

This paper presents the experimental budget analysis of OH, HO₂, RO₂, and the sum of all three radicals (RO_x) at a site on the east coast of UK in summer 2015 as a part of the ICOZA campaign. The data was split into two subsets, i.e. SW and NW-SE, according to the wind sectors. The RO_x budget was closed within experimental uncertainty, indicating no significant missing primary sources or termination processes. The OH destruction rate was slightly larger than its production rate, indicating a missing OH production process. The most severe imbalance occurred in the HO₂ and RO₂ budget analysis. The HO₂ production rate exceeded the destruction rate by the similar rate as the RO₂ destruction rate exceeding the production rate. Such imbalance elevated with NO mixing ratios.

To reconcile the imbalance in HO₂ and RO₂ budget, the authors performed several sensitivity tests. The most efficient case was reducing the RO₂+NO reaction rate constant by a factor of 5. However, the change in the reaction rate constant contradict with literature reports.

The gross in situ ozone production rate was also calculated from observed and modelled radical concentrations. Large discrepancy was found in the ozone production rate derived from measured and modelled radical concentrations.

The results are of interest to the atmospheric chemistry community, to show key processes of RO_x radical chemistry and unveil missing chemical processes. The paper is well structured and nicely written. I am in favor of publication after some of the issue being addressed. Also, the author may consider to concise the writing so that the main message(s) can be more prominent.

General comments:

1. The uncertainty analysis is missing. The authors stated the experimental uncertainty of radical destruction rates. But what about the production rates? Was it possible that the RO_x budget in the SW air was also balanced if uncertainty of P(RO_x) was considered. It would be useful to add one vertical bar at the time when the discrepancy was largest. The paper discussed the possible mechanism behind the experimental budget imbalance, which was fine. But the imbalance in the HO₂ and RO₂ budget could also be explained by

measurement interreference, for example, the RO₂ measurement interference. An evaluation of possible interreference and its contribution to close/enlarge the imbalance of radical budget should be added in the revised version to complete the discussion.

2. I would suggest to add the time series of radical budget in supplement at least. So the readers could see the variability of the experimentally determined budget.
3. The selection of the amounts of X, Y, Z looks quite arbitrary. It would be good to reconstruct the context to give the reason why such amounts of X, Y, Z were used. The amount of X was chosen to be 100 ppt as suggested in another paper, which conducted at a very different environment. The simplification of X mechanism was not really correct as the X species will have impact on OH, HO₂, and RO₂ radical budgets. The RO₂→OH conversion is possible, such as RO₂ unimolecular isomerization, which should be nominated to a different term other than 'X'. Although I don't expect a big change to the HO₂ and RO₂ budget, it's more comparable to previous papers.
4. As the authors proposed that reducing the reaction rate of RO₂ to HO₂ propagation was the most likely explanation to reconcile the HO₂ and RO₂ budgets, should the P(Ox) also be calculated with the reduced reaction rate constant?
5. If HO₂ uptake and Cl chemistry was not important radical processes, I would suggest moving the relevant figures to the supplement and reduce the context further.

6. The first part of the discussion seems to be a repetition of what have been done and belongs to the conclusion. It should be shortened massively.
7. The comparison to previous works looks interesting and informative. Could it be able to summarize into a table with the three studies side by side?
8. The citations are not properly used. For example, Mehra et al. 2020, Slater et al. 2020, Whalley et al., 2020, the discussion version is cited while the final version is published. I also noticed the same problem occurs in the accompany paper. I do not have time go through the list, but I think mistake in the reference is not acceptable in any kind of scientific journals. Please carefully check all the reference list.

Technical comments:

1. Throughout the paper, it should be the rates of production and destruction. Most of the sentences miss the word 'rate(s)'.
2. Line 106. It's not a good argument that H_2O_2 , ROOH and etc. were not measured so they are not considered in the radical budget. I think the contribution of these species is not important. Please give a rough estimate of these species and contribution to the radical budget first and say why they are not included.
3. Line 135. 'do not'
4. Line 212. Could you give an estimation on how much radical can be produced from $\text{NO}_3 + \text{VOC}$?
5. Line 231. The number is different from the figure.

6. Line 247-250. I don't get the picture why to split the data into two sectors. How significant are these two air masses different? I cannot really see from the radical budget analysis.
7. Line 258. Be more specific on what is the difference in VOC.
8. Line 264-266. Better rephrase this sentence to be clearer.
9. Line 302-310. The contribution of different species is better scaled to measured k_{OH} rather than calculated k_{OH} . The same applies to Table 2.
10. Line 306. 'Small but significant' sounds like a statistic phrasing, which may not fit in the current sentence.
11. Line 350. Is there a reason or reference to support this speculation?
12. Line 358. wrong citation format.
13. Line 403-404. Better to rephrase it to be clearer.
14. Line 408. 'HO₂+NO' looks confusing.
15. Line 411 E13. The RONO₂ formation should not be a O₃/NO₂ loss. I guess the authors are referring to PAN formation, i.e. RO₂+NO₂?
16. Line 430 and later on. 'FAGE-calculated' looks like a lab jargon. Maybe better to use derived from measurements or others.
17. Line 449-450. Not really needed this sentence.
18. Line 478-481. Better to rephrase it to be clearer.
19. Line 491. What does the 'complete' mean?
20. Line 502. How the ozone increase was calculated?