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## ***Interactive comment on “Comparisons of continuous atmospheric CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O measurements – results of InGOS travelling instrument campaign at Mace Head” by S. N. Vardag et al.***

**Anonymous Referee #1**

Received and published: 22 May 2014

Review of Vardag et al. - ‘Comparisons of continuous atmospheric CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O measurements – Results of InGOS travelling instrument campaign at Mace Head’

The submitted manuscript presents results from a two-month parallel on-site comparison of greenhouse gases observations with gas chromatography, cavity ringdown spectroscopy and fourier transform infrared spectrometry at Mace Head, Ireland. In particular, it reveals that novel spectrometric measurement techniques (such as the fourier transform infrared spectrometer used here) are suitable for quality control of

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continuous observations through short (in the order of a few weeks) side-by-side measurement campaigns in the field as the novel techniques are transportable, easily deployable, robust and are sufficiently precise to also detect small systematic differences in the range of the WMO/GAW compatibility goals.

The paper is scientifically sound, well written, and clearly structured and deserves to be published in ACP even if I agree with reviewer #2 that it is a conceptual paper that would have also fit (maybe even better there) in AMT. Moreover, I have a few comments that should be addressed prior to publication in ACP.

It should be clearly stated that the present approach, analysis and structure of the manuscript is very similar to the work of Hammer et al., 2013 (Atmos. Meas. Tech., 6, 1201–1216, 2013), but that it is applied to another measurement site, longer time series and also to N<sub>2</sub>O in addition to CO<sub>2</sub> and CH<sub>4</sub>.

The authors should carefully check the manuscript with respect to the use of acronyms. Some are most likely unnecessary, some are introduced several times (e.g. ILC twice in the abstract), some aren't at all (e.g. AGAGE, ICOS, HATS, CCGG) or at least not at first use (e.g. GC-MD). InGOS is introduced first in chapter 3.1 even if this acronym is even part of the title. I suggest to reduce the use of acronyms in particular in the abstract to a minimum and to introduce all acronyms at first use in the main text body even if it was already introduced in the abstract (e.g. ILC, page 10431, line 17). Is it of importance in the title that it is an InGOS travelling analyser? I suggest removing InGOS in the title.

Page 10430, line 25: Remove citation (WMO, 2009) since it isn't common to use references in the abstract. The same statement with the same reference is once more made in the introduction.

Page 10431, lines 20-21: add Rella et al. (Atmos. Meas. Tech., 6, 837–860, 2013) that also shows side-by-side results of a travelling instrument.

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Chapter 2.1: why don't you mention the manufacturer of the FTIR? what is the sample and recording rate of the FTIR?

Page 10433, line 2: "medium-size city", be more precise.

Page 10443, line 16: add Dlugokencky et al. (JGR, VOL. 110, D18306, doi:10.1029/2005JD006035, 2005) as reference.

Page 10435, line 3: The water correction parameters from Chen et al. (2010) were used for both Picarro analysers. It was shown that the parameters can slightly vary from instrument to instrument (see e.g. Rella et al. (Atmos. Meas. Tech., 6, 837–860, 2013)). Have the parameters used been experimentally verified? See also the comment to paragraph 4.3 below.

Chapter 2.3: what are the sample and recording rates of the Picarro analysers? Which aggregates were used for the intercomparisons?

Page 10437, lines 8 ff: is there any idea what could have happened?

Paragraph 3.3, Fig. 3: mention explicitly that different cylinders with different mole fractions were used for the SIS tests at Heidleberg and Mace Head (if it is the case).

Paragraph 3.4.2: no buffer volumes were used at Mace Head?

Page 10442, line 1: do I understand it correctly that the FTIR records 3-min averages and CRDS data are stored as 1-min means?

Paragraph 4.3: As mentioned above, the water correction parameters published by Chen et al. are based on tests with one single G1301 analyser. Is it possible that the observed differences of the CO<sub>2</sub> (dry air) mole fractions determined with the two Picarro analysers can be caused by some improper humidity corrections? Standard and target gases are dry, thus, this could also explain why no systematic difference was observed for the measurements of the cylinders.

Page 10447, first paragraph: the authors could also consult the paper by Corazza

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et al. (Atmos. Chem. Phys., 11, 2381–2398, 2011) that retrieved bias corrections (in comparison to NOAA flasks) from different European stations based on inverse modelling.

Page 10447, lines 9 and 10: correct the typo “flaks” (twice).

Chapter 5: To my mind, this chapter doesn't really fit into this paper. Either skip it or elaborate. E.g. Page 10448, line 24: add reference for CH<sub>4</sub> emissions from the ocean. Add references to flux observations at Mace Head (if available). If flux strengths are available, do the observed gradients correspond to what is expected? Can you calculate fluxes out of the gradients?

Page 10450, line 24: one week seems to be definitely on the short side.

Page 10450, lines 27 ff.: skip the part with the bureaucratic regulations. Such issues shouldn't be a determining factor.

One thing that wasn't mentioned at all and that I suppose that can be crucial for a best possible comparison result is the perfect match of the time series taking exactly into account the residence times in the individual inlet lines etc. This is only possible if you compare two high time resolution analysers that allow shifting the time series even only by a few seconds before calculating higher aggregates.

Table 1 and Figs. 4 to 7: which aggregates were compared and shown?

Figure captions Fig. 4 and 6: figure captions says “concentration” while the y-axis labels says “mole fraction”. Mole fraction is right. Please correct.

Do you really need Fig. 5?

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 10429, 2014.

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