

## ***Interactive comment on “Isoprene emissions over Asia 1979–2012: impact of climate and land use changes” by T. Stavrakou et al.***

**T. Stavrakou et al.**

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We would like to thank the reviewer for his/her positive evaluation of the manuscript and for the useful comments and suggestions. Below we address the raised concerns. The reviewer's comments are *italicized*.

*The authors present isoprene emission model output from five simulated cases, with each case beyond the first progressively adding additional corrections to the land-use, emission factor, and radiation inputs of the base case. Each of these corrections are explained and justified in detail, and the results of the final case are then compared to top-down isoprene emission estimates from satellite HCHO column measurements, showing good agreement in most areas within the examined domain. This work rep-*

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*resents an important contribution towards the evaluation and improvement of existing land-use and emissions datasets, thoroughly outlining the major factors influencing isoprene emissions in Asia, as well as the recent history of land-use and climatic changes in the area. The paper is generally clear and well-organized, and offers conclusions with clear importance to the atmospheric chemistry community, while highlighting the need for further research into emission measurement campaigns. Word choice, punctuation, and phrasing are occasionally awkward to my ear (and I have listed suggested fixes below), but never unintelligibly so. Overall this is a well-written paper with important contributions to future climate and air-quality modeling efforts.*

*General questions:*

- 1. Though the time series is short, there appears to be a decreasing trend in the difference between the bottom-up and top-down emissions estimates, as shown in Table 3. Is this an artifact caused by abnormally high and low discrepancies in 2007 and 2012, respectively, or is there any reason to believe that this could be indicative of some underlying trend in the error of either the top-down or bottom-up estimate?*

There is indeed a fairly continuously decreasing trend in the difference between top-down and bottom-up estimates over China as well as over the entire domain. Over Indonesia, India, Malaysia and Myanmar, the difference between bottom-up and top-down estimates remains approximately constant, and over Indochina, the year 2012 appears to be an outlier. The reasons for these (un)changing differences are unclear, but they do indeed indicate that the errors in either the top-down or the bottom-up estimates are not always constant in time.

- 2. The negative trend in isoprene emissions attributable to CO<sub>2</sub> is identified as approximately 0.15% yr<sup>-1</sup>, but is neglected in the analysis because this is “small compared to the trends associated with climate change.” However, in the conclu-*

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sion the primary cause for increasing emissions in Asia is identified as surface warming, with a net impact on isoprene emissions of around 0.2% yr<sup>-1</sup>. How can a negligible driver can have an impact only 25% smaller in magnitude than a primary one?

The referee is correct. We modified the paragraph as follows:

"Note that the increasing trend in CO<sub>2</sub> concentrations might have a significant impact on isoprene emission (Arneth et al., 2007). Using the simple parameterization proposed by Heald et al. (2009), based on the observed long-term response of isoprene to CO<sub>2</sub> changes for aspen trees, the CO<sub>2</sub> increase between 1979 (337 ppmv) and 2012 (394ppmv) is estimated to induce a decrease of ca. 5% in the isoprene emission, corresponding to a negative trend of 0.15%/yr. Although significant compared to the trends associated with climate change, it has been ignored here due to its high uncertainty, and because it is not a significant driver of interannual variability. "

*Suggested changes:*

1. Page 29553, lines 3-6: *"Finally, a decreasing trend in the top-down Chinese emissions inferred after 2007, is in line with the cooling episode recorded in China after that year, thus suggesting that the satellite HCHO columns are able to capture climate-induced changes in emissions."* -> *"Finally, a decreasing trend in the inferred top-down Chinese emissions since 2007 is in line with recorded local cooling, thus suggesting that the satellite HCHO columns are able to capture climate-induced changes in emissions."*
2. Page 29553, line 11: *Remove comma after "conditions".*
3. Page 29553, line 15: *Change "as measured e.g. by" to "as estimated by indicators such as"*

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4. Page 29554, line 1: *Remove comma after "uncertainties"*
5. Page 29556, line 3: *Add "and" after final comma.*
6. Page 29566, line 14: *Remove comma before "because of"*
7. Page 29566, line 14: *Remove comma after "reduced".*
8. Page 29567, lines 1-4: *I recommend completely reworking this sentence for clarity.*
9. Page 29567, lines 4-6: *"Moreover, the emissions are also reduced, by about 25% in Indonesia, due to the higher cropland fraction in S1 than in S0. Furthermore, the emissions are strongly reduced in the S2 scenario, by a factor of 2-3 on average, as already discussed in Sect. 4." replace by "The emissions are further reduced by approximately 25% in Indonesia due to the higher cropland fraction in S1 compared to S0, with additional reduction by a factor of approximately 2-3 in the S2 scenario as discussed in Sect. 4."*
10. Page 29567, line 12: *Replace "dominated" with "driven"?*
11. Page 29567, line 14: *Replace "all simulations, however" with "all simulations. However", and remove final comma before "due".*
12. Page 29568, line 16: *Remove space in "MetOp- A"*
13. Page 29570, line 4: *"comforting the strong emission reduction derived in the S4 simulation, compared to the much higher fluxes of the standard S0 scenario." replace by "supporting the strong emission reductions of the S4 simulation over the much higher fluxes of the standard S0 scenario."*
14. Page 29571, line 2: *Remove both uses of "by".*

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15. *Fig. 4: It appears that the bottom right panel has a misplaced % sign. Should it be in parentheses at the end, as in the top panel?*

All suggested changes have been introduced in the revised manuscript.

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