

Review of “The impact of monoaromatic hydrocarbons on OH reactivity in the North Sea boundary layer and free troposphere” by Ledster et al. in *Atmospheric Chemistry and Physics Discussions*

The authors present the offline analysis of several volatile organic compounds with special emphasis on monomaromatic species in whole air samples collected during research flights in the free troposphere and marine boundary layer off of the western and southsouthern coasts of the UK. The correlation of monoaromatic species to toluene are used to assess the relative importance of the C8-C10 aromatics on the calculated OH reactivity using the Master Chemical Mechanism (MCM).

The paper is well written and useful to the larger scientific community. I recommend publication after the following comments are addressed.

Major comments to be addressed:

All ambient air samples from the WAS must pass through the cold finger at -30 °C. This is at a sufficiently cold temperature to remove a significant percentage of the higher aromatic species that are targeted in this analysis due to their relatively low vapor pressures. Were calibrations conducted with the gas standards going through the cold finger?

Were tests run to measure the transmission efficiency of the WAS (i.e., fill the canister with a known calibration standard to ensure that none of the heavier aromatics are lost to the walls or other surfaces)? The fact that two different measurement techniques were able to accurately measure what comes out of the WAS does not directly address the question of what was actually in the WAS to begin with. Comparison to other in-situ measurements would be useful if available. Otherwise, laboratory tests or an appropriate reference to prior lab tests should be included.

What procedure was used to quantify individual peaks? For example, are the individual components quantified via 1-D maximum peak height, 2-D peak area, or 3-D volume?

P32434 L13 and Figure 5: Why were the intercepts set to 0? Since toluene is the longer lived species, one would expect the y-intercept of the VOC-to-toluene correlation to be small and negative but not negligible.

P32435 L20-22: The authors state that the additional monoaromatic species may have a considerable effect on the OH reactivity because the combined reactivity is twice that of toluene, however, what is the potential effect on the total OH reactivity (OH + CO, CH₄, NO₂, all other VOCs)? Is toluene and therefore the monoaromatic VOCs large contributors overall?

Figure 8, Right panel: A vertical profile would be much more useful. This would include the altitude on the y-axis and the J_{tol} on the x-axis. The flight track (non-colored) could be added to the panel on the left.

P32438 L9-L11: The difference of 1.9 s^{-1} is labeled as significant, but there are not enough statistics provided to support this designation. What is the uncertainty on the measured k' ? What was the overall OH reactivity (i.e., provide the relative difference not just the absolute)?

Wording, Clarity, etc.:

Title: While “North Sea” is accurate, it generally implies a much more remote location. I would suggest changing the title to include “coastal UK.”

P32427 L5: Define RONOCO. Is there a website or an overview paper that could be cited here?

Section 2.2: One suggestion is to structure the gas sampling section so that the description is in the order that the gas sampling actually occurs. For example, start with pre-sampling steps such as the line purging. Second would be the control of the WAS as detailed on P 32429 L8-19. Next would be the description of the cold finger and finally the Unity 2 system.

P32428 L24: I assume the “sorbent trap” is the same as the “cold trap” in Fig. 1. If so, it would be best to use consistent nomenclature.

P32430 L24: The authors describe the GC as a “*single* column dual channel FID” and then state on L26 that the system uses two columns running in parallel. I believe the intent was to say that each channel uses only a single column, but to avoid confusion I would suggest rephrasing L24 to simply read “dual channel FID.”

P32432 L10-11 and thereafter: The instrument names now include “TD.” Naming should remain consistent.

P32436 L8 and L13: The instrument name now includes “FGAM-DC” which is not consistent with previous designations.

Figures and Tables:

All legends and fits should have larger font in all figures whenever possible.

Figure 1: I am confused on the designations of “no flow” and “pressurized, but no flow.” Clearly, there must be flow from the WAS to the cold trap. Perhaps this is the schematic for the final phase of sampling rather than the entire process? If so, this should be clearly stated or the entire flow path for the entire sampling process should be shown. What is the unlabeled yellow box at the top of the figure?

Figure 6: Black markers should be labeled as GCxGC-TOFMS. The colors blue and black are particularly hard to distinguish in this figure.