

Interactive comment on “Leaf phenology as one important driver of seasonal changes in isoprene emission in central Amazonia” by Eliane G. Alves et al.

Anonymous Referee #2

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Alves et al. present a 7-month observation of isoprene flux in central Amazonia, and demonstrate the role of leaf age in controlling its seasonal variation. This study deserves documentation because it provides a long observational record of isoprene emissions and in-situ co-monitored leaf phenology, which is scarce in the tropics. However, I agree with the other reviewer that this manuscript ignores a pool of previous literature. Some other issues may need to be addressed as well before accepted for publication.

L64-68: What is the contribution of isoprene to total CO₂ emission in percentage? To my knowledge the number is very small.

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L81: “drivers of isoprene” should be “drivers of isoprene emissions”.

L83-88: “canopy phenology could therefore be an important seasonal driver. . .” Does the phenological control on isoprene emissions only occur through photosynthesis? Kuzma and Fall, 1993 suggested that the enzyme activity regulates the isoprene emission in response to leaf development. The authors may want to replace the sentence with a paragraph of literature review (including mid-latitude studies) on the theory and observations of isoprene emission versus leaf phenology. See review paper Harrison et al., 2013 (Table S2) and many others, Niinemets, Monson, Sharkey, etc.

L132: How did you choose the 5 or 6 days every month for measurement? What are the cloud conditions?

L305-314: In 2013, the monthly variation of satellite-derived isoprene emission is totally wrong compared to in-situ measurement. Is it because you only have a few days’ measurement each month? I suggest to include the 2013 satellite isoprene curve in Figure 3 for a direct comparison. Include both monthly average and the REA period average.

L333: Does Table 2 show R or R²? “Explaining 59% of variations” usually refers to R² values. The abstract should be consistent, too.

L342: “Regression” should be “Correlation”.

L352-362, Figure 6: No matter with EAF changes or not, the MEGAN monthly variations look more similar to the satellite-derived isoprene emissions. Again, is this because the in-situ observation only includes a few days every month? I wonder whether these days can represent emissions during the whole month. Is MEGAN run at a day-by-day basis? If so, the authors may try take out the MEGAN simulations during the same days as the REA measurement to see whether the correlations are improved.

Another possibility is soil-moisture dependence. Quite a few studies showed the importance of water availability, e.g. Pegoraro et al., 2004-2006, Zheng et al., 2015, 2017,

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etc. In Figure 3, observed isoprene flux shows a similar monthly pattern as the TRMM precipitation in dry and dry-to-wet seasons (when water is limited). The authors may want to do a MEGAN sensitivity test that includes soil moisture dependence or at least discuss the role of soil moisture in Section 4.1.

L434: The wording "during leaf phenology" is strange.

Figure 2, 3, 6: As a convention, the panel numbers (a)(b)(c) are usually placed in front of description.

Some references: Kuzma, Jennifer, and Ray Fall. "Leaf isoprene emission rate is dependent on leaf development and the level of isoprene synthase." *Plant physiology* 101.2 (1993): 435-440. Harrison, Sandy P., et al. "Volatile isoprenoid emissions from plastid to planet." *New Phytologist* 197.1 (2013): 49-57. Niinemets, Ülo, et al. "The emission factor of volatile isoprenoids: stress, acclimation, and developmental responses." *Biogeosciences* 7.7 (2010): 2203. Pegoraro, E., et al. "Effect of drought on isoprene emission rates from leaves of *Quercus virginiana* Mill." *Atmospheric Environment* 38.36 (2004): 6149-6156. Pegoraro, Emiliano, et al. "The interacting effects of elevated atmospheric CO₂ concentration, drought and leaf-to-air vapour pressure deficit on ecosystem isoprene fluxes." *Oecologia* 146.1 (2005): 120-129. Pegoraro, Emiliano, et al. "Drought effect on isoprene production and consumption in Biosphere 2 tropical rainforest." *Global Change Biology* 12.3 (2006): 456-469. Zheng, Yiqi, et al. "Relationships between photosynthesis and formaldehyde as a probe of isoprene emission." *Atmospheric Chemistry and Physics* 15.15 (2015): 8559-8576. Zheng, Yiqi, et al. "Drought impacts on photosynthesis, isoprene emission and atmospheric formaldehyde in a mid-latitude forest." *Atmospheric Environment* 167 (2017): 190-201.

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