

Comments on “**Influence of surface albedo heterogeneity on passive remote sensing of cirrus properties**” by Fricke et al.

Summary: This study uses the airborne measurement of solar spectral cloud reflectance to investigate the impact of surface albedo uncertainty on passive remote sensing of cirrus cloud optical thickness and particle effective radius. It is found that surface albedo heterogeneity effect is negligible for optical thickness retrieval, but substantial for the retrieval of cirrus effective radius.

General Comments:

The manuscript is difficult to understand and not very well organized. It is actually quite confusing to me what is the focus of this study (see my comments below). I don't think the manuscript should be accepted for publication in ACP. But I encourage the authors to substantially revise the paper and re-submit as a new manuscript.

From my point of view, a big problem of this paper is that it lacks a clear statement of the problem. There are no background overview or discussion of previous work in the Introduction. And there are few words about the motivation and objective of this work.

As a result, I am quite confused by the title and the method used in this study. The title seems to suggest that this study is about either 1) impact of *sub-pixel* level (surface heterogeneity within each FOV) surface albedo heterogeneity on cloud property retrieval, or 2) impact of *pixel-level*, resolvable surface albedo heterogeneity on cloud property retrieval. To investigate 1), one would need high-spatial resolution (at least ~100m level) surface reflectance. Investigating 2) seems to necessitate 3-D radiative transfer simulation. I don't think the paper is about either one of the above subjects. If my understanding is correct, the focus is not on heterogeneity but more about uncertainty. The manuscript would benefit a lot from a statement of the problem.

There also seems a fundamental issue in the method used in this study. The authors derived the surface albedo for two the investigated cases from MODIS product and they investigated the spatial variability of the surface albedo, including co-variance between VIS and SWIR bands, over the chosen flight legs (i.e., Figure 2 and 3). Then they use the variability of the surface albedo over the chosen flight legs to approximate the surface albedo uncertainty in cloud property retrieval. The underlying assumption seems to be that, the higher the spatial variability of surface albedo is, the larger the uncertainty of surface albedo in cloud property retrieval. But this assumption doesn't seem to be justified. There isn't necessary a correlation between the spatial variability of surface albedo and the accuracy of the *a priori* surface albedo used in the retrieval. Clarification and justification are needed.