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Atmospheric Measurement Techniques Discussions

Interactive comment on "Cloud base height retrieval from multi-angle satellite data" *by* Christoph Böhm et al.

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"The paper presents an interesting technique to infer cloud base height from the MISR standard cloud product. It demonstrated a valuable skill with this technique that uses the 15 percentile threshold to the vertical distribution of MISR cloud heights in a 10-km domain. The algorithm can be readily applied to all MISR cloud data for seasonal and global statistics of cloud base height."

We thank the reviewer for her or his constructive comments and suggestions.

"The technique is perhaps valid for broken cloud scenes in the 10km domain, but would fail if clouds are 100 optically thick or overcast in the domain. This is often the case over land, but not necessary over ocean. The authors should acknowledge this limitation in

the abstract and conclusion."

Yes, in case of complete overcast, MIBase cannot derive the cloud base. The algorithm requires at least one MISR z pixel within the field of view which is a surface pixel according to the stereo derived cloud mask. This is stated in the abstract: "[...] It can be applied if some cloud gaps occur within the chosen distance [...]", but not again in the conclusion. We can fix this. Cloud optical thickness itself should not be a limitation. However, the cloud shape could be a limitation. The thinner cloud edge should be visible by the instrument for the algorithm to retrieve the base height (see page 7, line 4.).

"For the sensitivity calculations summarized in Table 3, the results might be dependent on roughness of terrain since MISR cloud height retrievals would correlate worse with ceilometer base height if the site is surrounded by mountains. What would be the results if only those sites with flat terrain (in 10, 20, or 30 km radius) are included in statistics?"

Interesting point. To derive a quantity to judge what is "flat" terrain, we use the standard deviation of the average scene elevation (ASE):

- ASE from the MISR Ancillary Geographic Product (Bull et al, 2011) at 1.1 km resolution (like MISR cloud top height product)
- use ASE within field of view around each ceilometer station (R_{fv} = 5 km, 10 km, 15 km, 20 km, 30 km)
- calculate standard deviation of ASE for each ceilometer station and each R_{fv}

- plot density of standard deviations for each R_{fv}

- filter out stations with higher standard deviation to calculate statistics (correlation r, bias, RMSE)

Results are shown in Fig. 1. On the bottom row of the plot you see "max allowed sd" on the abscissa. This means, ceilometer stations with higher standard deviation (sd) then the given value have been excluded from the statistics. "Inf" means all stations are considered, as they have been before.

The threshold values of 20 m, 30 m, 40 m, 50 m, and 60 m for sd correspond to the 74th, 84th, 89th, 92th, and 94th percentile of the distribution of sd, respectively, for a radius of 5 km. For a radius of 30 km, the corresponding percentiles are 30th, 49th, 60th, 66th, and 71th. In other words, for a larger radius, more stations are excluded for the same sd threshold.

The correlation increases slightly if the more varying terrain is excluded. But only until sd=50m. If an even stricter threshold is applied the correlation decreases again. The bias improves more or less monotonically with a stricter sd threshold, i.e. for "flatter" terrain. The RMSE improves as well.

Conclusion: Limiting the comparison to sites showing more homogeneous terrain improves the comparison slightly.

"Some minor issues and English: p4, line 12: MISR cloud motion vector in L2TCSP file is determined at 17.6 km resolution, and is used to derive H_SDCM by correcting the wind-induced parallax effect. As noted in Mueller et al. (2013, 2016), the cloud height and along-track wind errors are correlated. p17, line 21 .. shows a higher number of ... p.17, line 27 .. seasons .. p20, line 20 ... mentioned ..."

Thank you for these points. We will take them into account and adjust the manuscript accordingly.

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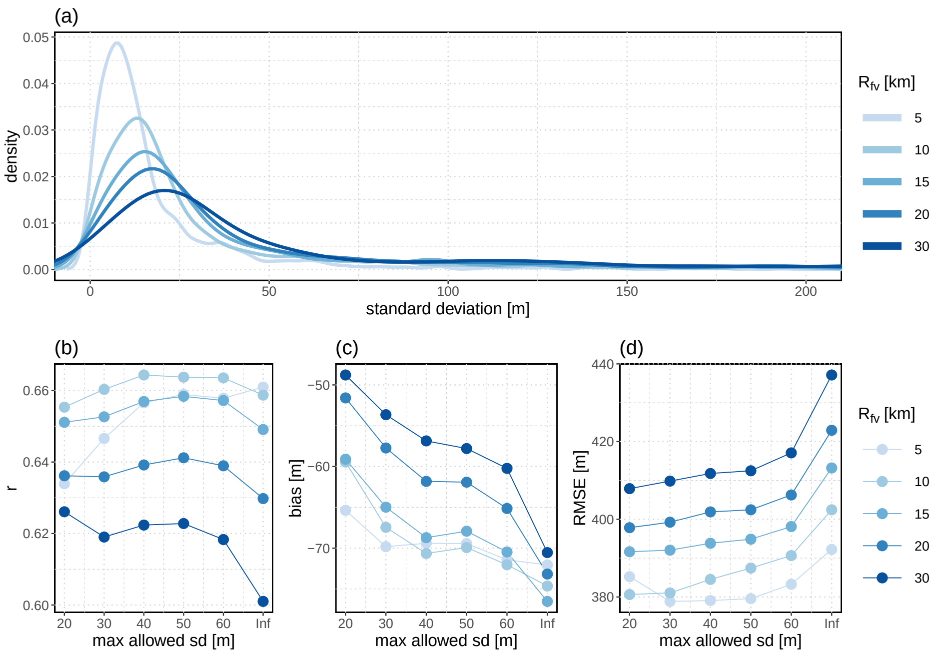

Fig. 1. (a) Density of the occurring std. deviations for various radii. Recalculation of corr. coeff. r (b), bias (c), RMSE (d) using only ceilometer stations below a threshold sd as denoted on the abscissas.