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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Validation of cloud property retrievals with simulated satellite radiances: a case study for SEVIRI" *by* L. Bugliaro et al.

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We thank Referee 2 for his suggestions and corrections. They have been considered by the authors in the new manuscript version. Major changes are listed here:

- a more exhaustive discussion of the method's limitations has been added
- cloud particle effective radius has been evaluated more thoroughly for the APICS retrieval
- cloud water path has been extracted from cloud optical thickness and cloud effective radius for APICS and it has been evaluated together with the corresponding

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CMSAF variables

- histograms of cloud top temperatures are discussed in addition to the plots already contained in the original manuscript version
- CMSAF data was processed again because of a small bug that affected mainly cloud optical thickness. Cloud effective radius is not a standard output variable for CMSAF and is not considered any longer.

In the following we review and answer all *reviewer comments (italic)* regarding our manuscript.

- How are these results any more illuminating than what we see in traditional validation studies where multiple products are inter-compared? For example, I am familiar with the CM-SAF algorithm. Every issue raised here was also raised during a EUMETSAT funded round-robin comparison where the CM-SAF results where compared to other SEVIRI products. Are there additional analyses to be done to better exploit these simulations? It would nice to mention this.

Model inter-comparisons are rather thought to highlight model deficiencies. However, the “truth” is still unknown in this kind of comparisons. Here, an objective information is present that can be used in a quantitative way (we think especially of cloud optical thickness and cloud effective radius) and.

- This simulated data should be made available to the public. Otherwise, its description is not very relevant to the community. This could be a good resource.

Yes. In case anyone would like to use this data, it can be obtained from us.

- Simulations provide full knowledge of the synoptic situation. It would be interesting to fold that into the analysis.

You are right, also this kind of information is available. However, it is not explicitly present in the study because we intend to show the potential (and limitations) of the

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method but doo not want to go into details.

- How is vertical integration (over the 35 COSMO layers) of particle size accomplished to obtain the truth-value?

A more detailed investigation of cloud particle radius has been added to the text. However, we implemented a vertical weighting function for cloud particle effective radii inspired by Platnick (2000). The reason is that the effective radius determined by a satellite retrieval does not correspond to the effective radius at cloud top but to a weighted mean of the effective radii in the “upper cloud layers”. However, our weighting function, as well as those proposed by Platnick (2000), only represent approximations to what happens in real world and are thus not the “truth”.

Nevertheless, this additional investigation is an interesting contribution to the paper. Section 6.5 has been thus rewritten and can be read in the new version of the manuscript.

- Since APICS is a DLR algorithm please state if there any shared RT assumptions with APICS and the model used to generate the simulated radiances. The CM-SAF look worse than APICS but this could be artificial. You do state this that there are shared assumptions for ice clouds between the simulations and APICS, but what about for water and mixed phase.

Yes, there are shared assumptions. The most important one is related to ice crytsal optical and microphysical properties and surely affects the results. Water clouds should actually not be affected since both retrieval schemes use Mie theory for the determination of cloud extinction as a function of LWP and r_{eff}. Mixed-phase clouds are also affected since they contain the ice phase as well.

Anyway, a discussion of the method has been included in the Conclusions that has been partly rewritten. Furthermore, reference to this issue is now present in the subsection related to cloud optical thickness, cloud effective radius and cloud water path.

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- For water clouds, the difference in particle size with APICS and CM-SAF is alarming and greater what is typically observed between two mature data sets.

From the more detailed analysis of cloud effective radius (see above) we obtain that the distribution of occurrences of cloud effective radii from APICS is realistic (i.e. close to our simulated truth). CMSAF only uses effective radius as a mean to derive cloud water path and is not routinely stored at CMSAF. That's why we removed it from the paper. Furthermore, the small bug mentioned at the beginning impacted the performance of the optical thickness-effective radius retrieval of CMSAF, which has now improved.

- Why so little analysis of the cloud-top height results? It's hard to draw conclusions from Figure 7.

The discussion of cloud top heights has been modified. In particular, a new picture with histograms of cloud top temperatures for reality, APICS and CMSAF has been inserted and described. We think that the present version is more ehaustive.

- The downscaling method seems very innovative.

Such methods have been developed in the last years independently at more than one institution (see for instanced Venema et al. (2010)).

- In the abstract, you state the mean difference in cloud temperature is 16.4K. That is really big – is that true?

This value was that big because we considered also some cloud pixels for which cloud top temperature retrieval could not find any reliable result. Thus, those pixels were set to the default value of 150 K. These pixels were the reason for the large differences. This part has been improved by considering these pixels separately. The new histogram figure mentioned above shows that CMSAF cloud top temperature are fully realistic.

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