Atmospheric
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Discussions

Interactive comment on "Validation of CM SAF cloud fractions: can cloud cover be reliably derived by satellite data at Hannover, Germany and Lauder, New Zealand? – a comment" *by* A. Werkmeister et al.

A. Werkmeister et al.

awerkmeister@rsmas.miami.edu

We would like to thank all referees for their effort on commenting our discussion paper. We appreciate their help and are grateful for the issues they have pointed out.

1 Answers to General Concerns

1.1 Spatial coverage of HSI

In Tohsing et al. (2013) the camera projection of the HSI camera system has been analyzed and found to be equidistant which is adequate for the cloud cover determination. An equidistant camera projection has the advantage that the acquired image is only minimally distorted and clouds can be analyzed to zenith angles of 80°. The cloud cover of the sky with a zenith angle greater than 80° is not analyzed due to horizontal brightening and hazy sky. The spatial horizontal coverage of the HSI Instrument depends on the considered Field of View (FOV) and the cloud base height. By assuming a FOV of 160° - thus ignoring the sky between the horizon and the elevation angle of 10° - and a cloud base height of 3 km the spatial horizontal coverage can be up to 900 km^2. With these assumptions the radius of the circular area is 17 km. With a decreasing cloud base height the spatial horizontal coverage is reduced. At a height of 1.5km the coverage is approximately 225km^2 which corresponds to the size of the spatial horizontal coverage of SEVIRI (15x15 km). The reviewer mentions another estimation from a cloud camera in San Diego. We found a corresponding paper published by Chow et.al. In contrast to our all sky camera Chow et.al. use a camera with a smaller FOV, which therefore covers a smaller area than our all sky camera system.

1.2 More information about the "improved" Cloud Cover Algorithm for HSI

We used an algorithm in this work for extracting the CFC from Red-Green-Blue (RGB) signal counts which is based on the approach by Yamashita et al. (2004). We define the SkyIndex in order to separate blue sky and cloud areas and is computed by the Red and Blue signal counts. Since the SkyIndex by Yamashita et al. (2004) cannot analyze hemispheric images with an adequate accuracy, we extended the algorithm.

We describe the major issues of this algorithm in the submitted manuscript and add the following paragraphs. " Improved threshold values were determined for the SkyIndex. In addition a Haze filter was implemented in the algorithm to analyze hazy areas in the digital image by taking into account the green signal counts. The haze filter defines a hazy area if the value of the green signal count is greater than the average of Red and Blue. A cloud is defined by the Haze Filter if the green signal count is smaller than the average. The position of the sun in the image is calculated in order to evaluate the mostly bright circular solar area with an additional sun filter. In contrast to the SkyIndex, the sun filter uses different thresholds which are optimized for the higher and saturated signal. The algorithm is computing the CFC with a spatial resolution of approximately 3 Mio Pixels (see also Sect. 2)."

1.3 Study period is too short

We agree that three months are not a long time for a validation of satellite products. Although an extension of the validation period would be desirable, it is beyond our possibilities at the moment. However, our major point is the question whether cloud cover can be reliably derived by satellite data. As shown in the manuscript this question can only be positively answered for daily means, but not for instantaneous data. For the latter case, the problems are so obvious that even an extension of the observation period will not lead to a positive answer.

Since we shared the concern of the reviewer and we have therefore changed the title to: "Can cloud cover be reliably derived by satellite data at Hannover, Germany and Lauder, New Zealand? A step towards the validation of CM SAF cloud fractions." We might consider to emphasize the short study period in all sections and include "case study" in the title. We highly agree that the title is still very questionable and the title "Validation of CM SAF cloud fractions using manual and automated surface observations in Hannover, Germany and Lauder New Zealand - A case study" is the most favorable title at this moment.

1.4 More Detail in Methodology and Dataset Description

We agree with the referees that some expressions and formulations in the manuscript are confusing and will be corrected in the manuscript. We also agree that it is unclear for the reader which dataset has been used at what point. Of course this will be explained in detail in the new version of the paper.

We would like to add at this point, that we considered parallax displacement, projection errors, AVHRR overpass times (estimated the overpass times over Hannover and Lauder to chose HSI data accordingly).

1.5 Statistical Scores are used incorrectly

We acknowledge the issue of the definition of POD and FAC (which of course is FAR). We missed defining the "event" for which we calculated POD and FAR. We recalculated these numbers for the events cloudy (6-8 octas), partly cloudy (3-5 octas), and clear sky (0-2 octas). Further results will be provided in the revised version of this manuscript.

1.6 Observation Period of HSI in Lauder

The observation period started on 27 March 2009 and images are taken in 5 minute intervals until today. The data are complete with a few exceptions in June and September. Only 35 days are missing out of 280 days of recording from 27 March to 31 December.

2   Specific Answers

P. 11147 l.2 and 21:Both sentences will be reformulated. P. 11148 l.6: The description of observers will be corrected and improved. **P. 11149 l.18:** Done and clarified.

P. 11150 l.14: Resilience has been corrected to resemblance. **P. 11155 l.18:** In this context we mean, that we are averaging the the Cloud Mask over 5x5 grid boxes.

P. 11156 l.8: Citation will be removed.

P. 11157 l.10-15: As mentioned above: Has been already corrected and new results will be included. Thank you for pointing out the problem.

P. 11157 l.19-21: Sentence will be clarified.

P. 11159 l.28: The figures will be rearranged and the paragraphs as well as the captions will be adjusted.

A additional figure showing a scatter plot as shown in Fig.1 will be included for SYNOP results.

P.11161 l.2-3: The results that are shown in the 3kmx3km sinusoidal grid include information about the pixel (cloud free, cloud contaminated, cloud filled, ice contaminated, and no information). According to this information, the pixels are marked with 1 (cloud contaminated or cloud filled) or 0 (cloud free). This binary pixels will then be averaged over 5x5 pixels and result in a CFC.

P.11166 l.1-2: We would like to introduce a specific function for this problem but unfortunately it is beyond our possibilities yet to work on a concrete result.

Technical comments have all been corrected.