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High-resolution satellite-based cloud detection for the analysis of
land surface effects on boundary layer clouds by Julia Fuchs, Hendrik Andersen, Jan Cermak, Eva Pauli, and Rob Roebeling

This paper examines two-slightly different regional cloud mask algorithms using the high-resolution broadband visible channel from MSG SEVIRI instrument for a region in Paris and its vicinity. Both algorithms started with pixel-level and solar zenith angle binned histogram of reflectance. The localized algorithm (LECDA) uses localized (down to pixel-level) thresholds based on gaussian fitted reflectance histogram, while the regional algorithm (RECDA) uses the maximum of LECDA thresholds for the entire domain. The RECDA algorithm is considered as independent of surface albedo.

The paper claims slightly better performance of RECDA method compared with measurements of a ground Cloudnet station. In addition, the cloud fraction from RECDA algorithm is shown to be able to demonstrate the impact of urban heat effect on fog formation from the city of Paris. The study is interesting as high-resolution cloud detection algorithm will enable the study of impact on cloud formation due to various natural and anthropogenic factors in very small scales. However, I am not totally convinced that RECDA is a better algorithm than the LECDA algorithm due to the following reasons:

1) Both algorithms have pros and cons as demonstrated by better POD, larger FAR in LECDA and poor POD, lower FAR in RECDA since the threshold in RECDA is higher than most used in LECDA. The large contrast in POD and FAR of the two algorithms and relatively insignificant difference in overall scores (PC, CSI, HSS) indicate that more fundamental difference of the two algorithm lies in the choice of a more clear-conservative or cloud-conservative approach rather than whether fine tuning of local threshold is better or worse. Therefore, what is more important in this case will depend on the application. Does the application require to have high POD or low FAR or an overall better score?

2) The LECDA aims to follow the reflectance distribution of clear sky pixels, as the algorithm is derived from the clear sky portion of the Gaussian distribution, while RECDA aims to preserve the cloud distribution as it assumes the cloudy portion of the Gaussian distribution does not change with surface albedo. This assumption will be more appropriate for thick clouds but not thin clouds as surface reflectance could also impact cloudy sky reflectance in the later conditions.

3) The evaluation is only conducted over one location even though the reflectance of the selected location is close to the domain mean. As mentioned by the author, the comparison over bright surface would be similar but over dark surface, LECDA is expected to have higher POD and little change in FAR. Therefore, over the entire

domain, it is yet to be seen which algorithm performs better. It may help to compare the cloud mask with other multi-channel satellite cloud mask products such as those from MODIS with 1km resolution and full spatial coverage.

4) The Cloudnet cloudy sample requires 90% of cloud fraction which is very cloud conservative while SEVIRI cloud masks only require 1/9 fraction to be cloud. This mismatch in spatial/temporal cloud fraction could contribute to slightly better performance of relatively underestimating RECDA algorithm as cloud detection rate could be even lower if more partial Cloudnet pixels are selected as cloudy.

5) The relative performance of RECDA and LECDA might change with the domain size and dominant cloud types in the region. It is well known that a globally fixed threshold does not work well. How does the domain size and surface homogeneity (range of albedo) affect the performance of the two algorithms, especially RECDA?

Minor comments:
What is the bandwidth of the HRV of SERVIRI? Some website mentions 0.4-0.9 µinstead of 0.4-1.1 µm.

What is x in Equ. 2?

P7L185-190. I don't see how RECDA would not create surface albedo dependent bias unless the algorithm only focused on thick clouds (in that case surface albedo doesn't matter). It seems to be a cloud-conservative approach and assumes that reflectance distribution of cloudy pixels does not change. However, due to the overlap of clear sky and cloud sky histogram, fixing threshold for cloudy pixel distribution inevitably affects cutoff of clear sky distribution.

Figure 6. How is the anomaly computed? Are the anomalies computed with respect to domain averaged mean? Could you plot the same figure (Fig.6a) from the LECDA method?