

# ***Interactive comment on “Application of Open Path Fourier Transform Infrared Spectroscopy (OP-FTIR) to Measure Greenhouse Gas Concentrations from Agricultural Soils” by C.-H. Lin et al.***

## **Anonymous Referee #2**

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This is a good investigation, and it has scientific and practical benefits to researchers in atmospheric monitoring. Before acceptance, there are several issues to be addressed.

In section 2.3, the authors stated that "we selected ninety spectra containing  $338 \pm 0.5$  ppbv N<sub>2</sub>O and ninety-three spectra containing  $400 \pm 5$  ppmv CO<sub>2</sub> which were measured from the S-OPS. These group of spectra covered broad ranges of water vapour content and air temperature. N<sub>2</sub>O and CO<sub>2</sub> concentrations were calculated from these selected spectra using different quantitative methods." What is the exact meaning of "ninety spectra containing  $338 \pm 0.5$  ppbv N<sub>2</sub>O"? The purpose of the selection seems

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to be "avoid the non-linear response of absorbance to the wide range of gas concentrations", then how could " $338 \pm 0.5$  ppbv N<sub>2</sub>O" serve this purpose?

In section 2.4, the authors stated that "Each sampled spectrum was acquired by co-adding 64 single-sided interferograms (IFGs) at a nominal resolution of 0.5 cm<sup>-1</sup>, which accounted for 32,000 data points were collected with the interval of 0.241 wavenumbers between data points, ..." For interferograms, the unit of the interval of data points is cm, not wavenumber.

In section 2.4, the authors employed some criteria to remove low-quality IFGs, which includes those of very intense centerburst. It is true that intense-centerburst IFGs result in severe non-linear response of MCT detectors. However, such IFGs have high signal-to-noise ratio, and would be valid once the non-linear detector response is corrected. The authors might be interested in a correcting method (L. Shao, P. R. Griffiths, Anal. Chem., 2008, 80(13), 5219)

In section 2.5.1, the authors stated using "a high-order fitting function" as the synthetic background. It is better to be specific about the function, is it a quadratic, cubic polynomial, or something else?

In section 2.5.2, some useful information about PLS models is not provided, such as the number of calibration spectra (to build the model), the concentration range that the model covers, the number of factors for the model.

In section 2.6, it is better to be specific about the statistical tests, are they t-tests or paired t-tests?

In section 3.2, the authors present the results of CLS (zap-bkg) and CLS (syn-bkg), and the result of PLS (syn-bkg). Why is the result of PLS (zap-bkg) absent?

It seems that the authors did not apply PLS to estimate the concentrations of CO<sub>2</sub>, as they did in case of N<sub>2</sub>O. The reason should be explained.

Fig. 7(b) is strange. As stated in the fig. 7(b), bias = FTIR - S-OPS. According to

this formula, the bias between 11/6/2014 and 12/6/2014 is negative, since the FTIR concentrations are clearly lower than S-OPS. But in the figure the corresponding bias is positive.

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