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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 #2

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The authors performed a series of experiments to characterize the impacts of land use and land cover change on surface atmosphere exchange (biogenic emissions and ozone deposition). This is of considerable importance for atmospheric chemistry and is an appropriate topic for ACP. The impact of landcover change on surface-atmosphere exchange is largely unknown and thus efforts to improve understanding of the effects of landcover change on the chemical composition of the atmosphere are certainly worthwhile. The paper is concise and well-written and the methods used are reasonable. My main concern with the paper is that it does little to go beyond what we already know on this topic. Previous papers have qualitatively already shown us that these exchanges are sensitive to landcover change so this work should consider the reliability

of these predictions and pointing out what we need to do to improve our quantitative understanding. Specific issues to address include the following:

1) The existing literature on this subject, which dates back several decades to Turner et al. Chemosphere (1991), is mostly missing from this manuscript. 2) What are the uncertainties associated with 1) the predicted changes in landcover and 2) the response of biogenic emissions and ozone deposition to these changes. Do we really even know the sign of the response? 3) What is the impact of assigning emission rates to broad vegetation categories? For example, it is assumed that the replacement of a needleleaf forest with a broadleaf forest will increase isoprene emission but this is not necessarily the case: a maple forest has much lower isoprene emissions that a spruce forest in North America. 4) The results here are different than what is reported by others. Does this mean the other studies (or this study) are wrong or does it mean that our knowledge is not sufficient to make an accurate estimate? 5) The paper would benefit from some effort to use observations to confirm the modeling results. For example, the study concludes that the conversion of needleleaf to broadleaf forests will result in decreased SOA. Is there any evidence of this from field studies? Forests have compounds, such as sesquiterpenes, that are not considered in the study and could influence the results. It would also be useful to provide a few more details on what controls the model results. For example, what is the relative contribution of isoprene vs monoterpenes to SOA? What are the SOA yields used in the model?

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