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Interactive comment on “Regional-scale transport of air pollutants: impacts of southern California emissions on Phoenix ground-level ozone concentrations” by J. Li et al.

Anonymous Referee #1

Received and published: 16 April 2015

The paper uses a regional modeling system to simulate ozone in the vicinity of Phoenix and perform a series of sensitivity studies to determine the relative contributions of local and distance sources on ozone in Phoenix. While the tools used are not novel and the model simulates processes that have been discussed previously in the literature (e.g. mountain-chimney effect), what is different about this paper is how the model has been used to simulate the regional scale transport from California to Phoenix at high spatial resolution encompassing this region. In this way, the effects of the complex terrain in California on the winds and transport are represented in a realistic way. The paper definitely demonstrates the importance of distant sources on local air quality. Overall,

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the methods used are sound and the discussion of the results is well organized, but some additional discussion is needed to clarify important missing information.

General Comments:

Although I found the model performance for the surface stations credible, there is no evaluation of the model aloft. The authors present several figures on transport aloft, but their analysis relies totally on the model. Including some observations aloft would have strengthened the author's assertions regarding transport. At a minimum, the authors should include some sort of analysis of the performance of the winds and temperature aloft. I understand there may be no data available on ozone and other chemical species aloft for the two case studies chosen. The authors should at least discuss the fact that many, many air quality campaigns have been conducted in the source region, California, in which aircraft measurements have sampled ozone and other trace gases aloft. It is reasonable to expect that at least some of these cases may have been suitable to study transport to Phoenix. Perhaps some discussion at the end of the manuscript could be added to state what sort of data is needed to further refine the analysis and better quantify the relative role of local and distant emission sources on concentrations in Phoenix.

Another area that needs additional discussion is the general meteorological conditions during the two cases and whether they are common or not. I assume that both of these periods are mostly sunny conditions? If this was for some other location, clouds would likely affect photochemistry at least somewhere in the domain. It is possible that there are mostly clear skies in these cases. Normally some sort of evaluation of cloudiness is needed as well in the simulation because of its affect on photochemistry.

Specific Comments

Page 8362, Line 5: Change "Control" to "control"

Page 8362, Line 7: Add "US" to Environmental Protection Agency.

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Page 8366, line 9: The authors should include which version of WRF-Chem is being used.

Page 8367, lines 9- 11: I do not think acronyms are needed for these areas are needed since they are not used that often and there is already plenty of acronyms in the text.

Page 8369, line 10: Which observations are being referred to? Are these all the stations shown in Figure 1b? Please be specific.

Page 8370, lines 3-5: The authors do not mention whether data assimilation is used in the present simulations or not. So I have to assume that it is not and that NARR influences the model simulation only through initial and boundary conditions. The domain is rather large, so the model could drift over a four-day simulation period. Given that the focus of the paper is transport from California to Phoenix and much of that transport is aloft, it would be useful to have some sort of evaluation of the model performance aloft.

Page 8370, line 6: As with Table 1, I would find 2 figures more useful. One showing the results for southern California and the other for those around Phoenix. The point of this paper is showing contributions of pollutants from California transported to Arizona, so knowing model performance in the source region is critical.

Page 8370, lines 16-22: I understand the authors are trying to note that the NEI05 emissions for their May 2012 case will be problematic, I find the justification about the reductions used in other studies is pointless since they do not try to adjust the emissions anyway. Those studies may use different reductions but none of them are likely to be “correct” since the model is not a perfect representation of real conditions. What they are simply doing is adjusting the emissions to best fit the model to observations.

Page 8371, line 2: The authors need to state how many stations are included in the analysis. Are these only for Phoenix or for a larger region? They should refer to Figure 1. Also it would be useful to segregate the statistics for those around Phoenix and those in southern California.

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Page 8371, line 14: Change “concentrations” to “ozone concentrations”. The NO_x and CO for the 2012 case are much higher than observed, however. So despite errors in precursor emissions, ozone still falls into the range of accepted EPA criteria?

Page 8373, lines 24-26: I am not convinced of this statement. This simulation includes ozone from the boundary conditions that varies in time as well. So the authors have not separated out just the biogenic contribution. There is some diurnal variability seen in the time series that does suggest a biogenic effect, however.

Page 8375, line 6: The authors mention the height of model levels 5 and 17, but do not mention what the height is for level 13.

Page 8379, line 16: Change “EPA” to “the US EPA”.

Figure 10: Include the date on the plots.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 8361, 2015.

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