

## ***Interactive comment on “Non Methane Hydrocarbon (C2–C8) sources and sinks around the Arabian Peninsula” by Efstratios Bourtsoukidis et al.***

**Anonymous Referee #2**

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This study reports the observed mixing ratios and relevant enhancement ratios for simple hydrocarbons including the light alkanes, alkenes, and C6-C8 aromatics via shipborne measurements conducted around the entire Arabian Peninsula on two separate transects. The authors collected high-quality data in an understudied region that contains many diverse emission sources including shipping, urban, oil and natural gas operations as well as very clean conditions with signatures of biogenic marine sources. Each of these sources was carefully identified using literature values and back trajectories to help determine likely source regions. The authors investigated how various emission source profiles and/or atmospheric oxidation would impact the observed enhancement ratios and variability in observed mixing ratios.

C1

This was a well-written manuscript. I recommend publication after a few small changes/clarifications.

Technical comments in order of appearance:

P1, L14 – Specify “This region...” as the Middle East, Arabian Gulf, etc., which ever term is most appropriate.

P3, L30 – “...uses a dual-stage pre-concentration principle, additionally equipped with a focusing trap and a stripper column...” It was unclear to me if the focusing trap and the stripper column were part of the “pre-concentration principle” or occur after the sample pre-concentration. What exactly does the stripper column do? Does it remove the permanent gases, the lightest alkanes, etc.? A little more information would make this clear to the readers.

P4, L17 – I would state the differences as factors as it is easier to quickly comprehend (is 120% = a factor of 2.2 or 1.2?). Be sure to include the sign of the “difference,” i.e., positive or negative artifacts.

P7, L22 – Please clarify what “this geographical demarcation” means. Do you mean “each region”? Perhaps, consider combining Figures 1 and 2 for ease of comparison with this statement.

P8, L1 – Curious! Did you observe a diurnal profile in ethene in this region, increasing with daylight hours? The marine boundary layer height usually doesn’t change much over open water, so a diurnal profile (particularly higher daytime concentrations) would bolster your hypothesis of a photo-sensitive marine biogenic source.

P8, L7 – “Interestingly” appears five times and starts to become a bit redundant after the second time. Please consider using sparingly, especially since it is a subjective term.

P8, L14 – Why would you “account for both isomers” when referring to the butanes? I’m not sure what is gained from that.

C2

P8, L29 – Figure S20 does not show that the benzene to toluene ratio only the distribution of the mixing ratios. You could easily show this in a separate graph. Please include references or how you came to the conclusion that benzene/toluene > 1 indicates fresh ship emissions and/or biomass burning.

P8, L32-33 – Please list what the “marine traffic associated gases” are or refer to Figure 6 to be discussed in section 3.2.1.

P13, L12 – A pie chart similar to the ship emissions detailing the composition of this sample would be great to include, even in the SI.

P13, L13-14 – The authors state that it is a crude oil slick (L11), but are now calling it “associated gas.” Also, beware of the “weathering effect” of oil slicks as the most volatile species tend to evaporate first and do not necessarily represent the actual composition of the starting material.

P31 –Include the region names as you did with the previous table. Also, are propane and methane really tracer compounds? If so, of what? Best to keep it simple and just state that you are presenting the VOC to propane or methane observed enhancement ratios.

P38 – Ethane was lower inside the ship plume than the background values?

P41 – Include what the picture is of and any photo credits. I'm assuming it's of THE oil slick, not just a random oil slick, but I'm confused as it looks like barbed wire is in the foreground(?). This makes me think that the picture was not taken from the ship. Perhaps best to simply leave out.

P44 – Check the caption. Replace pentane with butane. There are also red bars for case study #1.

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