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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 #3**

Received and published: 3 May 2014

#### General comments

This study examines the differences in measurements of atmospheric CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O between two stations, Mace Head and Heidelberg, relative to a Travelling Comparison Instrument (TCI). High precision measurements of atmospheric constituents, specifically greenhouse gases, are essential for monitoring emissions from human activities as well as changes in biogenic sources and sinks. Achieving the required levels of repeatability and inter-comparability between measurements, stations and networks

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is a challenge and the TCI is an important tool to meet this challenge. The manuscript is scientifically sound and well written. However, it is a very technical paper and does not present a lot of original research. In any case, I think it provides useful information for data-users and, therefore, I recommend the paper for publication after minor revisions.

#### Specific comments

P10431, L2: A gradient between 10 and 25 masl would rather reflect local emissions rather than regional ones, therefore, suggest changing “regional” to “local”.

P10434, L11-14: The authors state that one working standard is used for calibration. A one-point measurement can only correct for instrumental drift. So, I presume that the GC was calibrated using a suite of working standards and that this was repeated at regular intervals to account for any changes in the detectors etc. This should be mentioned. Also, for N<sub>2</sub>O, the FID response is not linear so at least 3-points are needed for the calibration. In general, I suggest the authors mention how the instruments were calibrated and how often this calibration was repeated. The instrument calibration may be a source of error for e.g. in N<sub>2</sub>O at MHD, which was found to differ from the TCI by about -0.4 ppb for both working standard and ambient measurements.

P10437: L4-8: The G1301 instrument samples “wet” air. Residual moisture in the gas-handling system for this instrument means that it may take longer for a stable value to be reached for CO<sub>2</sub> due to absorption/desorption effects. Did the authors check for this instrument whether or not stable values were reached for CO<sub>2</sub> when switching to the working standard?

P10437: Related to the above comment, I think it would be helpful to state what the water correction used for the G1301 instrument and the precision of the water measurement. Could errors in the water correction explain the difference between the TCI and G1301?

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P10448, L20: Do the authors mean only during the day or continuous i.e. over 24 h? Please clarify.

P10449, L4-7: I think it is extremely unlikely that an diurnal cycle in CO<sub>2</sub> would be observed from the ocean, considering that the change in pCO<sub>2</sub> in the surface layer is likely to be very small from marine photosynthesis/respiration and probably more dependent on ocean mixing. Much more likely, is that the air from the ocean sector also contains some continental signal.

#### Technical comments

P10431, L17: either remove “indeed” or change to “indeed been reached”

P10432, L8: “run in parallel with”

P10433, L5: I think ACP requests British spelling, thus “centre”

P10442: L1: Suggest “1-minute” and “3-minute”

P10447: L9-10: “flaks” -> “flasks”

P10448, L18: from -1 to -0.5 nmol/mol, the “gradient” decreases although the difference becomes more positive

P10448, L23-24: suggest changing this to “suggests only a very small or negligible CH<sub>4</sub> flux...” and removing “if at all significant”

P10448, L27: Again, the “gradient” has decreased (the absolute difference is smaller in the daytime) which is to be expected as the vertical mixing is stronger.

P10449, L19: “assess”

P10451, L5: “has not yet been successfully transposed” transposed is not the write word here, suggest changing to: “this has not yet transpired”.

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

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