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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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Overall Recommendation

Cloud detection is an important early step of the production chain of satellite remote sensing data and influences the quality of many subsequent level 2 products. Even though SEVIRI is in orbit since 2004, several cloud detection algorithms for this sensor still don't use the HRV channel albeit it offers important sub-pixel information for the remaining SEVIRI channels. The authors propose a threshold based cloud detection method which can in principle be used to add high resolution capabilities to any low resolution SEVIRI cloud detection scheme.

The paper is well written and has an overall clear structure and figures. The topic

is interesting and fits well to the aims and scopes of AMT. However, the paper (in its current state) was not able to convince me of the proposed method and I have several major comments which shall be taken into account before I would recommend publication in AMT.

Major Comments

Few case studies: Only a few case studies have been performed and Fig.2 clearly shows that by far not enough meteorological and surface conditions are covered to draw conclusions about the global usefulness of the proposed method. Cloud detection can be tricky above bright (e.g., desert or sunglint) surfaces, in tropical regions with frequent cirrus clouds, or in regions with high aerosol loads. The revised version should include more scenarios or discuss in detail which conclusion can (or can not) be drawn for a disc-wide application of the proposed method.

Definition of "cloud": The authors describe a cloud detection scheme but they give no definition for "cloud". At which clouds are they aiming in terms of cloud fractional coverage and cloud optical thickness? E.g., shall a cloud with an optical thickness of 0.05 and a fractional coverage of 0.3 be detected as cloud or cloud free? Obviously, there is a smooth transition from cloud free to cloudy. It shall be discussed that this results almost always in overlapping histograms (Sec.3).

Thinning of histograms: The proposed method of thinning the cloud-free histograms is a good idea and certainly helps finding a better discrimination. However, the authors shall discuss that the main problem is the much broader histogram of the cloudy cases (see e.g., Fig.3, Spain). The broadness of the cloudy histograms is strongly related to the definition of clouds the reference cloud mask is able to detect.

Cloud free composites: Eq.1 assumes that the low resolution reference cloud mask can reliably detect cloud free scenes. However, the paper aims at a HRV cloud mask because the reference cloud mask is assumed to have deficiencies, e.g., with sub-pixel cloud coverage. Therefor, I would suggest to use the median or 25 percentile to calculate the clear sky reflectance but not the average (which includes also pixels with potential cloud contamination).

Iteration (Fig.5): Please make clear why iteration can help. If pixels are mis-classified within the first iteration, the decision of thresholds will base on "wrong" histograms which will subsequently result in non-ideal thresholds. I can understand that the threshold value may converge to a certain value but I'm not convinced that this value is better than the first selected value.

Re-definition of cloud coverage (Sec. 3.2): What is the justification to re-define especially those pixels as cloudy where the high resolution cloud mask was cloud free in every sub-pixel. The given explanation ("This is done in recognition of the fact...") sounds that the reference cloud mask is more trustworthy and could be used to justify re-definition of every high-resolution pixel.

Cloud restoration: It remains unclear how the "cloud restoral" (Sec. 3.2) works. The physical background is not sufficiently discussed (why is $8.7\mu m$ so sensitive to thin clouds?). Which thresholds are used? Why using $8.7\mu m$ but not $10.8\mu m$ even though the surface emissivity at $10.8\mu m$ is closer to unity in many cases (e.g. deserts). A larger emissivity would increase contrasts between cold clouds and warm surfaces.

Validation: A comparison with the reference cloud mask (Fig.9) is not a prove that

the high resolution cloud mask is doing anything meaningful. It just ensures that the high resolution cloud mask is consistent with the low-resolution cloud mask in terms of cloud coverage. Showing some larger scale example-images (in addition to Fig.7) of the HRV channel in comparison with the reference as well as the HRV cloud mask could help to illustrate the value of the HRV-mask. However, strong conclusions about potential improvements due to adding the HRV channel are only possible after a validation with independent observations. Ideally, validation results should be shown within the paper. If this goes beyond the scope of the paper (which I do assume), the authors shall discuss this comment within the conclusions.

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