Response to reviews

Reviewer comments are in **bold**. Author responses are in plain text. Modifications to the manuscript are in *italics*. Page and line numbers in the responses correspond to those in the ACPD paper.

Review #1

The manuscript 'Power plant fuel switching and air quality in a tropical forested environment' presented three sensitivity simulations to demonstrate that switching from fuel oil/diesel to natural gas as power energy can reduce maximum afternoon ozone In Manaus, Brazil.

1 - The idea, approach, and analysis are not novel, as the paper lacks sufficient new science to contribute what we know about ozone chemistry in a forested environment. Normally I would not recommend its publication in ACP.

We thank the reviewer for this perspective. We are not aware of similar studies on a tropical forested region like Amazonas. We believe that the present study is important for the tropical context. Any additional literature that the reviewer is aware of would be appreciated by us.

2 - However I do see the potential interests of such a study for Manaus, a fast growing city surrounded by tropical forests. The shifting in power energy matrix is very exciting and is expected to have substantial impact on air quality, particularly in Amazonia region.

We thank the reviewer for this recognition.

3 - Should it be published in ACP, a major revision is suggested to provide more science for ozone chemistry and/or anthropogenic emissions in tropical forested environment. A few suggestions but not limited as follow could really improve the quality of the paper:

We thank the reviewer for this perspective. The reviewer has highlighted ozone chemistry and/or anthropogenic emissions as the focus of the manuscript, but the author's intent for what we wish to highlight and accomplish in this manuscript is actually different. Ozone and anthropogenic emissions were meant by us as a "means" but not an objective. In this context, the "objective" is to use the prime opportunity of a rapid switch in energy matrix to have a look at general effects on air quality in a tropical, forested environment, and in that regard we believe that this study is the first of its kind. By our intent, ozone and anthropogenic emissions inventories are incidental or a "means to an end" to this primary objective. In this light, we authors needed to clarify the manuscript. The introduction is revised with the following clear statement:

Section 1, Line 96:

The study herein evaluates how a changing energy matrix in a tropical, forested environment affects urban pollutant concentrations. Ozone is chosen for detailed study because of the concern for human health and the susceptibility of its secondary production to factors at play in a forest environment. Manaus is chosen for study because of its location in the tropical forest, its size, and its shifting energy matrix. A large international experiment, Observations and Modeling of the Green Ocean Amazon (GoAmazon2014/5), was also carried out across two years in 2014 and 2015 in the Manaus region (Martin et al., 2016b), including aircraft flights (Martin et al., 2016a). A companion study by Rafee et al. (2017) compared simulated to measured pollutant concentrations for GoAmazon2014/5. The present study, which investigates how a shift in the energy matrix across a ten-year period affects regional air quality, provides interpretative context for the two-year experiment of GoAmazon2014/5.

4 - Validation of ozone and its precursors. We need to have at least some confidence on the model performance in this region. Given the paper was submitted to the GoAmazon2014/5 Special Issue, including some field campaign data for model evaluation would give the model credibility. A full evaluation of the model probably would be out of scope of the paper, but again, we need to at least know if the model does a fine job.

We agree with the reviewer that although a detailed analysis is out of scope a comparison between model and observation is important. Figure S2 was added to the Supplement to compare GoAmazon2014/5 observations and the present study's simulated ozone. Material was also added to the main text.

Section 3, Line 227:

As a check on the model output, a comparison between aircraft measurements of ozone concentrations and model predictions for Case B is presented in Figure S2

5 - There is some effort involved in development the emission inventory for this region, but again it is unclear to me how realistic the inventory would be. I would give the paper enough credit for just developing and presenting a realistic emission inventory for the region, given that widely used global inventories may do a terrible job here. This could be very useful for others doing research for this region too.

We thank the reviewer for acknowledgment of the value of the study.

6 - According to the Table 4, basically NOx emissions are predominately contributed by power plants, with vehicles only contributing to 0.3%-3%. This is

the fundamental to justify the ozone sensitivity simulations, and would need to be assessed.

We thank the reviewer for this perspective. However, we think that extra sensitivity simulations are out of scope and does not attend to our main objective. We evaluated the change in energy matrix, specifically on fuel burned by power plants. For cases B and C the reductions of NO_x emissions were of 60% and 89% in relation to Case A. Therefore, ozone production is sensitive to these changes in the simulations.
About the vehicle contribution in Table 4 (i.e., about 450 kg day^{-1}), the values are coherent to what has been reported in the literature proportionally to vehicle number and fleet age in Mexico City (Peritore, 1999;Molina and Molina, 2004). This fact emphasizes the importance of the paper because the main emission component (power plants) is going through a real fuel change in an unprecedented way in a tropical environment.

7. The discussion and analysis can be improved. One suggestion would be to demonstrate how ozone production efficiency changes among sensitivity simulations.

Although undoubtedly valuable, for the present study we believe the reviewer's suggestion is outside the scope of our objective. In this regard, please see response 6. The RADM2 chemical mechanism used in the simulations is developed and tested, and chamber experiments have been performed to evaluate the sensitivity and accuracy of chemical mechanism. Nevertheless, sensitivity simulations were performed previously by our group in other studies (Rafee et al., 2015;Rafee et al., 2017) changing the emissions precursors in 15% and 30%. The results demonstrated that the ozone concentration has a sensitivity to those variations as well PM_{10} and NO_x. Ozone concentrations do not linearly changes as observed in general for NO_x and PM_{10} in response to changing emissions.

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