Response to Anonymous Referee #1

We would like to thank Anonymous Referee #1 for his / her critical comments helping us to improve our paper.

The referee's original comments are written in italics, while our response is intended to the right.

p. 4410 L. 17: "quite some time" - it would be better to provide precise years.

=> Eyre et al. (1984) were the first, who used AVHRR 3.7-10.8 µm differences for fog detection during nighttime. The first daytime detection techniques were those by Bendix & Bachmann (1991) & Kudoh and Noguchi (1991). We will mention that.

p. 4411 L. 1: I recommend to avoid the word "fog types" as the satellite detection method cannot discriminate between different fog development mechanisms. Maybe " fog under various conditions" is a more appropriate formulation.

=> We will use the formulation "fog under certain conditions".

p. 4411 L. 4: 3km resolution is only true at nadir, i.e. in West-Africa. In Central Europe the resolution is about 3x7km. Maybe this fact is worth mentioning, as the study focuses on Europe.

=> The resolution for Central Europe (about 3 × 6 km) will be given in brackets.

p. 4412f L. 21ff: It would be worth (shortly) providing the techniques or thresholds applied for these tests.

=> A short explanation will be given as follows:

- cloud identification (application of a threshold derived from a histogram analysis on the difference between the 3.9 and 10.8 µm BBT);
- snow pixel elimination (application of thresholds on the 0.8 and 10.8 µm channels as well as on the Normalized Difference Snow Index (NDSI), which is calculated from the 0.6 and the 1.6 µm channel);
- test for liquid phase (application of a threshold of 230 K on the 10.8 µm BBT. Further tests exclude warmer ice clouds and thin cirrus clouds which are not detected by this simple threshold approach);
- test for small droplet size (application of a dynamically derived threshold on the 3.9 µm channel)

[…]

- test for stratiformity (A threshold of 2 K is applied on the standard deviation of the 10.8 µm BBT for each entity.) ;
- test for low clouds (cloud top height < 1000 m. The cloud top height is derived from the 10.8 µm BBT or in some cases interpolated from the height of the surrounding terrain).

p. 4413 L. 12: add "described below" to the last sentence of the section.

=> agreed.

p. 4421 L. 5: How is the value of 200m motivated? Is it only the CTH of 1000m minus the cloud base height of 800m? Is there any physical explanation or motivation for this value?

=> A typical thickness of 200 m for FLS was empirically determined from random samples taken from a cloud thickness product which was calculated as described in Cermak, J. and Bendix, J.: Detecting ground fog from space – a microphysics-based approach, Int. J. Remote Sens., 32, 3345–3371, 2011.

We will add this information to the text.

p. 4421 L. 23: I wonder how a "round" 3x3 pixel window would look like and what would discriminate it from a 3x3 squared window. Is it diamond-shaped (i.e. corner pixels of the 3x3 window not accounted for)? In this case only 5 pixels for the statistical assessment remain... Some more xeplanation would be useful here.

=> You are completely right. The 3x3 pixel round window is diamond shaped / cruciform. We will ad this information to the text.

It is also right that only 5 Pixels can be used for each regression. However, as the validation has shown, the 3x3 pixels round window is superior to the other window shapes and sizes regarding the spectral quality. The spatial quality, on the other hand, is lowered which is most probably caused by the small sample size of each regression (see also p. 4422, l. 3 to l. 16).

p. 4424 L. 16f: A "strongly benefit" of the mask from a "slightly better" FAR is not convincing at all. Maybe the sentence could be reformulated.

=> We reformulated the paragraph as follows to make the point clearer:

"The better overall quality (PC and HKD) and a higher probability of detection in combination with a bias closer to 1 imply that the 1 km masks' quality is enhanced due to a lowered degree of underestimation. The POFD, on the other hand, is a little bit higher than for 3 km masks (but still on a low level), which means that the area of FLS is overestimated in some additional cases. However, the FAR, which is another measure for overestimation, is slightly better for the 1 km resolution. As the overall quality is enhanced, the degree of underestimation was lowered and the changes in the degree of overestimation are inconsistent, FLS masks do, all in all, benefit from SOFOS' reaction to resolution enhancement. "

p. 4426 L. 20: It is not really a "newly developed pan sharpening algorithm" which is applied here. Nevertheless it is valid to point out that the method is new and improves previous result. Thus I suggest to reformulate the sentence: " The new method uses an innovative application of a pan-

sharpening algorithm..."

=> You are right. We will change the sentence to “The new method uses an innovative application for a further developed version of an existing pan-sharpening algorithm suitable to [...]”

Table 1: is "n" the number of occurrence?

=> Yes, it is. We will add this information to the caption.

Fig. 2 (right): Does it really make sense to compare radiance of solar and thermal channels? I think it would be better to compare reflectance to brightness temperature.

=> We agree. Fig. a) will be changed to reflectance vs. reflectance
Fig. b) will be changed to BBT vs. reflectance.

Fig. 3: I miss a colourbar (in units "reflectance" and "brightness temperature").

=> We will add that.

Fig. 5: As above - why is brightness temperature compared to solar channel radiance rather than reflectance?

We agree. Fig. c) - e) will be changed to BBT vs. reflectance.

Is the 3.9µm channel used at all? How is the thermal fraction of the radiance then accounted for?

=> The total (= solar + thermal radiation) 3.9 µm BBT is used as input for SOFOS. SOFOS' cloud detection algorithm takes the difference between the total signals at 3.9 µm and 10.8 µm as an indication of surface reflectivity. It is expected that the reflectivity (solar signal) of clear ground surfaces is very small, while cloud reflection is large. Therefore, the difference 10.8 µm − 3.9 µm can be used to distinguish between both surfaces. BBTs are used for practical reasons as a unit only. For more information see Cermak, J. (2006): SOFOS - A new Satellite-based Operational Fog Observation Scheme. PhD-Thesis, Philipps-University Marburg.