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Comment

Interactive comment on “Biomass burning related ozone damage on vegetation over the Amazon forest” by F. Pacifico et al.

Anonymous Referee #1

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This interesting article is a new-generation Earth system modeling study that provides a first quantitative estimate of the effects of ozone pollution from tropical biomass burning on plant productivity in the Amazon using a systematic set of sensitivity simulations with HadGEM2. The quantitative results show potential substantial effects on carbon uptake in Amazon.

The work represents a model sensitivity study. The word “Sensitivity” probably should appear in the title. The main problem is that there is no measurement data (field and/or lab) to constrain the effects of ozone on tropical vegetation. The algorithm was developed using information for temperate and boreal vegetation. It is not known or understood at all whether the tropical vegetation will be more or less sensitive than other biomes to a certain ozone level. Tropical vegetation has evolved under low at-
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mospheric ozone conditions. There is evidence that isoprene emission (high for the tropical broadleaves) confers ozone tolerance in plants (e.g. Lerdau, Science, 2007 and references therein).

The unacceptable dearth of measurement data in the Amazon and tropical regions in general is a much wider problem for our understanding biosphere-atmosphere interactions and the carbon cycle in this critical region. This paper is important because it shows evidence for a potentially serious ozone-carbon cycle feedback in this sensitive region and draws attention to the serious data deficit.

Other comments:

1. Has visible leaf damage to tropical trees ever been reported during/after the biomass burning season?
2. Much of the paper is devoted to understanding the model's over prediction of surface ozone at 2 sites in the Amazon. The overprediction is a problem since the damage depends on the absolute magnitude of the ozone concentration. The authors' honesty is appreciated. Connected to this issue, that is not yet discussed in the paper but should be, how well does the HadGEM2 model simulate the meteorology over the Amazon? Please include discussion of this validation, what does the model surface temperature, precipitation etc. over Amazon look like compared with observations? Does the model ozone bias occur everywhere in the lower troposphere? Or does the model do a better job of ozone simulation in heavily polluted regions?
3. Can you use satellite data of tropospheric ozone and NO_x to evaluate the model's chemical performance over the Amazon further?
4. "The decade-mean CO₂ atmospheric mixing ratio was 368 ppm". How sensitive are your results to this assumption i.e prescribed not dynamic CO₂ levels? I imagine the atmospheric CO₂ levels near the tropical leaves will be quite variable.
5. The simulations aren't fully coupled such that the loss of forest leaves due the

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fires does not manifest as a change in the dry deposition of the ozone (and BVOC emission), correct? How does this lack of full coupling influence your results? Is it possible that the observed ozone cycles at the 2 sites might be related to the change in deposition (decreased ozone loss) over the season, rather than localized production from fire emissions?

6. It is intriguing that the authors included domestic biofuel emissions into their analysis. Can they offer any reason why to do this? Isn't domestic biofuel a separate activity altogether? What are the emissions totals for each source in the region?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 19955, 2014.

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