

Interactive comment on “Continuous measurements of atmospheric oxygen and carbon dioxide on a North Sea gas platform” by I. T. Lujikx et al.

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The authors would like to thank all contributing referees for their valuable comments. The input by the referees is greatly appreciated by the authors. Below the authors will respond to the individual comments of each referee.

Reply to Referee #1

P1697L8: The text has been changed using these suggestions.

P1697L22: The text has been changed accordingly.

P1698L2-8: The outer side of the membrane drier is supplied with the dried air from
C774

the outlet of the automated flask sampler, and not from the outlet of the setup for the continuous measurements. This was chosen because the flow rate in the flask sampler is much higher (2 litre/min) leading to more effective air drying by the Nafion pre-drier. In this way the air on the outer side of the membrane drier is the same air that was sampled a few minutes earlier and is not a mixture of sampled air and reference or calibration gases. The text has been modified in order to better highlight the use of the counter flow from the flask sampler instead of the continuous measurement setup. Furthermore, as stated below (P1989#1 A. Manning) the authors included further testing of the Nafion dryer in the outlook section.

P1698 from L9: The flow rates are added to the text, see also the response to A. Manning (P1698#3). The other suggestions will be taken into account in the outlook section for further improvement of the measurement system.

P1700L18: The text has been changed using this suggestion.

P1701L10: The text has been changed using this suggestion.

P1702L8: The text has been modified accordingly.

P1703L20: Winds from the south usually would not cause the sample air to be polluted by local emissions. Local pollution events from the south can only be caused by sporadic ships sailing south of the platform, which in most cases would take into account a large enough distance from the platform. Local pollution events from the north can be filtered by combined wind direction and wind speed data.

P1708L10-16 & P1708L11 & P1708L17-26: This section about the large oxygen decreases has been extended and clarified. The suggestions from this referee have been taken into account. More details are provided with the response to A. Manning below.

P1709L5: The text has been changed using this suggestion.

P1709 from L20: These suggestions have been included in the outlook section.

Fig 6: The caption has been adjusted accordingly.

Title: The title already includes the word atmospheric, for exactly this reason.

P1694L18: The authors intended to say fast changing. The text has been adjusted.

P1701L11: The text has been changed using this suggestion.

Reply to Referee A. Manning:

P1696L10-11: Non-linearity tests have not been performed, other than the measurements of the target gas, of which the concentration is also known. Since the target gas has been measured for only a short period and the degree of the non-linearity is best tested with more than 3 cylinders, the authors will include this in the outlook section for further improvements.

P1697: These suggestions have been included in the text and the section containing the Allen variance has been modified in order to clarify the calculation.

P1697-1698: The authors were not aware of this inlet design at the time of the installation of the air inlets at the platform. The inlet design will be included in the outlook section and the authors will look into the possibilities (there might be safety issues involved when using electronic devices on the deck) of implementing this setup design at the platform.

P1698#1: Further testing of the Nafion dryers is included in the outlook section, and will be carried out in the near future. See also response to Referee #1.

P1698#2: The testing of these pumps will need further consideration and will therefore be added to the outlook section. Thompson et al. (AMT, 2009) recommend in their "Response to Reviewer 1" (AMTD) to test all individual pumps as they conclude that differences appear to exist between individual pumps. The information about the wetted materials of the pump have been included in the text.

P1698#3: The flow rates in the sample and reference line are equal. This has been

C776

clarified in the text. The authors will look into the effects of using higher flow rates as is mentioned in the discussion section.

P1698L26-28: This sentence has been removed.

P1699: Experience with these valves from GC measurements in our institute have shown long lifetimes for these type of valves, which also switch every few minutes in case of GC measurements. However, we are aware that the influence of possible leakages on O₂ measurements are a larger problem than in other measurements. Therefore it's indeed necessary to replace the valves regularly. The used rotor material is the standard Valcon E type provided by VICI Valco.

Equation 5: The text has been changed using this clarification.

P1707: This has been adapted.

P1705: This is added to the outlook section.

P1706: This section has been extended with the details of the seasonal cycles at other measurement stations and the text has been modified to include a more extensive comparison.

P1708-9: This section on the O₂ events has been revised thoroughly using the suggestions of both referees. The suggested reference has been included in this section. In our observations there is no concurrent CO₂ signal visible, which might indeed be caused by the relatively bad precision of the CO₂ instruments. Small CO₂ signals could still have occurred, however we cannot be sure of that. The wind direction and wind speed have been included in the text. SST data is not available for this location. Some additional remarks about the wave period measurements has been included. Furthermore, the suggestions about the calculations of the signal have been included.

P1709: The analysis of the APO signal and trend will be part of future work, as the presented sampling period is limited. Furthermore a sentence has been added in order to clarify the effects of the fossil fuel correction.

C777

Fig 1: This suggestion will be added to the outlook section.

Fig 4: The authors have not been able to identify the cause of this slight drop in the signal. Our future test efforts will yield more results like these, and might help to resolve this issue.

“Less significant comments”

General: The text has been changed, using concentrations instead of mixing ratios and data as a plural noun.

Abstract and P1707: The text has been adjusted accordingly.

P1694L8: The text has been adjusted accordingly.

P1694L10: The text has been adjusted accordingly.

Abstract, last sentence: The text has been modified using this suggestion.

P1695L1-3: This sentence has been removed.

P1695L4: The text has been adjusted accordingly.

P1695L11: The text has been adjusted accordingly.

P1695L14: The GC technique was added, using the suggested reference.

P1695L20: The reference has been included.

P1695L27: The text has been modified using this suggestion.

P1696L23: The additional information has been added.

P1697L12: The reference has been included.

P1698L9: This has been changed.

P1698L12: The text has been adjusted accordingly.

C778

P1698L13: The text has been modified accordingly.

P1698L17: The name has been changed to the correct spelling: Bronkhorst.

P1698L25: Yes, there are two Neslabs as well as two Dewars with glass traps and a heating coil. The text has been adjusted in order to clarify this.

P1699L6: The text has been modified accordingly.

P1699L10: This is the stated precision by the manufacturer. Influence of the performance of the MKS will be added to the outlook section.

P1699L14: The name has been changed and the type number has been added.

P1700L12: This has been added.

P1701L9-15: The text has been adjusted to clarify this section. Indeed, an average calibration line is constructed for each reference gas period of several weeks, since this eliminates scatter in the individual measurements.

P1701: The reference has been changed.

P1701: The text has been changed accordingly.

P1701L18: Additional information is added to this sentence.

P1702L5: The text was adjusted using this suggestion.

P1702L13: This sentence has been deleted.

P1702L21-29: The text has been adjusted using this suggestion.

P1704L4: The text has been changed accordingly.

P1704L5: The text has been changed accordingly.

P1705L5: The unspecific word satisfactory has been removed from the text.

P1706L23-24: The text has been changed accordingly.

C779

P1707L20: R2 has been added.

P1709: Indeed, in this case Δ_{CO_2} is the same as in eq. 6. When this data is transferred to the Scripps scale, the authors will use the arbitrary factor of 350 ppm in the APO calculations.

P1709 Discussion: This section has been moved to the outlook section.

WMO reference: The reference has been adjusted.

Fig 3: The figure has been modified using this suggestion.

Fig 4: This figure has been adjusted.

Fig 4+5: The x-axis of all figures have been adjusted.

Fig 5: The figure has been adjusted accordingly.

Fig 6: The insets have been removed.

Fig 7: This has been added to the caption.

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