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Atmospheric Measurement Techniques Discussions

Interactive comment on "Ground-based all-sky mid-infrared and visible imagery for purposes of characterizing cloud properties" *by* D. I. Klebe et al.

Anonymous Referee #1

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General comments

This paper describes a new instrument, the All Sky Infrared Visible Analyzer (ASIVA), which is intended to be used to quantify the cloud cover (specifically, the hemispherical cloud fraction) and to estimate other cloud properties (cloud emission temperature, cloud base height,. . .) Therefore, the paper addresses a relevant scientific matter, which is the automatic observation, from the ground, of sky and cloudiness. The paper presents a now tool and some interesting ideas on the treatment of visible, and particularly of infrared sky images.

In general, methods are well described and this description is sufficiently complete to allow their reproduction. Some further details, as commented below, could help to clarify some particular points.

The authors mention some previous works related to their investigation. However, some important references to already published works are lacking, and should be added to the final version, probably in the introduction section. The title reflects the content of the paper, but the abstract should be a little bit more explicit about the "several other important cloud properties" that are mentioned.

The language is correct, the overall presentations is well structured an clear, but there are too many figures: they should be combined (see my suggestions below) in order to facilitate the reading of the paper.

Specific comments

1. Introduction. Lines 19-20. The "Atmospheric System Research (ASR) Science Program Plan, January 2010" is provided as a reference for a general statement about clouds and climate models. However, I don't know how to obtain this reference (further information to find the document should be added in the reference list). In fact, I would suggest using a different reference (as the IPCC reports) to support the statement.

2. The first paragraph of the introduction is extremely long (33 lines), but on the other hand, more recognition to previous works on infrared (and visible) ground-based sky imagery is lacking. I would suggest (1) to move lines 12-24 in page 7987 to section 2 (since the ASIVA instrument is described in section 2, so no need to give so many details in section 1); and (2) to write at least one new paragraph giving credit to previous works, such as:

- Liu, Lei, Xuejin Sun, Feng Chen, Shijun Zhao, Taichang Gao, 2011: Cloud Classification Based on Structure Features of Infrared Images. J. Atmos. Oceanic Technol., 28, 410–417. doi: http://dx.doi.org/10.1175/2010JTECHA1385.1

- Feister, U., H. Möller, T. Sattler, J. Shields, U. Görsdorf, J. Güldner (2010), Comparison of macroscopic cloud data from ground-based measurements using VIS/NIR and IR instruments at Lindenberg, Germany. Atmospheric Research, 96 (2–3), 395–407.

- Souza-Echer, M. P., E. B. Pereira, L. S. Bins, and M. A. R. Andrade (2006), Simple Method for the Assessment of the Cloud Cover State in High Latitude Regions by a Ground Based Digital Camera, J. Atmos. Oceanic Technol., 23, 437-447.

- Pfister, G., R. L. McKenzie, J. B. Liley, A. Thomas, B. W. Forgan, and C. N. Long 522 (2003), Cloud coverage based on all-sky imaging and its impact on the surface solar irradiance, J. Appl. Meteor., 42, 1421-1434.

- Mantelli Neto, S. L., A. V. Wangenheim, E. B. Pereira, and E. Comunello (2010), The use of Euclidean geometric distance on RGB color space for classification of sky and cloud patterns, J. Atmos. Oceanic Technol., 27, 1504-1517.

- Heinle, A., A. Macke, and A. Srivastav (2010), Automatic cloud classification of whole sky images, Atmos. Meas. Tech., 3, 557-567.

- Calbó, J. and J. Sabburg (2008), Feature extraction from whole-sky ground-based images for cloud-type recognition, J. Atmos. Oceanic Technol., 25, 3-14, doi:10.1175/2007JTECHA959.1.

- Cazorla, A. F.J. Olmo, and L. Alados-Arboledas (2008), Development of a sky imager for cloud cover assessment, Journal of the Optical Society of America A, 25, 29-39.

The reading of some of these references would mean their inclusion in the introduction and would allow the authors to better explain the main novelties of the current study related to the previous ones.

3. Across the text, when referring to micrometers, using the symbol (μm) is enough, the expression “microns” should be avoided.

4. Although the ARM SGP site is quite well-known, at least the exact (lat-long-altitude)

position should be detailed.

5. Please define FITS (p. 7988, line 13)

6. After equations (1) and (2), all symbols used should be defined, even if they are known by most researchers in the atmospheric communitiy.

7. In p. 7989, line 15, a “two-step” process is introduced. The first step is clearly identified as such in the next line. Contrarily, the second step must be what is explained in section 3.2, but this is not so obvious. The authors should clarify this.

8. Second paragraph of section 3.2 starts qualifying as “useful” the quantity defined by Eq. (4). The usefulness of such quantity, however, is not so clear to me. More explanation is needed.

9. The agreement between AERI and ASIVA as shown in Fig. 6 is “very good”, and I agree with this statement. Nevertheless, some explanation of the slight disagreement at some moments (20090525, 17 GMT; 20090721, 15:30 GMT) would be welcome.

10. Section 4.2. The “gold line” is hardly visible in Fig. 7a. A reference is convenient to support the statement about the criteria used by TSI to distinguish thin and thick clouds (lines 22-25):for example, Long et al. (2006).

11. Section 4.3. In line 15, “this day” should be “this image”. Why the new analysis package for TSI images has not been used in this study?

12. Section 5.4. First, when “zenith” is mentioned, does that refer to a single pixel or to a number of pixels around the exact point where the zenith is? Second, last sentences in this paragraph (lines 10-14) are unclear. What does “ASIVA instrument measures the mean temperature of the cloud to one optical depth” mean? And, in the next sentence, “This” refers to what? And, “then” should be “than”, shouldn’t it?

13. Conclusions. I appreciate the efforts to synthetize that the authors have made here, but some additional details, such as some quantification of the agreement (extracted

from the previous sections) could be added in this section. In addition, the limitations of this study and particularly the fact that it is based in just few images (from two days), should also be explicitly stated.

14. The authors should make an effort to reduce the number of figures, or to redistribute them to make it easier the understanding of the paper. Some suggestions in this sense: a. Figures 2 and 3 could be joined in a single figure with four panels. b. I would say that Figure 4 is not needed. The sample of AERI data is beyond the scope of the paper, and the response of ASIVA filters has been shown in Fig. 1. c. From Figure 6 to Figure 19, all panels could be condensed in four figures, or even in two figures. Specifically, Fig. 6, 9, 11, 13, 14, 18 and 19 are temporal representations of several variables for two days (20090525 and 20090721). So a figure with two columns of panels (each column corresponding to each day) and 5-6 files of panels (one for each variable or set of variables) would be easier to see as a whole. In addition, some current figures could be removed or combined. For example, are Fig. 9b and 13b really necessary? Or, three of the curves in Fig. 11b are exactly the same as in Fig. 11a, so the only new curve (thin cloud when using a different threshold) could be added to Fig. 11a).

Similarly, Fig. 7, 8, 10, 12, 15, 16, 17 correspond different treatments or results referred to two particular images. So again, a composite figure with several panels, starting from the original visible and infrared images for each time and then the series of different treatments, would be easy to analyze. In this sense, it is strange that the image selected for day 20090721 is for 1415 GMT, except in Fig. 8 where it is for 1450 GMT.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7985, 2013.