The authors demonstrated the application of a laser-based instrument to measure the mole fraction and isotopic composition (d13C and d18O) of CO2 in the field. The authors address the calibration protocols and the effect of matrix effect in the air used to dilute pure CO2 in detail. They classify and identify the airmass that reaches their measurement station based on the metrological data (wind direction), radon measurement, and HYSPLIT back tractor. The main focus of the manuscript is on the characterization and calibration of the Delta ray IRS. My main concern as stated in the manuscript, Thermo already ceased manufacturing such an instrument, as a result, it will be important how the calibration and performance evaluation used in this manuscript for Delta ray IRS will benefit other laser-based instruments that measure mole fraction and isotopic composition (d13C and d18O) of CO2.

General comments

1. Arranging the order of figure numbers as they appear in the text will increase the readability of the manuscript
2. In some places there are typos for instance "Line 66: - … deployed the then… "then should deleted

Specific comments

Line 16: - they achieved a precision of 0.07 and 0.06 per mill for d13C and d18O respectively, within the WMO range (again 0.1 per mill). However, online 25 you mentioned a different precision for the WMO network compatibility goal. The difference is not clear, it is also not explained in the main body of the manuscript. This requires attention in the main body of the manuscript since your goal is investigating the capability of Delta ray IRS to achieve the precision recommended by WMO (this is also mentioned in the conclusion section)

Line 39: …. ratio ratios in CO2? delete ratio, maybe even you could rephrase it as… similarly, d18O-CO2 have been used ……
Line 42: - GPP estimates ◊ GPP estimate, and if you include the number 30%, it is necessary why a d18O-CO2 based estimate is higher than the previous GPP values?
Line 65: - the production of the instrument is discontinued by Thermo
Line 66: - … deployed the then… remove then
Line 67: - ….to resolve variation ranges in both…. Should read ….to resolve variations in both…
Line 136: - what is the precision of the mole fraction with the Picarro and with GC since you are measuring with a precious of 0.07 ppm for the CO2 mole fraction using the Delta Ray IRS
- Name and address for Picarro company
- Name and address of the IRMS Company
Table 1:
- why for Kapuni and Marsden you did not use +/- for the uncertainty of delta 13C and d18O values where you give +/- for other gases
- The uncertainty for QC-5 CO2 mole fraction is higher compared to the other standards and it is much higher compared to the precision of the Delta ray IRS
- u_CO2 is better if you define it with parenthesis in the table legend.

Line 170: - How did you come up with a flush time of 150 seconds? Do you already test the memory effect and the optimum value is 150 seconds? It will be good if you add a sentence about how you decided to have a flush time of 150 seconds.

Section 3.3.
- the conversion of transmission to ppm is not clear
Line 70: - This Allan deviation value requires the integration time and the precision of the measurements depends on the integration time the samples are measured?

Section 4.1:
- Allan deviations are dependent for each laser instrument, why the authors assumed the Allan deviation is similar to the previous instrument or is this confirmed by the company
Section 4.2:

- Figure 4:
the figure requires a legend for QC 1 and QC2. For the $CO_2$ mole fraction measurement, for QC with a red marker is more stable, however, we did not see this for the second QC (with a yellow marker).

Line 293: - the second hypothesis, why instability in the referencing step only affects the isotope composition (d13C and d18O) without affecting the $CO_2$ mole fraction?

The paragraph started from Line 330 to 346, for some of the instruments the company name and address are given, however, for some of the instruments it is not provided.
Line 360: Why does the radon measurement contradict the HYSPLIT back trajectory for S1 and S3? It will be good to add a sentence about this difference.

line 380: - Does the instrument measure cell pressure, temp, etc.? I am wondering if a sudden drop in cell pressure might cause such an effect on the isotopic composition?

Line 403: - Why do the cylinders or pressure regulators only affect the mole fraction of $CO_2$?
Line 528: include the error for the average d13C value

Line 530: - To see the negative correlation from figure 11 easily it is better to change the axis label for the d13C from low to high value similar to the $CO_2$ mole fraction (Figure 11 C) and d18O (Figure 11 A)


Figure 14 and in other figures add the error (uncertainty) for the slope and intercept of the linear regression

Line 527: Section 7.3. The message is not clear, the section moves from one reference to another. I recommend reformatting the section: give the summary of the main finding first, then the similarities and differences from other studies.

Line 642: The authors describe an increase in the d18O and d13C of $CO_2$ in nighttime due to respiration and anthropogenic activity. Plant respiration might be a possibility of enrichment when we CO2-H2O exchange with leaf water and soil water assuming the d18O of leaf and soil surface water is enriched compared to the ocean. How combustion would cause an enrichment in d18O of $CO_2$? Paragraph line 637, explains a depletion in the d18O due to

CO2 exchange with depleted water. Is it not in contradiction with the paragraph that started line 642? These arguments need more clarification, maybe using a leaf water record.