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Atmospheric Measurement Techniques Discussions

Interactive comment on "A robust threshold-based cloud mask for the HRV channel of MSG SEVIRI" *by* S. Bley and H. Deneke

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Reply to Anonymous Referee #1

We thank the referee for his/her constructive and detailed comments on our manuscript.

The following text states our replies to the major comments of the referee:

#Title: We agree that the word "robust" is not really justified in the title in terms of characterizing our algorithm in all observation conditions, and the lack of evaluation with independent reference data so far. It was chosen because of the robustness of the threshold at different cloudy and clear sky conditions. "One advantage of the MCC is its insensitivity to the frequency of both classes. This ensures that our cloud mask

performs well in regions and seasons with low, medium and high frequency of clouds." But we agree with the comment of the referee and will remove the "robust" from the title.

#Clear-sky composites: The temporal averaging of the 16-days clear sky reflectances was chosen to obtain the monthly mean value of all clear sky time slots. But relying on you advice, we will calculate the 16-days clear sky reflectances by using for the instance median and compare the result with the one determined by our average. This comparison will be added to the revised manuscript.

#Optimal threshold computation We will add the following text in line 22 (P.2837): "The calculation of the quality criteria is based on the MPEF cloud mask and the normalized HRV reflectance field. The resulting relative threshold of each iteration is then applied to that reflectance field." The next sentence will be deleted. The optimal threshold is the functional value of the maximum of the MCC. We could add a plot of the MCC as a function of the threshold to clarify the choice of the optimal threshold. A suggestive plot to demonstrate the stop criterion of the iteration algorithm is to present the MCC or relative threshold as a function of the iteration. We will change the stop criterion as follows: The iteration algorithm will stop, if the deviation of the relative threshold between two iterations is below 0.001.

#Thin cloud restoral We agree with the referees opinion that the thin cloud restoral can also lead to false cloud detections. But we have considered these artifacts in the results and discussion chapter. "This approach is problematic for situations where small-scale low level clouds occur underneath a larger cirrus cloud...". Our idea is to apply a thin cloud test in addition to the iteration algorithm (see e.g. Meteo-France, 2012). These restored pixels should anyway be labeled with another value.

#Results and discussion Currently we are looking for a good case study where the low resolution CLM is missing many small-scale clouds to demonstrate the enhancement of small-scale cloud detection effected by the HRV cloud mask. Concerning to the frequency of cloudy HRV pixels which are assigned as clear by the low. res. CLM, we found a amount up to 10 % over the Upper Rhine Valley. This frequency means the number of small-scale clouds missed by the low. res. CLM (false positive) divided by all detected clouds (true positive + false positive). This study will be done for all regions and added to the text in the next version.

The following text lists our replies to the minor comments of the referee.

#Comparison of simulated HRV cloud mask and 0.6 μm and 0.8 μm linear combination In our opinion the comparison between the HRV cloud mask and the simulated one issued from channel 0.6 μm and 0.8 μm does make sense, especially in regard to the lack of independent validation possibilities. Deneke and Roebling (2010) have shown, that this linear combination lies within the broadband HRV reflectance. Therefore indicates the low deviation of the cloud mask based on the comparison between the linear combination CLM and the EUMETSAT CLM a good result of the HRV CLM too.

#Tests over desert: Absolute threshold tests with solar channels over bright desert and arid areas are difficult. We tried to find out a threshold for the solar channels 0.6 μm and 0.8 μm, but the clear sky reflectance was to high to calculate a stable threshold.

#Fig. 7 – thin clouds We definitely agree with the referees comment, that another thin cloud test should be presented to demonstrate the occurrence of thin cirrus. Usually the IR-10.8 μm minus IR-12.0 μm is applied over all surfaces to detect thin cirrus clouds (e.g. Meteo-France, 2012). We will use the brightness temperature difference IR-10.8 μm minus IR-3.9 μm for that, because it shows a better occurrence of thin cirrus clouds in our case (Frey et al., 2008). This BT difference is attached as color plot (Fig. 1). To show you more clearly the feature of the normalized HRV reflectance we have calculated two plots which are attached as "normalized_HRV_refl.png" (Fig. 2). The histogram on the left hand side demonstrates the comparison between the HRV reflectance and the normalized reflectance for the same region and time step as in Fig. 7. After the surface variability was filtered out, the normalized reflectance indicates a

sharper boundary between the relative cloudy and clear sky reflectances. This feature is used to determine the relative threshold.

References:

Frey, R. A., S. A. Ackerman, Y. Liu, K. I. Strabala, H. Zhang, J. Key, and X. Wang (2008), Cloud detection with MODIS: Part I. Improvements in the MODIS cloud mask for collection 5, J.Atmos. Oceanic Technol., 25, 1057–1072.

Meteo-France: Algorithm Theoretical Basis Document for "Cloud Products" (CMa-PGE01 v3.2, CT-PGE02 v2.2 & CTTH-PGE03 v2.2), http://www.nwcsaf.org/HTMLContributions/SUM/ SAF-NWC-CDOP-MFL-SCI-ATBD-01_v3.2.pdf, (last access: 26 April 2013), 2012.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2829, 2013.

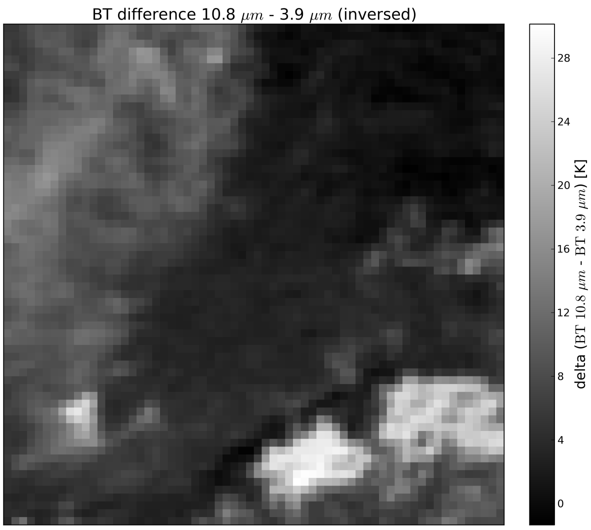

Fig. 1. Brightness temperature difference (BT 10.8 μm - BT 3.9 μm) for the case study: Fig. 7. The colors are inversed, so that whitish means a high difference and blackish means a low difference.

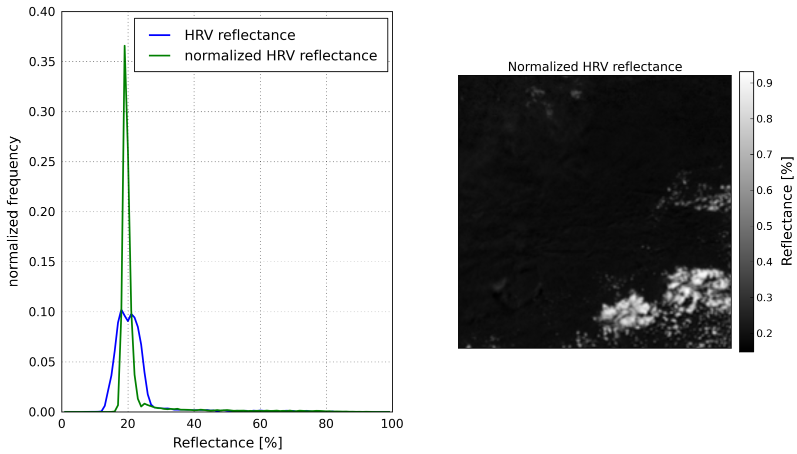

Fig. 2. Left: Normalized frequency of the HRV and the normalized HRV reflectance for the case Fig. 7. Right: Normalized HRV reflectance over Spain which could by added to Fig. 7.