

Interactive comment on “AirCore-HR: A high resolution column sampling to enhance the vertical description of CH₄ and CO₂” by Olivier Membrive et al.

Anonymous Referee #2

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Membrive et al. present AirCore-HR that is a version of AirCore with higher resolution than the originally one developed in Karion et al., and further provide comparisons of vertical resolutions of different AirCores. AirCore-HR was flown in the StratoScience 2014 campaign along with a lower resolution AirCore, which enables the authors to compare the resulting profiles in terms of vertical resolution and absolute values. Besides these, the authors have also estimated the uncertainties of the vertical profiles, and compared the observed profiles with model simulations.

The manuscript focuses on the design and comparison of vertical resolution of AirCore profiles, which is a very useful aspect for improving the AirCore technique. The manuscript is well structured and written. I suggest publication after addressing the

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following points.

General:

1. There is a lack of understanding of the disagreement in absolute values of CO₂ from AirCoreHR and AirCore-GUF. The speculation on the dryer given by the authors is not convincing. See the detailed comments below.
2. How has the cell volume affected the vertical resolution? It was mentioned in section 2.1.1. However, it is not clear how this was taken into account in the calculations.

Detailed comments:

Page 4/line 6: how is the flow determined as being laminar? Can the authors give the upper limit of the flow rate for being laminar in the AirCore-HR?

Page 7/line 2: analyzers → analyzer

Page 7/line 19: version → mole fraction

Page 7/line 19-20: it is not for “an eventual drift of the measurement”, but for dilution and spectroscopic interferences, see Chen et al., 2010 and Rella et al., 2013.

Page 10/line 31 – Page 11/line 3: These are too speculative. Magnesium perchlorate is widely used in ground-based and aircraft measurements of greenhouse gases. Levin et al. 2002 Tellus page 699 explored the potential effects of magnesium perchlorate on CO₂ measurements, and from the two experiments no significant biases due to the use of magnesium perchlorate were found.

Page 12/line 7: why not use accuracy instead of using precision? Note that the precision can be averaged down to even lower values when vertical resolution is considered.

Page 14/line 11: stonger → stronger?

Page 15/line 10-14: If it were explained as remaining impacts of diffusion with the very low values of altered CO₂ sampled at the plateau, AirCore-GUF would be expected

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lower than AirCore-HR; however, the observed difference is opposite. Furthermore, diffusion will unlikely have such an impact on the tropospheric values. I do not get the point why humidity plays an increasing role. Please explain.

Table 2: How are the uncertainties defined? They seem to be unrealistically small.

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