Yates et al. present an instrument to measure CO and N_2O aboard high altitude aircraft. They describe the modifications they made to a commercial analyzer in order for it to perform on an aircraft platform that samples up to 18 km in the atmosphere and in very cold and warm/humid conditions. They compare their CO measurements from one campaign on a NASA WB-57 platform to two other instruments that measured CO. Correlation slopes between the other two instruments vs. the instrument described in depth in this manuscript had slopes that ranged from 1.10–1.15 and 0.94–1.10, respectively, depending on the flight that was compared.

Overall, this paper described modifications to a commercial instrument that could be helpful to the scientific community aboard high-altitude aircraft. However, I think the authors should go into more details on both the modifications and for the other CO instruments that were compared to. Therefore, I think major revisions are necessary.

Response: The authors would like to thank the referee for their review and comments; we feel the revised manuscript has been significantly improved as a result. We have responded to each comment separately below, our response is in italics.

First, more detail is needed for the inlet diaphragm pump assembly. For example, the I was surprised that the calibration bottles were not inserted into the sample flow upstream of the diaphragm pump. Were any tests done in the lab to show that this pump did not affect the CO or N_2O measurement? What material were the diaphragm parts and seals made of?

Response: We have added more details to the 'flow system' section. Re calibration bottle's location: The inlet diaphragm pump was installed upstream of COMA to increase the inlet pressure when sampling ambient air at high altitudes. Multiple testing in the environmental test chamber allowed us to evaluate the instruments performance under reduced pressure (and temperature). We found an ideal operating cell pressure of ~52 Torr. The upstream pump allows for this cell pressure to be maintained, up to 18 km altitude with existing instrument orifices/ vacuum controller conductance's. Because outlet pressure from the calibration bottles is maintained it was not required to flow through the inlet diaphragm pump) prior to sampling. Re testing/pump: No prior testing was done on the pumps effects on CO/N2O. However, upstream KNF's pump have been used in prior studies measuring CO and N2O (e..g. https://amt.copernicus.org/articles/12/637/2019/amt-12-637-2019.pdf)

Along those lines, I am not aware of people using Teflon FEP tubing to measure CO and N_2O. Are there any lab tests the authors can point to that show that this material does not affect CO and N_2O?

Response: We did not do any lab tests on this. We were careful to keep all tubing to a minimum and used Teflon FEP tubing in locations where we needed moveability/flexibility (i.e.

connecting/disconnecting to inlet). The same tubing of similar lengths is used in the calibration line and inlet/air sample line. So if it is true that there are some effects they would be in both lines and any offsets would be accounted for by the calibrations.

I also had some questions about the flow diagram in Figure 3. What is the purpose of Port 1? Is it the default flow path?

Response: Port 1 in this diagram is the default sample line.

line 68-73, how was cell pressure maintained? Were the authors using the slow flow path that originally comes with an LGR/ABB instrument? What was the flow rate in flight?

Response: Cell pressure is maintained by flow though the inlet diaphragm pump, along with an internal (to COMA) pump and the external (to COMA) exhaust pump (both of which are provided by the manufacturer). COMA contains internal valves that maintain a pressure of ~52 Torr within the sampling cell. We have added additional text to the 'flow system' section to better describe this.

Flow rate is not measured by COMA and therefore not recorded in-flight, other measurements which are indicative of operation/flow are measured including sample cell pressure which is used as a primary indicator of instrument operation (i.e. some deviations in cell pressure were observed on some descents as the instrument was cold-soaked and if the instrument descended into particularly humid conditions this would causing icing within the lines, which would block flow, impacting the cell pressure and as we used this variable in our post flight analysis, this data would be flagged and subsequently removed from the final dataset).

Figure 2, how are the "Solenoid" and "Ext front" temperatures below the ambient temperature? Also, the text suggests this is in flight data, but the figure caption says the black trace is the environmental chamber pressure altitude?

Response: We have re-worded the misleading caption; the altitude is indeed flight altitude and data is from flight data on 21 Aug 2022. We have re-plotted the data and noticed a mis-labeled legend, Ambient temperature has been re-plotted and is now very much lower than the other temperatures.

line 173, I'm not sure why calibrations that differed by more than 4 standard deviations were removed? Wouldn't this reflect instrument performance and need to be retained?

Response: Instrument precision is impacted by both internal (ability to maintain sample cell pressure, flow rate, internal temperatures etc) and external variables (temperature, humidity, variation etc). We ran laboratory and chamber tests and an in-flight calibration system to be able to define COMA's overall uncertainty to the best of our ability and to define a data filter that is applied to all data (not just calibration data) to remove spurious spike/deviations in N2O and CO that are not reflective of the sample. This filter was the best performing filter to identify (and remove) data spikes while retaining data representative of the sample. We added some text to section 2.2.3 to explain this.

Figure 7, why the switch from NOAA standards to Matheson standards? Could the authors discuss this switch?

Response: We filled the in-flight calibration system with NOAA (primary) standards in our laboratory, prior to field deployment in Korea. The secondary (Matheson) standards were deployed with the field campaign. The two NOAA-filled cylinders (primary standards) were the first to be sampled by COMA during in-flight calibrations before moving on to sample the secondary standards. The deployed secondary standards were used to re-fill the in-flight calibration system to ensure there were calibrations throughout the campaign (the primary standards were not deployed). We have added some additional context to the paper (Section 2.1.2).

Figure 9, could the authors use a different color for COMA? It is hard to distinguish the dark blue from the light blue and/or black trace.

Response: We have re-plotted Figure 9 to include a comparison of COMA with COLD2 and ACOS instruments during the entire ACCLIP flight data, which shows a more thorough comparison of the different instruments. By doing this we have had to remove the timeseries plot as there is not a constructive was a showing this when the entire dataset is used (which was the plot referred to in this comment). We feel the ratio plot is the best method to display the intercomparison of ACCLIP flight data from the three independent instruments.

line 229, could the authors add a short description of which groups operate COLD 2 and ACOS? And how were they calibrated? Did they get their standards from NOAA?

Response: We have added the group names to the text in Section 3.1. We also provide references to publicly available papers that further describe the instruments.

line 236, since the authors use two decimal places for the overall comparison, it is probably best to use two to describe the August 29 comparison

Response: We have updated this text and Figure 9 to provide comparisons of the instrument performance over the entirety of the ACCLIP campaign. Decimal places have been updated also.

Typos/Grammar suggestions

line 115, NOAA ESRL no longer exists, and it is misspelled "ERSL". I would use "NOAA's Global Monitoring Laboratory".

Response: Updated.

line 121, the URL is missing "a.". Should be …gml.noaa.gov…

Response: Updated

lines 93 and 129, don't need to hyphenate "in-flight"

Response: We have kept this hyphenated for consistency throughout the paper.

line 178, perhaps say "equally comprised of the residuals…"

Response: This section has been updated.

line 217, remove comma after "N_2O"

Response: Updated