) that these authors themselves have explored in previous works. No estimation of uncertainty are provided, nor is the extent to which the results provided here might be counteracted by other competing feedbacks considered. Overall, I would suggest that the authors dig a bit deeper into their results in order to arrive at a more substantial manuscript. This would constitute some additional discussion and minor revisions.

Comments:

abstract: the changes in concentrations of ozone or SOA listed here – over what time scale are these calculated? Daily average? Yearly average?

p3: Regarding the first sentence, haven't previous studies investigated the feedback of climate driven CO2 changes on isoprene emissions?

p4: "SOA formation from monoterpenes. . . is based on the algorithm by Chung and Seinfeld [2002]. . ." Isn't this the same algorithm of equilibrium partitioning that is used to treat isoprene SOA?

p5: When discussing the impacts on isoprene emissions, I would think it might be relevant to mention again that these effects may be opposite in sign if CO2 inhibition of isoprene emissions were accounted for. Or would they? Can the authors estimate, based on previous studies, to what extent these impacts might cancel out?

p5: "This appears to be largely driven by the increase in ozone dry deposition. . ." Can the authors investigate their model results / setup in a way to make this assertion more definitive?

Table 1: How is it that the 2100 simulation including all effects (right column) has increases in isoprene and monoterpene emissions but a decrease in SOA burden? Is there a volatility effect at play?

p9: I don't think a 1 ug / m3 change in SOA concentrations is that significant. Or at least it is hard to say without providing some context. What percent change in total pm2.5 does this represent? How does this change compare to changes in pm2.5 coming from anthropogenic emissions changes noted in the authors' previous works?

general: To what extent do uncertainties in isoprene emissions impact the quantitate and qualitative results found here?

general: To what extent do uncertainties in SOA modeling (aging, semi-volatile species, cloud processing, etc., are all important mechanisms not addressed) impact the quantitative and qualitative results found here?

Technical:

p8: "effect of on"

p8: "2100changes"

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 15469, 2011.