

Interactive comment on “An improved cirrus detection algorithm MeCiDA2 for SEVIRI and its validation with MODIS” by F. Ewald et al.

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We thank referee 2 for the comments which we address in the following. The referee comments are printed in italics:

1) specific comments: title: I am not sure if "validation" is the correct wording as only MODIS data, i.e. also indirect satellite retrievals are used (in a sophisticated way as I recognize) for this purpose. I would suggest the term "evaluation" here unless independent direct cirrus data, e.g. from ground observation networks are used.

Thank you for this suggestion! We already discussed this with our colleagues but could not come up with a more suitable wording. As this was also mentioned by our second

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referee, we changed the title of our draft to "An improved cirrus detection algorithm MeCiDA2 for SEVIRI and its evaluation with MODIS" and the subcaption "Validation" to "Evaluation".

2) p 5273 ll 16ff.: Has there been done anything with IASI, which is in orbit since 2006 (data delivery started in 2007) and has much better quality than AIRS?

Following this comment we additionally mentioned the cloud product of IASI described in detail by Schlüssel et al. (2005). First reviews of its results done by Lavanant et al. (2011) and mentioned by Hilton et al. (2012) show a promising agreement with the location of maxima and minima we found using MeCiDA2. However, the detailed studies by Stubenrauch et al. (2010) also concur with our findings that at present the largest differences between different cirrus detection algorithms can be found towards the south pole.

3) p 5276 ll 23f.: How is cirrus defined elsewhere in the literature. I am fully aware that some authors call all clouds with ice tops "cirrus" and others call only thin ice clouds "cirrus" (which is the correct way to do in terms of synoptical weather observations, by the way). It would be good to have some reference here besides Krebs et al. (2007) for the decision to call all ice top clouds "cirrus" (which I fully understand technically).

In order to clarify our decision, we added following statement into our draft:

"This is in contrast to the synoptic definition of cirrus being only a thin ice cloud. As several studies have shown cirrus clouds are often closely connected with or even overlapping deep convection. However, passive remote sensing methods in the infrared from above the cloud struggle to separate cirrus clouds from iced tops of deep convection just like deep convection leads to an underestimation of cirrus cover in ground-based observations. Since microwave measurements have shown that it remains hard to screen out deep convection in cirrus cloud coverage with existing IR methods (Evans et al., 1998; Hong et al., 2005), we proceed with the definition of Krebs et al. (2007)."

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4) p 5277 l 3: what is a "thick cirrus"? $COD > 2$? $COD > 5$, $COD > 10$?

Each of the six test are designed to detect as much cirrus clouds as possible without introducing false alarms. For this reason, the individual outcomes are additively combined to a single cirrus mask. As our algorithm does not retrieve the cirrus optical depth, this question can not be answered in a quantitative way.

5) p 5277 l 15: where does the information about the "underlying feature" come from?

Since one of the primary goals were the independent performance of our algorithm, no model or albedo climatology is being used here. As described in Krebs et al. (2007), the warmest pixel in the neighbourhood is searched from a 3×13 , 9×19 , or 19×119 pixel area in order to find a potential cirrus-free pixel. For clarification we included this explanation in our draft.

6) p 5280 ll 18-24: Which optical properties are used for cirrus (ice clouds)? Are they applicable globally?

For the analysis of the viewing angle dependency we used the same radiative transfer simulation dataset that has been employed during the development of MeCiDA1 (see Krebs et al. (2007), Sect. 2.2). This time the full range of possible viewing zenith angles have been used to determine individual thresholds for each viewing zenith angle. In this dataset, ice cloud single scattering properties in the thermal IR were parameterised according to Fu et al. (1998) which includes the single scattering properties of hexagonal ice columns for a wide range of effective radii.

7) p 5281 l 5: What does "each mu" signify? in 1 steps? in $\delta\mu = 0.1$ steps? interpolated?

Here, all satellite zenith angles between 0 and 78 were used for which individual radiative transfer calculations have been done in equidistant steps of 0.02 in the cosine of the satellite zenith angle. So no interpolation had to be employed.

8) p 5282 ll 9f.: If it is possible to detect cirrus with tests 1-5 with reasonable quality

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(high enough to run the further steps on this mask), what is the additional benefit of test 6 then? chapter 5: as suggested for the title I would prefer the wording "evaluation" rather than "validation".

For the following analysis we used test 1-5 to select only these clouds, that could be identified as being ice clouds with a fairly high probability. As test 6 seemed to be the key source of erroneous detections, test 1-5 served as an selection criterion to observe the annual variation of BTs over these clouds. However, the contribution of test 6 to the overall cirrus cloud coverage is quite significant (compare Krebs et al. (2007), figure 12). Since the continuity in detection performance over europe was one of the main objectives of these work, test 6 was also included in the new version (MeCiDA2).

9) p 5286 ll 1-8: *Please introduce the MOD06 and MOD02 products. I assume MOD06 is the level 2 retrieval while MOD02 is level 1 measurements?*

That is correct. We introduced MOD06 in the description of the Cirrus Cloud Optical Properties (CPO) in Section 3.2 and added a sentence in section 2.2: "In the following study we used the MODIS Calibrated L1B radiance data (MOD02) with a horizontal resolution of 1 km."

10) p 5287 l 6: *MoCiDa1 or MoCiDa2?*

In this section we used the improved version MoCiDA2. We clarified this where it was missing.

11) p 5289 l 2.: *-70N I assume.* That is absolutly right - must be a typo.

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