Review of: Measurement report: Method for evaluating CO2 emission from a cement plant by atmosphere O2/N2 and CO2 measurements and its applicability to the detection of CO2 capture signals

This is an interesting paper that presents important data and should be published. I have a number of suggestions for improvement, however. Most of my comments are minor.

1. Don't think you need "Measurement report" in the title
2. The title doesn't sound quite right to me. I think "by atmosphere O2/N2 and CO2 measurements" should be "using atmosphere O2/N2 and CO2 measurements"
3. In a few places you have written "CO_2 emission", I think it should be "CO_2 emissions". Emissions are usually written as a plural.
4. The O_2/N_2 and CO_2 are referred to as "amount fractions", I think it should be either "mole fractions" or "molar fractions".
5. In some places you use "analyses" and I think it should be "analysis". If you're referring to one study, you use the word "analysis." But when you're referring to multiple studies, you use the term "analyses." Also, you use "analyzed" and I think this should be "analysed".
6. Need to be careful when using the words "significantly" & "significant" as this usually implies some sort of statistical test with a p-value. In some places maybe change it to "substantially".
7. Lines 16-18: "The simulated CO2 amount fractions were converted to O2 amount fractions by using the respective OR values for each of the incorporated CO2 fluxes, and then simulated OR values were calculated from the calculated O2 and CO2 amount fractions." Rephrase this sentence as it is difficult to follow, its sounds like you used OR values to calculate O_2 and then used O_2 to calculate OR values.
8. Line 30: Should probably also include here reference for Pickers et al., 2022, Science Advances
9. Lines 32-34: These ratios are typically very stable/ tend not to vary very much. The analysis you do later on is only possible because these ratios are so reliable so need to say so somewhere. Also, mention here that 1.4 is global average for fossil fuels, as you use the 1.4 ratio later on.
10. Lines 34-36: "Therefore, atmospheric O2 and CO2 fluxes due to terrestrial biospheric activities and fossil fuel combustion (excluding cement production) vary in opposite phase." This sentence needs to be reworded, as respiration in the terrestrial biosphere takes in O2 and releases CO_2 which is the same phase as fossil fuel combustion.
11. Line 39: There is a full stop at the end of the equation which I don't think should be there.
12. Line 43: I think "global fossil CO_2 emissions" should be changed to "global fossil fuel CO_2 emissions"
13. Line 70: It says that you have been continuously making measurements since 2017. That implies that the measurements are still ongoing. But if that is the case, why are you only using measurements until 19th November 2018? If you have more data for 2019 to 2022 you should include this, as at the moment you only have 16 months of measurements, and more measurements to base the conclusions on would make the study better.
14. Methods: In the first paragraph of the methods section, say that the measurement site is on the coast.
15. Line 86: 1/0.2094 is 4.78 to 2 decimal places and 4.8 to 1 decimal place. I'm not expecting you to change it for this article, because it will make a tiny difference, but in the future, you may want to think about whether you really want to round it to 1 decimal place. I think lots of studies instead of dividing by 4.8, will multiply by 0.2094. This is a wider problem within

the O_2 community, but we should probably try and have O_2 datasets produced using the same method, so different groups can be compared.

16. Line 96: Should probably say something like, “gaps in the data due to routine calibrations, maintenance and technical issues”. I can see from Figure 2 that there is a gap at the end of August/ beginning of September 2017. Might also want to say that there are X number of data points or what percentage of the time period has data.
17. Line 97: I think you need more detail about the measurement system, instead to referring the readers to another article. Add in a sentence or two summarizing the measurement system. Then you can say “for more information see Ishidoya et al. (2017)”.
18. Line 108: You talk about the CO_2 calibration scale but not the O_2 scale. In Figure 2 the O_2 data is 0 to -300 per meg so you can’t be using the Scripps scale. Need to add information about the O_2 calibration scale.
19. Line 120: Should probably explain what “clinker” is.
20. Results and discussion: There is only just over 1 year of measurements so need to be careful about the wording when talking about the seasonal cycle. In order to properly investigate seasonal cycles at least a few years of data are needed. So try rephrasing to something like "over one year of measurements CO showed a seasonal cycle with" or “in 2017/2018 the seasonal cycle was”, etc.
21. Lines 132-135: It says that O_2 exchange is faster than CO_2 but I’d actually put the timescales in here, O_2 is about a month and CO_2 is about a year.
22. Line 145: Change “1-week average” to “1-week rolling average”
23. Line 153: I think you need to explain more clearly what the ratios tell you. 1.05 to 2.00 indicates terrestrial or fossil fuel. Anything lower than this indicates cement as the 0 ratio mixes with the surrounding air that has already been influenced by terrestrial or fossil fuels pulling down the ratio.
24. Lines 157-160: Why did this study choose these particular 5 months to focus on? Does this mean that not every month has evidence of cement production, or these were the months where the evidence was largest? And if so why do you think this is, there was less cement production taking place at the plant then, or air was coming from the direction of the plant less often?
25. Lines 157-159: “In October 2017, short-term variations in observed CO2 and d(O2/N2) were opposite in phase, and the amplitudes of some CO2 variations were larger than those of the corresponding d(O2/N2) variations. This result suggests an effect of cement production.” I think these two sentences don’t join together properly. CO_2 & O_2/N_2 opposite in phase doesn’t suggest cement production, CO_2 increasing and O_2/N_2 staying the same would suggest cement production.
26. Line 168: Change “land biospheric” to “terrestrial biospheric” as that is what you have used everywhere else.
27. Lines 191-192: Used “however” twice in two sentences.
28. Line 208: Change “This means CO2 presumably as well” to “"This means CO2 is presumably released as well"
29. Line 213: “$CO_{2cement}$”
30. Summary: Articles usually include something about “next steps”, how the research could be developed in the future.
31. Also say something about the limitations of the study. Although the limitations can go in the results and discussion section if you think it will fit better there.
32. Line 284: In the acknowledgments change “observation” to “observations”

33. Lots of Figures: Figure 4 and Figure 5 are actually 5 figures each, (a-e) for each of the months. I think this is probably too many figures. Could you try combining them in some way, or choose an example month and move the others to the supplement.
34. In Figure 2 and the top panels of the Figure 4's CO_2 is in units of µmol mol-1. Isn't this just ppm units, that is what most people are more familiar with?
35. Figure 2 Caption: Change "1-week average" to "1-week rolling average"
36. Figure 2 Caption: Add something about how the CO_2 & O_2 y-axes are scaled to be visually comparable or the O_2 y-axis is 5 times larger than the CO_2 y-axis or something like that.
37. Figure 2: Could you add another panel for the Oxidative Ratio. I know we can see it for some of the individual months but I'm curious to see it for the whole time period.
38. Figure 3 Caption: "Severinghous"
39. The supplement doesn't include any of the model output or the CO measurements.