

Interactive comment on “Modeling regional aerosol variability over California and its sensitivity to emissions and long-range transport during the 2010 CalNex and CARES campaigns” by J. D. Fast et al.

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Reviewer: Exhaustive examination of regional aerosol variability during the 2010 CalNex and CARES campaigns using WRF-Chem.

Response: We thank the reviewer for taking the time to read our long paper and giving us valuable comments, including many typos we missed in the original submission. We have revised the paper by taking into account the reviewer's suggestions and provide responses to the individual comments below.

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Reviewer: Suggest shortening abstract by at least 33%. I would also mention the overarching goals of CalNex/CARES within the abstract.

Response: The overall goals of the campaign are now included and the abstract has been shortened.

Reviewer: End sections 4.1, 4.2, 4.3, 4.4, and 4.5 with summaries of how well the model simulated the respective quantities: meteorological quantities (4.1), trace gases (4.2), etc.

Response: We have added short summaries to sections 4.2 - 4.4. Section 4.5 is shorter and therefore we thought that a summary was not needed. Section 4.1 has been moved to the supplemental information to shorten the paper, but a short summary is still included in the main paper.

Reviewer: How much of the high-bias in emissions is due to emission reductions between 2008 and 2010 and how much is due to a high-bias in the CARB2008 emission inventory?

Response: The reported trends in emissions during the decade would suggest a relatively modest reduction in emissions between those two years, which is smaller than the 50% reduction used in the 50%_ANT simulation. That suggests there are likely biases in the emission inventory itself, but we cannot quantify that without performing simulations for 2008. There would only be surface air quality data available for that period which not as comprehensive as the CARES/CalNex measurements.

Reviewer: Specific Comments: P7199L27: Needs a more specific web site

Response: There is a more direct link now available that will still be valid by the time of the publication, but it could be moved in the future so it is better to contact the first author directly for the datasets. Therefore, the link has been replaced and moved to the appendix along with some additional contact information.

Reviewer: P7200L12: Why did Shrivastava et al. adjust primary organic aerosol emis-

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sions by a factor of two?

Response: This was done to obtain a better agreement between simulated POA and HOA (a surrogate for POA) obtained from PMF analysis of AMS measurements. The text has been modified to clarify this point.

Reviewer: p7202L19: With respect to the "considerable differences" found by Knote et al., is there anything readers of this paper should know?

Response: As shown in Figure 2 of Knote et al. (2014), the differences vary from specie to specie. The results are presented as a histogram and the exact VOC scaling factors were not given in a table or in the text. For propene and ethane, emissions were increased by a factor of ~ 3 . For lumped alkenes, emissions were adjusted downward by a factor of ~ 8 . Other species are somewhere in-between. We have modified the text to better clarify the range of values used in that study.

Reviewer: p7205L30: What do you mean by smaller "wind speed statistics"? Please re-write.

Response: This was a poorly worded sentence and has been changed.

Reviewer: p7209L25: How much of models low bias for MVK+MACR is explained by these interferences?

Response: It is not possible to speculate. Liu et al. (2013) did not provide a quantitative estimate on the magnitude of the interference.

Reviewer: p7224L16: impact of the marine intrusions → After reading the following paragraph it wasn't clear to me what you meant by this statement. You focus on a refinery source as opposed to a marine source.

Response: The marine intrusions are responsible for transporting the emissions from the refinery source inland to Sacramento. The text has been revised to clarify.

Reviewer: p7240L9: Reducing anthropogenic emissions by 50% decreased isoprene

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and terpene concentrations by what percent?

Response: Not sure what the author is referring to in this line. In line 7 we state that changing anthropogenic emissions also affected isoprene and terpene concentrations, even though the biogenic emissions remained the same. The text has been altered somewhat to be more specific.

Reviewer: p7241L8: You state the MOZART boundary conditions are likely too high. Any thoughts as to why?

Response: There could be a number of reasons, including emissions in Asia that are too high, the lifetime of aerosols that are too long (either from how chemical aging is handled/or and rate of aerosol wet removal processes), or how MOZART treats dust. Dust in this version of MOZART is based on climatological values, which may or may not be applicable to the meteorological conditions during May and June of 2011. While it is beyond this study to evaluate MOZART, a sentence has been added at the end of Section 5 regarding the potential uncertainties associated with global model predictions.

Technical Corrections

Reviewer: p7189L10: evaluate the one configuration → evaluate one configuration

Response: Done.

Reviewer: p7189L12: sensitivity of regional variations in aerosol → sensitivity of aerosol

Response: Done.

Reviewer: p7189L18: contribute to errors (in what?) Response: Added "to simulated trace gases and aerosol."

Reviewer: p7189L26: some aerosol species (which?)

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Response: The species were sulfate and nitrate mentioned in the second half of the sentence. To avoid confusion, the first phrase of the sentence has been deleted.

Reviewer: p7199L19: are also been included → are also included

Response: Done.

Reviewer: p7200L18: model domain that encompasses → model domain encompasses

Response: Done.

Reviewer: p7200L19: grid spacing of 4 km is identical → grid space of 4 km. It is identical

Response: Divided the sentence into 2 sentences, but somewhat different than suggested.

Reviewer: p7202L9: consistent with trend → consistent with the observed decrease

Response: Done.

Reviewer: p7202L10: that has decreased the → over the

Response: Done.

Reviewer: p7203L14: optical properties variables from → optical properties from

Response: Done.

Reviewer: p7205L10: observed, but the largest biases are for → observed with the largest biases for

Response: Done.

Reviewer: p7209L24: PTR-MS as the → PTR-MS at the

Response: Done.

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Reviewer: P7209L25: may be expected to be larger than simulated → are likely to be biased high Response: Done.

Reviewer: p7211L2: Statistics that describing → Statistics describing

Response: Done.

Reviewer: p7214L18: detection range 80 → detection range of 80

Response: Done.

Reviewer: p7215L11: are higher than the observations at times → are occasionally higher than the observations at SPECIFY LOCATION(S)

Response: Done.

Reviewer: p7226: likely to low → likely too low

Response: Done.

Reviewer: p7232L25: contribute to a significant → contribute a significant

Response: Done.

Reviewer: p7237L8: may be due missing important → may be due to missing important

Response: Done.

Comments on Tables and Figures

Reviewer: Table 4: How is index of agreement defined?

Response: Added a sentence at the beginning of Section 4 citing the Index of Agreement.

Reviewer: Table 6: What are range gates?

Response: The radar wind profiler measurements are not made at a point, but are

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average values over a vertical layer in the atmosphere. Ranges gate is the term used to describe the vertical layer in the atmosphere that the measurements occur, analogous to vertical grid spacing in a model. The Table caption has been modified to clarify this point.

Reviewer: Table 4 etc. The RMSE contains a contribution from the bias. Consider replacing the RMSE with the centered root mean square error (i.e., the RMSE after removing the mean)

Response: This is a good suggestion, but we have decided to leave RMSE since it has been used in past studies in case readers want to compare these statistics with other studies.

Reviewer: Figure 1a: R/v Atlantis line does not show up well -

Response: A darker blue is now used.

Reviewer: Figure 1c: Acronym key would be useful

Response: Added to the figure caption.

Reviewer: Figure 3 caption should mention LA basin

Response: Done.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 7187, 2014.