

Interactive comment on “Estimating Criteria Pollutant Emissions Using the California Regional Multisector Air Quality Emissions (CA-REMARQUE) Model v1.0” by Christina B. Zapata et al.

Anonymous Referee #2

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The authors present an ambitious modeling effort to project air pollutant emissions from multiple sectors under differing climate policies at high resolution across California. In doing so, this study carries out a significant effort to simulate changes to technology, fuels and human activity for varying sources based on multiple models, datasets and careful assumptions. The paper describes a methodology that goes beyond prior attempts to project pollutant emissions changes associated with GHG mitigation strategies. The methodology and model developed will be a valuable contribution to the air quality and climate modeling communities. Additionally, the manuscript is well written.

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I believe the paper should be considered for publication in GMD. However, I have some concerns with the manuscript in its current form. These issues must be addressed before I can recommend publication. My comments are described below:

- My largest concern relates to the presentation of results under section 3 Results and Discussion. Although the authors describe the model's results and discuss some interesting findings, the section (particularly the plots and visualizations) should be improved to better communicate the study's results. Figures 10-15 are not informative. Figures 16 and 18 are unclear. The quality of all figures with maps in the section could be improved. Some specific comments are provided below. I encourage the authors to improve the manuscript's overall discussion of results.

-Although the study focuses on California, and the depth with which the authors model projected emissions within the state is a strength, the manuscript would benefit from including a discussion of the potential benefits and challenges associated with applying the emissions modeling methods used to other regions beyond California or at a national scale. Given the specificity of the analysis, it is difficult to identify which elements may be extended to other locations or to Policy/GHG/Energy projections developed with other models beyond CA-TIMES.

- Line 17: Change "play" to "plays"

- Cite references to strengthen the statements in lines 38-40, 40-41 and 42-44.

- The paragraphs from line 38 to 48 felt a bit verbose and off the point.

- Line 49: "Most previous attempts. . . focused on developing countries. . ." This is not correct; many studies have focused on the US.

- Line 53-55: Consider the study, by Zhang et al.; doi: 10.5194/acp-16-9533-2016

- Line 68: remove "previous"

- Line 81: define AB32

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- Line 82: Better explain “step function constraint”
- Line 88-89: How do projected energy consumption and population compare to current levels?
- Line 93: Change to “overview”
- Define acronyms upon first mention, e.g. EMFAC on line 105
- Line 117: Define VMT
- I found figure 2 hard to follow and not very informative. In the figure, I do not see where the 4 km² resolution is achieved or the 2010 emissions inventory is used. I would recommend simplifying this figure into a version that better conveys the overall process, without showing every step included in the algorithm.
- Line 129: Is there a reference for the 2010 inventory?
- Line 136: Is 2050 meteorology being used? If so, what is the source of this data?
- Line 148: This appears to be a second scaling factor, beyond that just described in equations 1 and 2. This can be made clearer in the sentence.
- Lines 148-151: It seems that there are 2 projections being used, (1) the projection from EMFAC (which also accounts for policy) and (2) the CA-TIMES projection. Are both projections fully compatible?
- Line 280: change 2050 to 2010
- Line 318: Define ROGs
- Figure 10: This figure should use the same scale on all panels to adequately contrast the emissions projected under the BAU and GHG-Step scenarios. It would also be useful to map the difference between both scenarios, as well as the difference between each and the 2010 emissions inventory. In its current form, the figure is not very informative.

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- The same observations mentioned above apply to figures 11-15.
- Lines 572-573: I'm not sure if this is clear; improving the figures would help.
- Figure 16: What are the units on the color scale?
- Lines 646-649: These sentences are unclear. Which are minor and major pollutants? this is not a typical classification.
- Lines 656-657: Cite literature supporting this.
- Lines 659-660: What is the rationale for this statement? PM_{0.1} is a component of PM_{2.5}, how are the health benefits amplified?
- Figure 17: The net total marker could be made clearer.
- Figure 18: The quality of this figure should be greatly improved. Label the panels, make the scale coloring uniform among them. What units are being used for NO_x? This shows the change with respect to BAU or 2010?
- Line 706-707: This sentence is unclear. How is the effect immediate?
- Line 11: What is meant by "second or higher rounds of emissions controls"?

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-176>, 2017.

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