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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A measurement-based verification framework for UK greenhouse gas emissions: an overview of the Greenhouse gAs Uk and Global Emissions (GAUGE) project" *by* Paul I. Palmer et al.

Anonymous Referee #3

Received and published: 10 April 2018

The paper gives an overview of the GAUGE project, which combines atmospheric observations of greenhouse gases to quantify the UK GHG budget. In general the paper is well written, and I recommend publication after the following, mostly minor concerns have been addressed.

General Comments:

The introduction should refer to other networks, such as the global greenhouse gas reference network from NOAA ESRL GMD, the research infrastructure ICOS, or the

Integrated Global Greenhouse Gas Information System IG3IS.

In this overview paper many papers are referenced as "in preparation for ACP" (Stavert et al., Wenger et al., Connors et al., Helfter et al., Pitt et al., Lunt et al., Palmer et al.), is it the intention to have these published soon so that they can be properly referred to? This would be very helpful.

Balloon CO2 sondes: The section seems a bit speculative. The two profiles (morning and afternoon) start deviating strongly (1-10 ppm) above about 4 km, while the description in the text mention problems with baseline drift and span measurement during one of the flights affecting only data collected above 6.5 km. Given that the traceability requirements for using such data for validation of space-borne remote sensing of GHG measurements is quite tight, the balloon CO2 sonde is far away from being useful. I suggest shortening the section, just pointing out the status of the system.

Intercalibration activities: As multiple calibration scales are used for CH4 and for N2O, it should be made clear that for use in (inverse) modelling the data need to be put on the same scale to reduce any impact from bias errors.

Specific comments

Table 1: Please explain "CG-MD"

L 177: The Thoning et al. (1989) method does not provide a baseline, it is rather a curve fitting using harmonics and trend. A baseline would need to have some filtering of e.g. polluted episodes to retain the "baseline conditions".

Fig. 2, left panels: the colours used for the time series plots differ quite a bit from those in the legend. I suggest adopting the legend colours for the plotting.

L 186: the role of the boundary layer height during winter should be explained a bit more.

L 202: "We added an extra flask to the collection" this is unclear

L 237: suggestion to replace “to” with “and”

L 250: “boundary layer likely plays the dominant role” do you mean boundary layer height? Otherwise this is a trivial statement as the boundary layer is sampled by the sites.

L 286: “Differences between sailing ...” does that refer to different trips or directions of the ferry? Should this be “sailings”?

L 345: “and more sensitive” -> “and higher sensitivity”

L 535: replace “;” with “and”

L 560: “free-running CTMs” from Table 9 it seems that all transport models use assimilated meteorological fields

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