

Interactive comment on “A new method for continuous measurements of oceanic and atmospheric N₂O, CO and CO₂: performance of off-axis integrated cavity output spectroscopy (OA-ICOS) coupled to non-dispersive infrared detection (NDIR)” by D. L. Arévalo-Martínez et al.

Anonymous Referee #2

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This manuscript presents a new system for the continuous analysis of oceanic and atmospheric N₂O, CO₂, and CO. The system combines a Weiss-type equilibrator with an OA-ICOS analyser for N₂O and CO and a non-dispersive infrared gas analyser for CO₂. The study addresses the assessment of the system conducting experiments in the laboratory and in the Atlantic Ocean. The manuscript presents a novel method that can be a methodological major advance over the classical discrete measures by gas chromatography in assessing the distribution of N₂O, CO₂ and CO in the surface of the

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ocean. The scientific approach and the method applied are valid and well described and the manuscript is clearly and well written, despite some time too large background is included in the results and should be better included in the section 1 (introduction). I recommend the publication of this paper in Ocean Sciences after solving several points.

Major points

- The authors conducted a validation of the N₂O measurements comparing the OA-ICOS with gas chromatography at the sea. The differences obtained are not quantitatively described in the text, although for a large number of cases in figure 8. the differences are up to 1 nmol L⁻¹, representing this error a 15% of the surface N₂O concentration. The explanation that the OA-ICOS has higher temporal resolution is not precise in view of the range of variation of N₂O concentrations in Figure 10. The differences between OA-ICOS and GC should be addressed deeper in the text. If the line 1:1 is add to the figure 8 a., it seem that OA-ICOS values are systematically lower that GC values and therefore, this should be also explained in the text.

- The consistency of the CO measurements are not enough tested in this study and also the factors affecting the CO concentration in the equilibrator should be deeply explained in the text: CO has a relatively short lifetime in surface seawater and consequently the concentration of CO in the headspace could suffer concentration changes on the time scale of the equilibration time (45 min), the author should quantify how affect this and discuss more the reliability of the CO measurements. The assumption that any air that is vented into the equilibrator headspace is ‘clean’ and of known concentration should be evaluated in this study. The engine exhaust and other ship fumes are potential large sources of pollution, especially for slightly soluble gases such as CO. If these sources are allowed to vent into the equilibrator, its reliability and state of equilibrium could be greatly compromised. The validation of the equilibrator/OA-ICOS measurements with other method (GC) is very important in the case of the CO. The author should explain deeper the limitations of this new technique for CO.

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Below I suggest other minor points that should be considerate by the authors in a new version of the paper:

- Introduction: I miss in the background any cite of previous systems of underway measurements for N₂O and CO in the ocean with equilibrator coupled to GC. - pp 1287 (L 6-9): This paragraph is redundant with the calibration explanation of the section 2.3. - pp1289: (L7-9): "The estimated error.Johnson et al, 1999". This information should be place in the introduction, because it is related with background description. Could you estimate the error of your measurements?? - pp1291- The authors should explicitly describe the accuracy of the calibrations standards. I also miss in the paper values measured in terms of partial pressure (ppb). - pp1291 (L16-20): I suggest to relocate this information at the introduction section or shorten this paragraph. - pp 1299 (L 27). Which is the concentration of N₂O in the synthetic air used for the headspace creation? Did you measure it? -pp 1304 (L 11:24) This paragraph should be shortened or be placed in the Introduction section.

-pp 1305 (L3) "Surface distribution of N₂O increase from May to June". Which increase, the distribution or the concentrations of N₂O? Rewrite clearly the sentence.

Kind regards

Interactive comment on Ocean Sci. Discuss., 10, 1281, 2013.