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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ozone vegetation damage effects on gross primary productivity in the United States" *by* X. Yue and N. Unger

Anonymous Referee #2

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Yue and Unger provide an interesting article that estimates the impact of ozone on GPP in the US. The authors find that the inclusion of ozone reduces GPP in the US, primarily in the eastern half of the country. The ozone concentrations and GPP are evaluated against measurements, and the sensitivity of using different land cover datasets and meteorological datasets was also tested. Overall, this is a relatively clear and very thorough analysis of GPP responses and model sensitivities, though there are a few problems with methodology and analyses that need to be clarified.

The model bias is largest for C3 grasses, which the authors attribute to incorrect seasonality. It is not clear why the model simulates incorrect seasonality given that both LAI datasets are based on remote sensing observations, and the authors never clarify why or how seasonality might be the cause. One potential complication is the selection of

the Ball-Berry parameters, “m” and “b”, for the C3 grassland PFT types in Table 1. The authors have chosen to adjust these parameters for only the C3 grass PFT, while the C4 grass and crops use the same values as all the other PFTs. Traditionally, models that include photosynthesis, including the CLM, which the authors reference, use the same “m” and “b” values for all C3 plants and different values for all C4 plants because the photosynthetic physiology is so different for these two photosynthetic pathways. The fact that the C3 grasslands have such a large bias in their analyses suggests that this might be a serious problem with the methodology.

Throughout the analyses, the authors need to make sure they clearly distinguish when they are discussing observations or simulated results, and it needs to be clear whether the simulated results include or do not include the impact of ozone. Additionally, it would be nice to have a clear visual comparison of how the model, both with and without ozone, compares to the observation, followed with some statistical quantification of the comparisons. The only figure that currently visualizes this is Figure 4, which is very hard to understand given the small size of the 40 panels included. In the text, the authors allude to some statistical analyses that compare the model with and without ozone to observation (it sounds like they have calculated X2 and bias), and it would be helpful to have that summarized somewhere. Last, the authors continually stress that the change in response to ozone depends on the magnitude of GPP and use this to justify comparing observations with completely different model PFT. While the impact depending on GPP values is true in an absolute sense, the authors present many of their results as a % change, so the absolute magnitude of GPP should not matter. Additionally, this should not be used as justification to compare the observation of a C3 plant to a simulated C4 plant.

The authors include numerous figures, several of which should probably be moved into the supplemental material. Additionally, many of the figures need to be adapted to better summarize the information. Including 40 thumbnails or 40 bars in a figure is too convoluted, and the authors should consider summarizing the information included in

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a different way that can more clearly make their point.

Detailed comments are included throughout the manuscript.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/13/C12699/2014/acpd-13-C12699-2014-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 31563, 2013.