



Interactive comment on “An airborne amplitude-modulated 1.57 μm differential laser absorption spectrometry: simultaneous measurement of partial column-averaged dry air mixing ratio of CO_2 and target range” by D. Sakaizawa et al.

C. Frankenberg (Referee)

christian.frankenberg@jpl.nasa.gov

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The manuscript by Sakaizawa et al presents some interesting and encouraging results from airborne campaigns using amplitude-modulated differential laser absorption spectrometry (LAS). Especially the range detection system seems to work very well and results seem robust and scientifically sound (though I cannot judge the instrument

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section, which should be evaluated by a differential laser specialist). The manuscript is well suited for AMT and I recommend publication after some minor comments are taken into account:

Specific comments:

Nomenclature: I find the symbol q (with a bar) somewhat misleading, why not use XCO₂ as column averaged mixing ratio (as is done in most of the column average remote sensing and ground-based community)? This would help avoid some misunderstandings (even though you only plot partial columns but you could indicate this by a superscript indicating the actual height up to which is integrated)

Page 4852:

Line 7: The high correlation is mainly caused by variations in topography, not CO₂. Depending on the kind of terrain you are flying over, it is very easy to get good correlations but is not necessarily a proof that you can measure XCO₂ well (see later comments)

Line 13: "highly distributed": do you mean "enhanced"?

Line 17: Please provide a reference for this statement, it seems rather vague and not fully justified.

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line 5: There are more original references to GOSAT (e.g. Kuze et al and Hamazaki et al; you have GOSAT scientists on the team, please consult with them

line 9: precision or accuracy?

line 17: Please rephrase, it sounds as if NIR spectrometers are essentially useless (which is not the case).

line 25: "at a specific position *to* less than..."

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line 20: iwf is a somewhat unfortunate symbol I think.

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Line 2: Water vapor may be highly variable. What is you estimated error induced by this uncertainty (same holds for changes in surface pressure)?

Page 4861:

line 24: spectroscopy error of "0.13%"! How do you you know this error to two digits? It seems very low. How would a deviation from a Voigt line-shape (speed dependent line-shape, line-mixing, etc) play into your retrieved column?

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line 8: Did you plot sub-columns in Figure 9? I.e. did you also integrate the profile for the in-situ data (up to the respective height of the LAS system)?

line 17-18: "return from nearby airplanes": don't understand what you mean

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line 3: "significant similarity": You didn't really show this yet though I think you should be able to easily do this. First of all, it is somewhat unclear what you mean by q profile (as all of those are subcolumn just with a different integration ceiling). Looking at your figure 9 and table 3, you should be able to create a correlation plot of XCO₂(LAS) and XCO₂ (VAL) using datapoints for different days and flight altitude (ideally, days and heights are somehow visible in such a scatterplot, e.g. by using different symbols per day and height indicated by color-scaling). If you can show how well these correlate (maybe exclude the 2009 flight as it has so much less CO₂), you can really strengthen the manuscript and corroborate your claims (with the naked eye, it looks like they should but it is not easily obvious from your plots).

Figure 5 (and 6): Is the lowest panel really the difference between the two curves in the second lowest panel? differences of only about 20m seem very low and judging

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by eye, the scatter looks larger. Also: How many XCO₂ measurements did you get per day? Judging from Fig 5, you should be able to record quite a lot per day but you don't seem to show them. Why can't you show a plot like Fig 5 and 6 and also plot the retrieved XCO₂ along the track? This would make it much more convincing, otherwise it looks like some data points are "hidden". This is a crucial point I think! If noise is an issue, you can smooth the XCO₂ time-series.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 4851, 2012.

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