

Interactive comment on “Continuous measurements of greenhouse gases and atmospheric oxygen at the Namib Desert Atmospheric Observatory” by E. J. Morgan et al.

Anonymous Referee #1

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The manuscript presents a comprehensive description of the setup, quality control and performance of a recently established monitoring site for greenhouse gases and atmospheric oxygen in the Namib Desert roughly two years after start of operation. The paper is well written and structured. It provides much useful information for readers that also aim at establishing monitoring capabilities in pristine and remote areas. The manuscript definitely merits publication in Atmospheric Measurement Techniques. There are only a few minor comments that should be considered before publication.

Abstract, line 16-17: what is a working tank?

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1 Introduction, fourth paragraph (on atmospheric O₂): move the paragraph to the end of Chapter 1 to keep the same order (GHGs, O₂) throughout the document.

1.1 Site description: add coordinates (lat, lon); please provide a short description of the meteorological measurements as they are not mentioned here but data are presented later in Fig.11; It is uncommon to have a chapter 1.1 but no chapter 1.2. Please revise the numbering.

2.1 Overview of the measurement system: please clarify in the beginning of the chapter that separate inlet lines are installed for each individual analyser. It is not clear until you refer in the third paragraph to Fig. 1. I supposed first that “the intakes of the sample lines” refer to several inlet heights; Concerning the lab view programme: does it only control the entire system or does it also serve as data acquisition? If so, what is the data logging rate? For some specific parts the manufacturer is given in the text (e.g. “four-port, two-position valve (Bürkert ...)”) while it is not the case for others (e.g. “Large volume (5 lpm) pumps run ...”). Please be consistent. I suggest skipping the specification of the manufacturers for the periphery items in the text as this information is given in Table 1.

2.2 CO₂ and CH₄ measurements: “Likewise, standard gases should have the same composition as the sample ...” I suggest replacing “composition” by “buffer matrix”

2.5 Flask sampling: How long does the sampling take? Line 12: explain MPI-BGC; Line 19: please specify the pump (model, material) as this can be crucial since the sampled air passes the pump.

2.6 Sensor stability: The 24-hour test, was it done on-site or in Jena prior to the installation?

2.7 Drying and water correction: The water droplet method setup applied here: is it one of the methods described in Rella et al., 2013? If so, please refer to it; Page 1524, line 20: add below: “a and b are empirically determined factors determined by the

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experiment described above."

2.8 Calibrations . . . : First paragraph: Make reference to WMO/GAW report #213 where part of the numbers in Table 2 are coming from. Page 1525, line 9: why are initial cylinder pressures above 200bar unwanted? Page 1525, lines 14-15: This statement is physically wrong. Concentrations cannot be reported as mole fractions; Page 1526, lines 3-5: "... a linear fit of the average of the last 5 min of working secondary standards (WSS) measurements and the mole fraction determined by the MPI-BGC facilities (all WSSs are traceable to NOAA or Scripps primary standards): ..." last part is a repetition. Why not "... and the mole fractions determined at MPI-BGC." How long were the secondary standards measured? How long does it take after valve switching to reach stable signals? Page 1526, lines 17-19: what do you mean by "small matrix-related artifacts due to gas storage or gas handling"?

2.9 Drift correction . . . : Page 1527, line 6: "through" -> "thorough"

3.1 General performance: Page 1528, line 6: "measurement computer" -> "control and data acquisition computer"? Page 1528, line 12: "communication computer": is it the same as the measurement computer? Is there no chance to use the raw data of the individual analyzers when the data acquisition computer fails? Page 1528, line 26: how was this leak test performed?

3.2 Stability of the CRDS: Was this test repeated? By doing so, a tank artifact could be maybe distinguished from temperature effects.

3.5 Water correction: Page 1530, lines 21-24: I don't agree that Table 3 shows substantial differences. It is difficult to assess the effect when choosing difference parameters just by looking at the individual numbers of the parameters. How much can a different set of parameters account for in absolute mole fractions? Please elaborate on your exact strategy. Which correction was finally applied? A mean over all tests? Did you use different correction factors for different episodes? Did you see any systematic influence on the GHG mole fractions itself, since e.g. at least for CO the mole fraction

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ranged from 46 to 238ppb.

3.6 Water correction of the OA-ICOS: Page 1531, lines 21-22: "...by comparing it to values calculated from the meteorology." It sounds too colloquial. Please rephrase.

3.7 Calibrations: Page 1542, line 15: "greater" must read "smaller"

3.8 Target measurements: Page 1533, line 10: how does the "more robust power-down procedure" look like? Page 1534, lines 4-5: change order: CO₂, CH₄, N₂O, CO, O₂

3.10 External validation: Flask to in-situ comparison: Which aggregate of the continuous measurements was compared to the flask data? Also refer to the length of the flask sample filling procedure that you may add in Chapter 2.5

3.11 Time series: Page 1535, line 20: it is the first time that the meteorological measurements are mentioned. Page 1536, line 3: growth rates should be also calculated for full years as it can result in misleading results in particular for trace gases with strong seasonal cycles; Page 1536, line 12: Dlugokencky et al : year is missing; Page 1536, line 13: "results" -> "result"

Table 2, caption: "in-situ vs. in-situ" refers to the cylinder comparison, right. If so, please clarify as in-situ vs. in-situ is misleading.

Table 3: add one extra column that states that Winderlich data were retrieved for a Picarro EnviroSense analyzer, Chen for a G1301. The Rella coefficients are an average over a bunch of different analyzers.

Figure 2: labels are wrong, it is not "log tau" and "log sigma" that is shown. It is "tau" and "sigma" on a log scale. Add second x-axis on top that shows the time in hours? As it is down in the lower panel on Figure 3.

Figure 3: see first comment to Fig. 2

Figure 5: change order: CO₂, CH₄, N₂O, CO, O₂

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Figure 10: change order

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