Response to Anonymous Referee #2

We would like to thank Anonymous Referee #2 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.

The introduction should be expanded. It is advisable to mention other approaches based on the expansion of use of METEOSAT SEVIRI data by combining low-resolution color multispectral images with a high-resolution panchromatic image (e.g., Downscaling of METEOSAT SEVIRI 0.6 and 0.8μm channel radiances utilizing the high-resolution visible channel by H. M. Deneke and R. A. Roebeling, Atmos. Chem. Phys., 10, 9761–9772, 2010)

=> There are several pan-sharpening techniques and most of them could be used for SEVIRI data. We account for that in our introduction by citing an overview article by Strait et al. (2008). Additionally the paper by Bugliaro and Mayer (2004) was cited because they use pan-sharpening in the context of fog and low stratus detection.

However, the article you are referring to is quite interesting, as it uses an statistical pan-sharpening approach that could most probably used for the sharpening of thermal channels. We will change a paragraph in the introduction as follows:

“The main aim of the current paper is to develop an automatic method that can be used operationally without manual post-processing. The technique is based on a specific pan-sharpening approach, also including the SEVIRI thermal bands. This is an innovation in comparison to common pan-sharpening algorithms (see Strait et al., 2008, for an overview). However, statistical downscaling approaches that could most probably be used in the context of FLS detection do exist but have not proven their ability for the sharpening of thermal channels yet (Deneke and Roebeling, 2010) or can not be used for SEVIRI data as multidimensional high-resolution input is needed (Liu and Pu, 2008). The newly developed technique presented in this paper is based on a local regression approach presented by Hill et al. (1999). Sharpened solar and thermal channels are then used to detect FLS by using the SOFOS approach.”

p. 4413, line 4 - Give the reference(s), where “entities of cloud” is determined

=> The whole section is about a technique described in Cermak and Bendix (2008 & 2011). To make that clearer we will give an additional citation in the middle of the section.

p. 4413, line 10; p.4415, line 7; Fig. 5e - Most likely solar component was excluded in the calculation of BBT in the channel 3.9 μm. How was it done? 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.

p. 4420, line 15 – clarify what does it mean "interpolated channels";

We will use the following formulation to make things clearer:

"For purposes of comparison these measures were also calculated for masks based on channels the resolution of which was increased after degradation by using a simple nearest-neighbour interpolation instead of pan-sharpening. A Comparison with interpolated data was done for validation approach A only since approach B would gain perfect results for masks based on channels that were interpolated using a nearest-neighbour approach and degenerated afterwards."

p. 4421, line 4 - Why as a typical cloud thickness of 200 m is chosen?

=> 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, lines 9-10 - Does it follow that the definition of FLS presense using this technique is only possible in the absence of the middle and high clouds?

=> Yes, you are right.

p.4425, line 7 - clarify what does it mean DEM;

=> DEM = Digital Elevation Model. We will add this information.

Fig. 2 - I'm not sure that it is appropriate to compare the radiances in HRV and 10.8 µm channels due to significant differences in the range of variation. It may be better to use the BBT for spectral channel 10.8 µm;

=> Fig. a) will be changed to reflectance vs. reflectance & Fig. b) will be changed to BBT vs. reflectance due to Referee #1's request. Differences in the range of variation should not be a problem.

Fig. 2, Fig.5 - The authors use a very small font.

=> We will enlarge the font