

# ***Interactive comment on “Increasing the spatial resolution of cloud property retrievals from Meteosat SEVIRI by use of its high–resolution visible channel: Evaluation of candidate approaches with MODIS observations” by Frank Werner and Hartwig Deneke***

## **Anonymous Referee #2**

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My opinion is that this manuscript presents significant work well worth publishing. The key achievement lies the development and testing of methods for using geostationary satellite data to obtain cloud properties at a three times higher spatial resolution than the current standard. The methodology is sound, and the presentation is generally clear. I recommend a number of minor refinements (mainly to improve clarity), but there is one issue I'd like to single out in particular.

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The text says throughout the manuscript (starting with Lines 3-4 of the abstract) that the proposed methods can increase the spatial resolution of SEVIRI cloud products from 3 km to 1 km (from the resolution of most SEVIRI bands to the resolution of the SEVIRI HRV band). My understanding, however, is that the resolution of SEVIRI observations is 3 km and 1 km only at the sub-satellite point, and that this resolution degrades with the cosine of the viewing zenith angle. (See, for example, [http://www.esa.int/esapub/bulletin/bullet111/chapter4\\_bul111.pdf](http://www.esa.int/esapub/bulletin/bullet111/chapter4_bul111.pdf) or <http://www.icare.univ-lille1.fr/projects/seviri-aerosols>.) For the test area around Germany, this can increase the meridional extent of SEVIRI pixels by 40% or more. For the most part, considering this effect would require only a clarification in the text; the only part where this becomes a substantial issue is the comparison with MODIS data. Considering that the meridional resolution of MODIS images should remain around 1 km even if the SEVIRI resolution became 40% coarser, it could be more appropriate to use a larger (e.g., 4 X 3) array of 1 km-size MODIS pixels to cover a coarse-resolution SEVIRI pixel. My own guess is that a such modification would not bring substantial changes to the overall outcomes (e.g., it would not change which method is deemed best), and I am not certain that considering the exact pixel sizes and using 4X3 arrays of MODIS pixels would yield more appropriate comparisons to 3X3 arrays of SEVIRI HRV pixels. Even so, it seems important to clarify in the manuscript the actual SEVIRI resolution around Germany, and to discuss any limitations or problems the different pixel sizes may introduce into the comparison of small-scale variability in SEVIRI and MODIS data.

Additional suggestions for minor revisions are listed below:

Page 3, Line 4: The resolution of 2.1  $\mu\text{m}$  MODIS data is 500 m (and not 1 km).

Page 5, Line 23: It could help to clarify that the subscripts 06, 08, and 16 indicate 0.6  $\mu\text{m}$ , 0.8  $\mu\text{m}$ , and 1.6  $\mu\text{m}$ .

Page 6, Lines 11-12: I suggest starting the paragraph with something like “As is it

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discussed in Section 4,” just so readers know they will be able to learn about the exact estimation methods later on.

Page 6, Line 14: For added clarity, I suggest inserting “latter” in front of “variables”.

Page 8, Lines 5-10: It would be interesting to add a few words about what may cause the variations in  $c$ . For example, could it be variations in typical cloud droplet size?

Page 14, Line 22: Wouldn't spatial averaging of MODIS data provide a better comparison than subsampling?

Page 14, Line 29: The part “(a)” seems to be missing from “Figure 8(a)”.

Page 14, Line 31: The “t” in “table 1” should be capitalized.

Page 15, Line 4: The “s” in “section” should be capitalized.

Page 20, Line 9: It would help to clarify what is meant by SEVIRI LUT (what specific look-up table is referred to).

Page 20, Line 17: Some readers jump from the Abstract straight to the conclusions and read the rest only afterwards. For the sake of these readers, it is important to clarify in the conclusions section what is meant by the caret accent over  $\tau$  and  $\text{reff}$ .

Page 20, Line 25: It would help to clarify that “local slopes” refer not to the slopes of the cloud top surface, but to the steepness of curves in the used LUT.

Page 21, Line 6: The spatial averaging used by MODIS is a reasonable alternative to downscaling. Although at visible wavelengths MODIS reflectances are available at a higher resolution, the MODIS cloud algorithm degrades the resolution of all input reflectances to a common 1 km resolution. Therefore, while downscaling could certainly help, the resolution mismatch can also be avoided by averaging, without the downscaling approach. Accordingly, at least the word “should” should be replaced.

Page 32, Lines 4-5 of Figure 2 caption: It would help to clarify that the blue lines

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show the relative difference between the Constant Reflectance Ratio Approach and the resampled original data. To this end, the words “relative difference” should be included, and the mention of color should be moved to the end of the sentence.

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