

We sincerely appreciate the time and effort the reviewers have dedicated to evaluating our manuscript. Their insightful comments and suggestions have greatly contributed to improving the quality and clarity of our work. In the following, we provide detailed responses to each point raised by the reviewers. To facilitate readability, our responses are highlighted in blue.

Here are the technical corrections to implement before publication:  
L63 - It sounds like you are saying that you "fitted" the equation but isn't it just taking parameters from The Bucsela reference?

Bucsela et al. (2019, Fig. 11 (c)) provided data of PE (mol/fl) vs Flashes (kgl/h). We fitted these data to Equation (1) by calculating the parameters a and b. "a" and "b" were not given by Bucsela et al. (2019). This fitting can be applied in EMAC.

Eq1 - Don't a or b have units?

A and b are dimensionless. Since  $\exp(-a * \log(f)+b)$  must have the same units as PE (mol/flashs), we deduce that  $\exp(b)$  must also have units of mol/flashs. This means b must have the same units as the logarithm of mol/flashs, which is dimensionless (since logarithms take in a pure number). Thus, b is dimensionless.

Since  $\log(f)$  is dimensionless, and  $-a*\log(f)$  must also be dimensionless, it follows that a must be dimensionless as well.

We have included in the manuscript that "a" and "b" are dimensionless.

L280 - You haven't defined your significance test, so you can't say whether it's significant. What is it? a two-tailed t-test? and what p-value criteria are you using?

We have modified that phrase in order to provide more information about the significance:

"We use the mean and standard deviation to compute the p-value of a two-sample t-test to assess the significance of differences in methane lifetime. A p-value threshold of 0.05 is used to determine statistical significance. The results indicate that the differences between CTR and LNO<sub>f</sub>s are significant in the P and G simulations, with p-values of  $3 \times 10^{-3}$  and  $10^{-5}$ , respectively. In contrast, no significant differences are observed in the L simulations, as the obtained p-value is 0.2."

L342 - I think the grammar might not be working in this sentence. please check. "...by obtaining that tropical PE is only..."

This phrase has been grammatically corrected:

"However, Allen et al. (2019) used a similar method to derive LNO<sub>x</sub> PE within the tropics (including oceans), finding that tropical PE is only 10% lower than the midlatitude PE derived by Bucsela et al. (2019)"

Please provide an extra column in Table 1 to report total global LNO<sub>x</sub> production over the ocean for all simulations.

Done.