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 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.
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?

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.

How is the 5 arcsec uncertainty due to winds obtained?

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

define FTIR in Abstract and main text
define web addresses for NDACC and TCCON consistently, either both with or without http://
define mid-infrared (MIR)
delete continuously
list all three references within one set of brackets
non-correctable rather than non-recoverable errors?
we have overcome these problems
equivalent to centering the solar disc
any deviations . . . introduce errors

Why hyphenate gas-concentrations? There are many other unnecessarily hyphenated words (do a search to check which ones are needed), while hyphens are missing in other cases.

to reduce the tracker impact in the near infrared by ratioing the CO2 slant column to the O2 . . .
our measurement site at Kiruna
Here and throughout the paper, both ’ and arc s are used. It would be preferable to use one notation consistently.

this analysis or these analyses
Hase et al., 2010
define OPD
which have been operational
ellipse-shaped
wavelength-dependent
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.

What is meant by a subframe? Use two instead of 2?
delete the before information
delete the hyphen in mirror-system

delete comma after advantage
. . . as shown in Sect. 7.
as often happens
such as the partially
determine the actual pointing
e.g., moving objects such as clouds, e.g., contours of . . .
Camtracker or CamTracker? Choose one.
should this be the distance between the centres?
delete hyphen
add comma after Fig. 7
Before 22 September . . .
In the time series presented . . . Frequently
List references chronologically.
delete very?
is the need to position
Miller et al. (2007) and Notholt et al. (1995) are not cited in the text.
Delete hyphen in the legend (1/cos(z) approximation). Use upper case for
Apparent . . . in x-axis label for consistency with y-axis.
Put units on axes labels in square brackets for consistency with other
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.
Use periods rather than commas to denote decimal place in the x-axis num-
bers.
Figure 9: . . . one sample measurement day