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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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General comments

The paper is well written, its structure is clear and the figures are understandable. It introduces a supervised clustering threshold-based cloud mask (cloud conservative) for the High Resolution Visible on the METEOSAT SEVIRI, constrained by an existing cloud mask derived using lower resolution SEVIRI bands. As the HRV channel is not frequently used in known SEVIRI cloud masking algorithms (indicating that its use is not easy) the topic addressed by the paper should be noticed by people involved in cloud properties determination from METEOSAT measurements.

The intention of the authors is to propose a method to resolve small-scale cloud structures which cannot be detected by the low resolution SEVIRI channels. As a cloud mask based only on a solar channel cannot be as efficient as those using multiple

SEVIRI channels, by necessity the resulting mask is designed as a complement to an existing one, the CLM performed by Central Application Facility of EUMETSAT. The implicit hypothesis made by the authors is that an HRV-based cloud mask should lead to better cloud properties retrievals (cloud fraction, cloud optical depth, cloud thermodynamic phase). As the perception of the quality of a cloud mask depends on the targeted applications, here the determination of cloud parameters, I understand that the authors want to minimize at the HRV scale the false detections induced by the low resolution of SEVIRI information, while also adding detections of small broken clouds. With such a goal the risk is to miss clouds. As HRV is not suited to detect thin ice clouds this risk is highly increased. Therefore it is not surprising that a final cloud restoral is necessary, the CLM cloud mask is used for this purpose.

As the results show that the high resolution mask trends to decrease the cloud fraction, it seems that the goal of the minimization of false detections is possible. Without validation or comparison with other independent methods the argumentation is not complete, because the reduction of the cloud cover is carried by the higher resolution. This lack of validation or comparison detracts from the message that the paper intends to deliver. The second major drawback of the paper is that it misses also the demonstration for the second objective (minimize false clear-sky detections in presence of undetected small-scale clouds by CLM). I would be more convinced by the results of the approach if the paper would have presented the capacity to add true positive detections (for instance the massive detection of small-scale cumulus over a bright background missed by CLM). The absence of details on the iterative determination of the local threshold is also detrimental.

Major comments

Title

The choice of a title is not harmless. Here the authors qualify their cloud mask as "robust". A cloud mask can be qualified robust when its quality is rather not dependent

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on the observation conditions (viewing and solar angles, easy and difficult backgrounds (ocean, sunglint,desert,snowy grounds, high aerosol loadings etc)). As the behaviour of the HRV-based cloud mask is not sufficiently illustrated (only 12h00 scenes, areas not well distributed over the Meteosat earth view, no desertic area etc), the use of the adjective robust is not really justified by the examples given in the paper.

Clear-sky composites

The method uses clear-sky temporal composites derived from the mean values of HRV reflectances assumed clear when their corresponding CLM pixel is not cloudy. These clear-sky composites are input to create anomaly maps used to normalize the observed HRV reflectances. The normalization subtracts to the observed HRV a term being the difference between the local clear-sky mean temporal value and the spatial mean of the clear-sky composite of the considered region. This normalization narrows the histogram of the clear-sky HRV reflectances as described in Fig 4. This normalization is a main asset of the method. Obviously CLM is missing small-scale cloud structures, i.e. small convective clouds may be classified as clear by CLM. Therefore the temporal mean (which may include missed small-scale clouds) is certainly not optimal for the temporal filter. The authors should consider the use of another filtering method instead (for instance median, which would reject both cloud missses and cloud shadows) or explain why their choice does not impact the results.

Optimal threshold computation

The Matthews Correlation Coefficient constraining the predicted HRV cloud mask is correctly described but the way it is used to compute the threshold applied to the normalized reflectance is not precisely described. Could you give some details on how the relative threshold is selected (p. 14), i.e. how it is initialized, how it is changed between iterations, and describe the criterion used to decide that iterations can stopÂă? I understand here that the thin cloud restoral is performed when no HRV detection is present in a low resolution CLM cloudy pixel, it concerns the 9 HRV pixels, this restoral

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may also bring false CLM detections.

Results and discussion

Adding at least a study case when CLM is missing many small-scale clouds would favour the understanding of the behaviour of the method to perform correctly when initial CLM is not so good. As correct small-scale clouds detections are considered as false negative by MCC, I need to be convinced that your iteration process does not lead to decrease the probality of detection. Additionaly it would be interesting to give an idea on the frequency of HRV detections that are issued from pixels assigned clear by CLM..

The lack of independent validation/comparison in this section is the major drawback of this paper to convince a reader of the interest of the approach.

Minor comments

P 10 The upsampling of CLM to HRV resolution is described as a nearest-neighbour interpolation. EUMETSAT documentation states that there is a perfect determination when using the image coordinates of HRV and SEVIRI. Have you checked that your interpolation (I understand that it uses geolocated coordinates) gives exactly the same results as when using image coordinates stated by documentation ? (EUM/MSG/ICD/105, section 3.1.5 Geographical alignment of the Non-HRV and HRV images).

In my opinion the section (P17 and 18) showing that the cloud mask issued from the simulated HRV lies within the one issued from 0.6 and 0.8 is not very useful, all the more as there is no desertic area in the comparison.

Fig 7 uses IR 8.7 to show the presence of high thin clouds. This channel is very sensitive to land emissivity, and it is well known that appropriate brightness temperature differences or specific RGB are suited to detect high thin clouds. Could you consider using one of them instead of IR8.7 alone to illustrate that thin clouds are present where restoral operates? I would have been interested to see also in Fig 7 the feature which is used in the thresholding (normalized HRV).

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