

Interactive comment on “The mechanisms and meteorological drivers of the ozone–temperature relationship” by William C. Porter and Colette L. Heald

Anonymous Referee #1

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The manuscript provides an interesting investigation on the causes of ozone concentration correlation with atmospheric temperature. This correlation has relevant implications connected to the climate change trends that is expected to increase future surface ozone concentrations. The manuscript provides a useful evaluation of the influence of the temperature depending emissions and chemical model mechanisms in comparison with the other temperature related meteorological forcings. The manuscript is well written and needs just few clarifications. The only part that can be improved concerns the discussion of the model limits that could have an impact on the proposed analysis (see detailed comments).

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Detailed comments

2 Model Description Page 3-4 It would be important to add information on limits and uncertainties of the computational schemes implemented in GEOS-Chem for the investigated Ozone-Temperature mechanisms. A general discussion of the known models limits/reliability based on existing literature and of the representativity of the used land and vegetation description datasets would be useful. Page 3 Lines 25-27 The Authors should comment the possible effect of the limited horizontal resolution of their simulations. The dilution of emissions at coarse resolution can cause differences in the simulated O₃ concentrations in areas characterized by high NO_x emissions, like urban areas, with what would be obtained at higher resolution (e.g. due to titration). Page 4 Lines 1-2 Are the mentioned differences between North America and Europe attributed to the different vegetation species present in the areas? What land-use/landcover datasets have been used? It would be relevant to comment the possible impact of vegetation cover description on the isoprene/terpenes emission (e.g. different broadleaf species can have large differences in isoprene basal emission factors and a “simplified” land cover mapping can cause a relevant bias in BVOC emissions). Lines 8-10 Does this mean that NO_x emissions from soil are generally underestimated? Even their impact on the O₃-T relationship should be considered underestimated? Lines 31-32 Does this mean that increasing temperature does not necessarily cause an increase of surface layer turbulence but can be associated to reduced turbulence e.g. in stagnation conditions? A reliable vegetation mapping can have relevant impact on dry deposition through z₀ and canopy resistance model. 4 Results and Discussion Page 6 Line 3 OLS stays probably for Ordinary Least Square. The acronym has not been previously introduced. Lines 3-17 O₃/T slope (Figure 4) seems overestimated for low observed values and underestimated for high observed values. Is there an understandable reason for this model behavior? Page 7 Lines 3-8 The comment suggest that deposition mechanism is scarcely relevant while Figure 5 suggests that its contribution is larger than biogenic emissions and similar to soil emissions in north America, while its contribution is the lowest in Europe. Lines 2-21 Figure 5 lower panel y-axis labels make

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difficult for the reader check the % values mentioned in the manuscript text. A different subdivision and maybe figure size would make the manuscript reading easier.

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