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Atmospheric Measurement Techniques Discussions

Interactive comment on "Camtracker: a new camera controlled high precision solar tracker system for FTIR-spectrometers" *by* M. Gisi et al.

Anonymous Referee #1

Received and published: 17 December 2010

General Comments

This paper presents a clear and concise description of a new solar tracker system that has been developed for use in infrared solar absorption spectroscopy, partially motivated by the precision requirements for column CO2 measurements. This Camtracker system was optically coupled to a Bruker IFS 125HR FTIR spectrometer at Karlsruhe and operated for about six months. The resulting data were used to show that the solar tracking achieved a precision of +-11 arcseconds. This is significantly better than the precision of solar trackers that employ quadrant diode sensors (about 50 to 100 arcseconds). The advantage of the new system is the use of a digital camera that records images of the sun from which the edge and centre of the solar disc can be determined

even if there are intensity variations across the disc, for example due to thin clouds. This system is likely to be of interest to anyone requiring accurate and precise solar tracking, and particularly to the TCCON and NDACC FTIR communities. I recommend publication after the minor comments below are addressed by the authors.

Specific Comments

Page 4866, line 19: The reference to Toon et al., 2009 for TCCON could be added to or replaced by D. Wunch et al., Calibration of the Total Carbon Column Observing Network using aircraft profile data. Atmos. Meas. Tech., 3, 1351-1362, 2010. and D. Wunch, et al., The Total Carbon Column Observing Network (TCCON), Philos. T. R. Soc. A, in press, 2010.

Page 4867, line 26: Doesn't 10 percent/degree correspond to 18 arcseconds for 0.05 percent (3600arcsec/10 x 0.05)?

Page 4868, line 19: Explain the reason for the square root of two (extending 1-D results to 2-D?).

Page 4868, lines 19-21: For Kiruna, explain what happened in February 2006. For Izana, explain what changed in May 2007. What was the accuracy at Izana before May 2007? It would also be helpful to state upfront exactly what systems are used at each of the three sites considered in the paper.

Page 4869, line 24: Explain why the input field stop is needed.

Page 4870, line 8 and Figure 4: It is not clear from the figure how the solar beam is falling on the camera or how the "input side of the field stop wheel" is recorded. Explain and show in the optical diagram.

Page 4872, para 1: It is not really clear from this paragraph how the combination of the two procedures is used to determine the mirror movement. A more complete description should be added.

Page 4874, line 10: There is no discussion of this point. What is the conclusion based on the results in Figure 7? Do the residuals imply that the offset must be much less than 5 arcmin because the real residual is less than the simulated one?

Page 4874, line 11: The spectral range used in Figure 8 differs from that used in Figure 2. Comment on why and whether any impact is expected from this.

Page 4874, line 17: How is the 5 arcsec uncertainty due to winds obtained?

Page 4875, lines 10-12: This discussion is a bit confusing. Clarify whether the VIS/NIR refers to observations with the IR filter in place. Does IR bandpass refer to the bandpass of this filter or to the IR region of the spectra? Also, at lines 16-17, what is the impact of not accounting for this 1 percent difference in the deviation of the beam?

Technical Corrections

Page 4866, lines 1 and 13: define FTIR in Abstract and main text

Page 4866, para 2: define web addresses for NDACC and TCCON consistently, either both with or without http://

Page 4866, line 16: mid-infrared (MIR)

Page 4866, line 21: delete continuously

Page 4866, lines 23 and 26: Hase et al., 1999 and Abrams et al., 1994

Page 4867, lines 4 and 5: list all three references within one set of brackets

Page 4867, line 9: non-correctable rather than non-recoverable errors?

Page 4867, line 10: we have overcome these problems

Page 4867, line 15: equivalent to centering the solar disc

Page 4867, line 16: any deviations . . . introduce errors

Page 4867, line 17: Why hyphenate gas-concentrations? There are many other un-

necessarily hyphenated words (do a search to check which ones are needed), while hyphens are missing in other cases.

Page 4868, line 1: to reduce the tracker impact in the near infrared by ratioing the CO2 slant column to the O2 . . .

Page 4868, line 18: . . . our measurement site at Kiruna

Page 4868, line 19: Here and throughout the paper, both " and arc s are used. It would be preferable to use one notation consistently.

Page 4868, line 24: this analysis or these analyses

Page 4868, line 26: Hase et al., 2010

Page 4869, line 6: define OPD

Page 4869, line 9: which have been operational

Page 4869, line 11: ellipse-shaped

Page 4870, line 10: wavelength-dependent

Page 4870, line 25: Camtrack(er) has been changed to CamTrack - is this correct? CamTrack appears to be used consistently for the software several times later in the paper, but the system is referred to both as Camtracker and CamTracker.

Page 4871, line 20: What is meant by a subframe? Use two instead of 2?

Page 4871, line 23: delete the before information

Page 4871, line 26: delete the hyphen in mirror-system

Page 4872, lines 3, 4, 17: delete the hyphens

Page 4872, line 7: delete comma after advantage

Page 4872, line 25: . . . as shown in Sect. 7.

Page 4873, line 4: . . . as often happens

Page 4873, line 11: . . . such as the partially

Page 4873, line 13: . . .determine the actual pointing

Page 4873, line 16: . . .e.g., moving objects such as clouds, . . . e.g., contours of . . .

Page 4873, line 22: Camtracker or CamTracker? Choose one.

Page 4873, line 23: should this be the distance between the centres?

Page 4874, line 3: delete hyphen

Page 4874, line 10: add comma after Fig. 7

Page 4874, line 21: Before 22 September . . .

Page 4874, line 24: In the time series presented . . . fRequently

Page 4875, line 9: List references chronologically.

Page 4876, line 6: delete very?

Page 4876, line 7: . . . is the need to position

References: Miller et al. (2007) and Notholt et al. (1995) are not cited in the text.

Figure 1: Delete hyphen in the legend (1/cos(z) approximation). Use upper case for Apparent . . . in x-axis label for consistency with y-axis.

Figures 2, 6, 9: Put units on axes labels in square brackets for consistency with other figures. Delete hyphen in NDACC-station.

Figure 6 caption: line 3 . . .was recorded on 22 September; line 4 . . . in two-second intervals; line 5 . . . used before 22 September. Also differentiate between what is shown in the upper and lower panels.

Figure 7: Use periods rather than commas to denote decimal place in the x-axis num-

bers.

Figure 9: . . . one sample measurement day

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 4865, 2010.