

The manuscript “Source attribution of methane emissions from the Upper Silesian Coal Basin, Poland, using isotopic signatures” by Alina Fiehn et al., calculates the isotopic source signatures of  $\delta^{13}\text{C}$  and  $\delta^2\text{H}$  from the airborne samples and the ground-based samples using the Keeling method which later helps to constrain the different source contributions for coal and biogenic emissions.

Overall, this work provides important information and data about isotopic source signatures. The isotopic signatures analysis is presented in a straightforward way which is easy to understand. The manuscript is written and structured well. Therefore, I suggest it to be suitable for publication in ACP after addressing specific and technical comments as listed below.

**Specific comment:**

1. L210: how to obtain the uncertainty of  $\delta^{13}\text{C}$  showed in Figure 3?  $\delta^{13}\text{C}$  is the interception for the fitting line and how do the authors define the uncertainty?
2. L224: authors mentioned that “the signature of all inflow samples....indicates that the  $\text{CH}_4$  enhancements in the upwind boundary layer are mostly biogenic, but with a fossil influence”. But from figure 4, the IN symbol and its error bars are all located in green shaded area, i.e., EMID modern microbial. I do not fully understand why there is a fossil influence.
3. L 250, Table 1: are the values of the isotopic composition and standard error originated from all flasks during each flight or only from the flasks in PBL? Please specify it.  
I suppose the symbol “#” presents the number of flasks. Maybe No. is better for understanding.
4. L253, Figure 4: I think the individual source signatures (with black symbols and numbers) represent the results originate from the flasks in PBL. If so, please specify this information, otherwise, it is misleading.
5. L267: “ $\delta^{13}\text{C}$  signatures from all samples are in the same range (not shown)”. It would be interesting to see the results. Maybe put it in the appendix.
6. L269: “...with one signature at -38 ‰.” I assume that you mean this value is out of the main range. Perhaps change it to “with one biased signature at -38 ‰”.

7. L278: “The aircraft samples showed average  $\delta^2\text{H}$  signatures for the southern region, but the southeastern mines had lower  $\delta^2\text{H}$  signatures than the entire USCB.” I assume the aircraft samples indicate the dots in Figure 3, and the cyan square symbols in Figure 4. If so, in my opinion it would be beneficial to show another figure (like in the appendix) to better present the statement. The coordinate-related information cannot be found from Figure 3 or 4. If the “aircraft samples” represent the isotopic source signatures in PBL shown in Figure 4., it is the southwest but not the southeastern mines having lower  $\delta^2\text{H}$  signatures. Please comment.
8. L339: “For comparison, the EMID includes  $\delta^2\text{H}$  signatures from 7 landfills ( $-275 \pm 21 \text{ ‰}$ ) and signatures from 6 wastewater facilities ( $-323 \pm 14 \text{ ‰}$ ) across Europe. The average signature over all these data points is  $-297 \pm 30 \text{ ‰}$ .” I assume that the average signature from the  $7+6=13$  sites is calculated based on weighted average. How about the uncertainty? Is the error propagation or other method used? Please comment.
9. L343: “we assume that the USCB  $\delta^2\text{H}_{\text{bio}}$  signature for waste emissions is  $-300 \pm 20 \text{ ‰}$  for our study”. Is the mean value of  $-300\text{‰}$  from the global modeling as mentioned in L341? This value does not match with the mean value of biogenic signatures shown in Figure 7. Additionally, from where the uncertainty of  $20\text{‰}$  come? Please specify.
10. L351: CAMS-REG-GHG inventory has been updated to v5.3 in 2022. There might be no huge difference between v3.1 and v5.3. It is for your information.  
It would be also beneficial to compare the spatial distribution of gridded inventory and the results here. Will the CAMS inventory in the southwest area tends to have more biogenic sources?

**Technical comment:**

11. L100: the subscript in the “ $\delta_2\text{H}$ ” should be superscript.
12. L162: not fully understand the sentence “For each of these categories we determined the mean isotopic signature from all flights combined and for PL samples also for individual flights.” Please rephrase.

13. L199: please keep consistent format for  $\delta_x$  in equation(3) and afterwards. The  $\delta_{obs}$ ,  $\delta_{bg}$  are in bold in previous text.

14. L264: I think this sentence has a grammatical error. “This variability may result from different areas of the mine being exploited as longwalls at different depths of the mine are opened up or shut down during excavation.”

Maybe change to “This variability may result from different areas of the mine during longwall exploitation at different depths of the mine which are opened up or shut down during excavation” Please rephrase.