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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of temperature-dependent NO_x emissions on continental ozone production" *by* Paul S. Romer et al.

Anonymous Referee #1

Received and published: 19 October 2017

This manuscript is well-written, within the scope of ACP, and provides valuable evidence for the increasing importance of emissions of NO_x from soils to ozone production as temperatures increase. This manuscript should be published after minor revisions detailed below.

General Comments

1. The finding of increased soil NO_x emission with temperature is valuable, and could be strengthened by a discussion of any known limitations on this effect, such as soil moisture or nitrogen availability. The authors discuss this briefly on page 12, but a more thorough discussion of what is known about microbes would be a valuable addition to

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Discussion paper

this manuscript.

2. The authors should improve the discussion of the effects of local meteorology on surface ozone. Jacob and Winner (2009) also discusses the strong positive relationship of ozone with temperature due to the association of temperature with regional stagnation. Was there stagnation on warmer days that would be a contributing factor to the ozone-temperature relationship? Convince the reader of the extent of the effect of the increased NO_x emissions on this relationship in the context of likely different meteorology on hot days.

3. A final valuable addition would be a statement about whether the authors observe any breakdown of the observed ozone-T relationship at the highest temperatures, as found by Shen et al, 2016 (GRL), or whether their approach could be applied to this problem as well or would be impacted by this phenonemon.

Specific Comments

Page 2, line 17-18 – Could you clarify the point of Berlin et al, 2013? They are talking about 'background' ozone coming in to Houston, and I don't see the connection between your point about rural ozone and this paper.

Page 4, line 23-24 – You say, "When HNO_3 is the most important NO_x loss pathway, O_3 production and NO_x loss occur through separate channels and can change independently." Can you clarify this? Aren't both pathways competing for NO_2, so they are not actually independent? In the example that follows, more explicit statements of what is happening would be useful.

Page 4, line 30 – It is unclear to me whether you include thermal decomposition of PAN for example here, so that if temperature goes up, the effective yield of the sink would go down and OPE would not be fixed. Also, if you are integrating over a day, do you think that ignoring deposition is at all important?

Page 7, line 18 – How does an average OPE of 45 compare to OPE calculated from your model of PO_3/LNO_x?

Page 7, line 19 – Why do you say there is no OPE trend, but then provide a value (0.2)? If it is not statistically significant, don't show a number.

Page 10, line 20 – You say, "The increase of PHO_x is mostly driven by increased solar radiation, and not by temperature directly." Could it not also be driven by increased water vapor with higher temperatures?

Page 12, line 22 – You say "These emissions cannot be regulated or controlled directly, and therefore present challenges to traditional air quality management techniques." Then this statement seems to be a contradiction - "Alternative approaches, such as changes to fertilizer application practices, have the potential to significantly reduce SNOx from agricultural regions (Oikawa et al., 2015)."

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