**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "Sky cover from MFRSR observations: cumulus clouds" *by* E. Kassianov et al.

Anonymous Referee #1

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The paper introduces a new technique to estimate "fractional sky cover" from ground-based spectral diffuse flux measurements. The "fractional sky cover" is a measure of "hemispherical" cloud amount (p. 717, line 8) which is never formally defined (perhaps the definition is in Long et al. 2006?–a quick Google search seems to indicate that the term is almost exclusive to the ARM community and may be traced to whole sky imager parlance). It is never clear when the technique can be applied. The title and content of the paper clearly suggest that the technique is applicable to "cumulus" clouds, but which kind? In the conclusions the authors seem to state that their method applies to only "shallow" cumulus or "optically thin clouds of small horizontal size". So, it appears that the technique is relevant to only a very small subset of clouds. How often are clouds of this type encountered at the ARM SGP site? It would have been useful if the authors had included that information. And if the technique applies to only this

special category of clouds, it seems to me that it is not very suitable to be automated or unsupervised; basically you need to know through some other means (i.e., other observations) that such clouds are present before applying the algorithm. In any case, it is what it is, and a technique that applies to only a subset of clouds is still useful as long as it is physically sound and gives correct results. In conclusion, I still think that the paper makes a useful contribution to surface-based cloud remote sensing and I don't object to its publication. Some things that in my opinion need to be addressed and/or corrected can be found below.

– Comparison with Nsw does not validate the algorithm since that retrieval can also be imperfect as the authors show (are you sure you want to call it a "well-established method" in p. 721, line 15?). So calling Nsw a "reference" data set is somewhat misleading. It is a comparison set that helps you check for consistency, not accuracy.

– If the ARSCL "cloud fraction" represents a physically different observable than "sky cover" then why compare the two in Fig. 3? And if it is appropriate to compare the two, why not do it all the time?

– The abstract and p.721 line 11 mention that the method can be applied to "different cloud types". Which cloud types beyond shallow cumulus can it be applied to?

– Fig. 1a and line p. 718, line 12: What "optical depth" is this meant to show? Aerosol only? Aerosol contaminated by cloud? It needs to be clarified.

– p. 719, line 12: Would have been nice to give some more info on the radiative transfer model. If this has been documented before please provide the reference.

– p. 719, line p.15: Is only the total (vertically-integrated) AOD need to be input in the radiative transfer calculations? Are the SSA (acronym should be expanded) and asymmetry factor assumed vertically invariant?

– A few small things: p. 716, line 16: Berg et al., 2011; p. 717, line 25-26 delete "the ARSCL"; p. 718, line 19 delete "the" before "transmittance"; p. 719, lines 1-2 "are more

than double their morning. . .”; p. 720, line 8 use “total solar irradiance” instead of “solar constant”; p. 721, line 7 delete “The” before “Eq. (3)”; p. 722, line 9 delete “the” before “most”; p. 722, line 14 and Fig. 4 caption “8 other”; p. 722, line 29 and p. 723 line 4 “mid-altitude” instead of “middle-latitude”.

C124