Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-53-AC1, 2016

Atmospheric Measurement Techniques Discussions
Open Access
EGU

Interactive comment on "Automatic processing of atmospheric CO_2 and CH_4 mole fractions at the ICOS Atmospheric Thematic Center" *by* Lynn Hazan et al.

Lynn Hazan et al.

Lynn.Hazan@lsce.ipsl.fr

Received and published: 20 July 2016

4 - The treatment of uncertainties along the traceability chain should be more rigorous. The method of simple linear regression (e.g., Figure 9) does not consider the uncertainty of the standards against which is calibrated. To do this properly, a fully weighted regression technique, as described by Press et al, Numerical Recipes, Chapter 15.3 should be considered

We agree with the comment that the calculation of uncertainties must be developed. As part of the ICOS project we have organized working groups to handle specific issues. There are currently two working groups focusing respectively on the calibration strategy, and the water vapor corrections. For both issues we want to come up with

Printer-friendly version

Discussion paper

a more rigorous approach for uncertainties calculations, which will be implemented in the data processing. Regarding the calibration, the group will assess the uncertainties associated to the fitting curve (in which weighted technique should be implemented), time interpolation of the calibration, and possible non linearity. A comment about those further developments of the data processing has been added in the conclusion P13 L27: Within the ICOS project research actions are ongoing for a better assessment of the calibration strategy and the water vapor correction, and their associated uncertainties. The outputs of these studies will be implemented later in the data processing to improve the current data corrections and uncertainties estimates.

4 - Further, the calibration cycle suggested (cf. Figure 8A) could be improved by randomization, such that the sequence within the cycle changes and possible correlations are more easily detected.

For most cases the calibration are done with calibrations gases analyzed in rising order, even though this is not mandatory for ICOS, and it is the responsibility of the station PI to configure the order of the cylinders. One test has been done showing that the order of measurement of the 6 cylinders had not significant effect on the results (see additional figure 1).

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? - Yes, except for the unit Mo/day and Go/day (p3L14, p3L20, and throughout manuscript).

The units have been checked and MB/day and GB/day are used throughout manuscript.

13.Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

- p11 L16: A reasoning should be given to explain why this approach is considered superior (or why it even makes a difference)

Not being sure which approach the referee is pointing out, we assume it concerns the double quality control, both automatic and manual. It is very hard to completely automatize the quality control, there are always some specific cases which can only be seen by expert's eyes who may have additional information at hand; therefore the need of a double control. The PI has to provide codified reasons for invalidating data or useful information for validating data (the list of such reasons, called 'descriptive flag', can be found in Table 2).

The following text has been added P11 L33:

This example shows the importance of the expert examination; it is very hard to completely automatize the quality control and the PI may have additional information at hand to help define the status of the data. However, when invalidating data the PI has to provide codified reasons (the list of such reasons, called 'descriptive flag', can be found in Table 2).

- p12 L7: This statement is important and should already be used in the introduction/motivation

We have moved the statement to the introduction P2 L12:

The NRT processing chain was built on the expertise gained during previous European projects including CARBOEUROPE, Infrastructure for Measurements of the European Carbon Cycle (IMECC) and Global Earth Observation and MONitoring (GEOMON). NRT is defined here as on a daily basis.

- Figure 7: The text on p8 should distill the main message better. This reviewer reads from the text and figure mainly that water-vapor-corrected data exhibit less of a bias than the raw (wet) data. Is this the message?

The text and the figure deal with the level of the water vapor correction (difference between the data with and without the H2O correction) depending on the water vapor level . For both wet and dry air the water vapor correction is applied. The amplitude

of the correction is a function of the H2O concentration. In dry air, the level of the water correction is close to zero (it depends on the level of residual water vapor). In term of uncertainties, the water vapor correction may introduce a correction bias for wet air depending to the water vapor level (imperfection in the determination of the water vapor correction function). On the other hand the method used to dry the air (e.g. Nafion membrane) may also introduce a bias. We are currently preparing another paper to assess those uncertainties associated with the water vapor.

We have clarified the text as follows on P8 L23:

The water vapor corrections shown in Figure 7 correspond to the difference between data with and without the H2O correction (amount of water vapor correction), and not to a measurement or correction bias. These corrections are needed to convert humid air mole fractions in dry air mole fractions. However, any error in the water vapor correction would introduce a bias in the resulting dry air mole fractions, whose amplitude would depend on the H2O concentration. The determination of a specific correction for each instrument by the ATC will minimize the bias associated with humid air measurements. Conversely, drying the air (e.g. using a Nafion membrane) may also cause a measurement bias by contamination of the sampled air. The evaluation of these biases is underway at the ATC and will be published separately.

- Figure 10: The Figure is extremely busy, and this reviewer finds it hard to identify the example discussed in the text. It is suggested to perhaps present most of the points in gray (losing their identity) but instead highlight those that are being discussed in color. Moreover, interesting features like (blue dots), where the drift is towards smaller bias, should be discussed.

For a better view of the figure, we have added to the Figure 10 a one month zoom with only 3 sites (Finokalia - FKL, Lamto – LTO and Puy de Dôme – PUY)). Few events were already discussed for Mace Head, Finokalia and Trainou, and we have added a short description of the zoom portion of the figure. The legend has also been enlarged.

The figure 10 caption has been updated as follows:

Figure 10. CO2 (above) and CH4 (below) mole fraction differences between the validated and the near-real time values at eleven stations in 2014 (left), and at three stations (Finokalia - FKL, Lamto – LTO and Puy de Dôme – PUY) in June 2014 (right). Most of the differences correspond to the drift between two calibrations, which cannot be considered in real time. Each point corresponds to an hourly average.

We have added the following precisions to the manuscript:

P11 L2: At AMS station we see a reverse slope for a short period (2 weeks) on early July 2014, with drift going towards smaller bias over time. This is due to a revision of the calibration performed on July 1st, after the correction of an erroneous injection of one calibration gas.

P11 L25: The zoom over June 2014 (Figure 10 right) also shows small wavelet in the CO2 differences at Lamto station. This feature is related to the strong diurnal cycle observed at this tropical site (typically 50 ppm). The correction applied to the data being concentration dependent the difference between NRT and validated dataset also display the diurnal cycle.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-53, 2016.

Printer-friendly version

Discussion paper

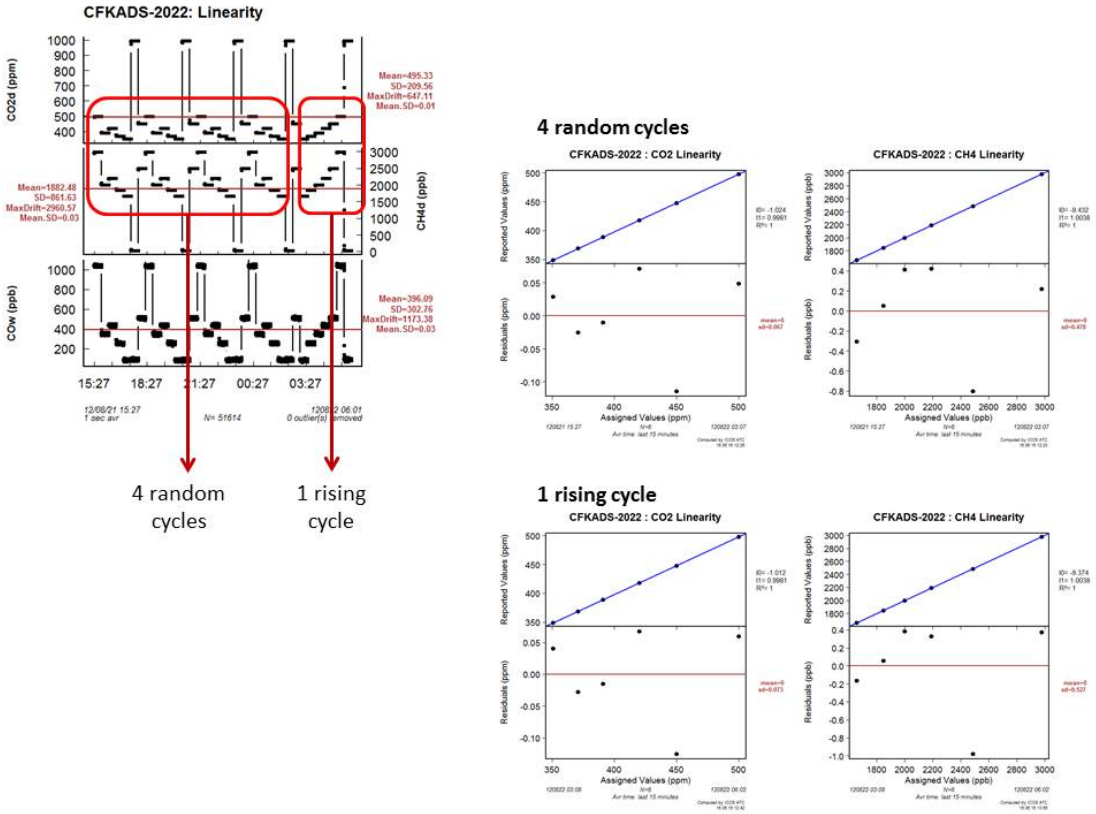

Fig. 1. Additional figure 1

Printer-friendly version

Discussion paper

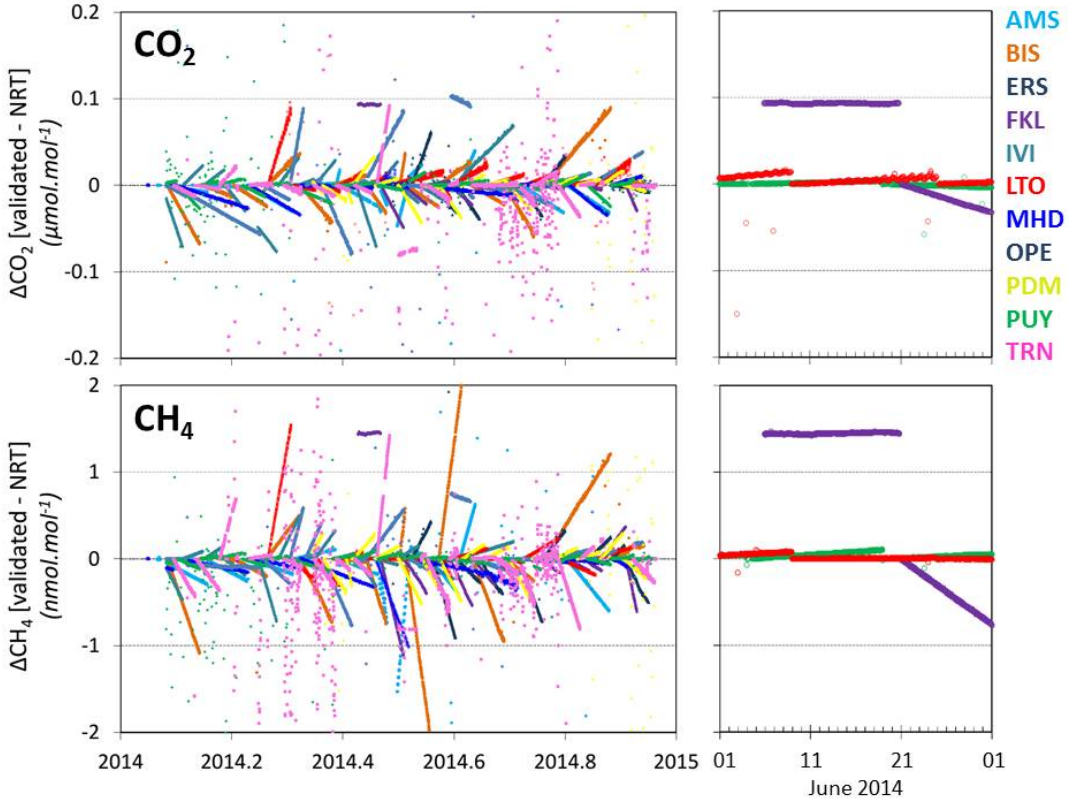

Fig. 2. Updated manuscript figure 10

Printer-friendly version

Discussion paper