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Atmospheric Chemistry and Physics
Discussions

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

**Anonymous Referee #4**

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The paper presents an interesting evaluation of evolution of isoprene emissions in the last three decades over Asia using modeling driven by local land-use changes, climatology, in combination with top-down constraints from remote sensing and explicit consideration of recent field measurements at oil palm plantation and rainforest in Borneo. As field data of isoprene fluxes are extremely limited in Asia, satellite approaches seem to provide a robust approximation of the emissions.The top-down and bottom-up estimates seem to agree well overall and over specific subdomains including China, India, Borneo, Japan, etc. This paper can clearly be an important contribution attracting attention to Asia in terms of air quality and land-use effects, and gives the motivation for focusing more atmospheric measurements in that region.

Questions/comments:



1. Page 29554, Lines 7-11: "Moreover, Southeast Asia faced massive land use changes during the last decades, in particular deforestation and conversion of primary forests to croplands, leading to a decrease of isoprene fluxes, since crops are known to be weaker isoprene emitters than the forests they substitute."

Was the major expanding crop in Southeast Asia the oil palm? What fraction of croplands constitute oil palm plantations in Malaysia and Indonesia? As oil palm has an extremely high isoprene emission potential (e.g. Fowler et al., 2011), the statement could be true, if oil palm was excluded from the crops, but it is not clear in the text if this exclusion was made.

2. P29560 L.5 Treating oil palm as a separate PFT makes sense because it is a very specific crop type with orders of magnitude higher emissions capacities than most other crops. Was the expansion in oil palm area reflected in this PFT as the expansion in crop areas or how were crop and oilpalm PFTs separated and used in the model?

3. P29556 L21 Does the emission factor represent here the net flux above the canopy? If so consider adding this information.

4. P29568 L21 "HCHO columns and their error characterization are available at the TEMIS website (http://h2co.aeronomie.be)". I could not find any information on the error characterization at this link. It might be helpful to a reader to briefly describe the uncertainties here and if they are the same/different for the regions studied.

5. P29552. L21 "The impact of oil palm expansion in Indonesia and Malaysia is to enhance the trends over that region, e.g. from 1.17% to 1.5% in 1979–2005 in Malaysia." By comparing S2 and S3 for Malaysia (Table 2 and Fig. 9) it seems that this enhancement is very small. In fact the emissions seem very slightly lower in S3 than S2. Is it because the model is so insensitive to the oil palm expansion vs more extensive rainforest, or is there perhaps an issue with the crop/oil-palm PFT or crop/oil-palm emission factor? See also next comment.

6. P29564 L28: “While Indonesian emissions are increased, no significant change is found for Malaysia, where oil palm plantations were already considered as a major crop in the MEGAN distribution of emission factors.” The MEGAN paper (Guenther et al., 2006, P.3189) assigns different emission factor to crops where oil palm is dominant and different emission factor to the remaining crop areas, so I assume the former emission factor or the emission factor from Misztal et al., 2011 was applied to the Malaysian region. If so, it is still somewhat surprising that S3 did not increase significantly the emissions between 1979 and 2005 (Fig. 9), for example as implied by the trends in Fig. 2.

7. Some changes in the landcover-driving variables are attributed to a likely cause of significant changes in isoprene emissions (e.g., effects from the dimming due to aerosol or brightening due to reduction in clouds). This is very interesting over China where upward trend was observed in the base simulation and was further enhanced in S4 possibly by solar brightening in the isoprene-rich part of China. Could these changes in isoprene emissions result in a feedback on aerosol formation from isoprene oxidation and possibly induce the changes in the opposite direction?

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