Response to Anonymous Referee 1

General points:

1) In the revised paper a discussion is added related to the possible effect of 3-dimensional radiation transfer effects. The results presented in the paper should be considered as a lower limit for the retrieval accuracies, because they are based on the 1-dimensional RT case. It is expected that the 3 dimensional RT effects become important for cloud fractions above a certain threshold. In that respect, probably the maximum cloud fractions mentioned in the paper for which certain accuracy requirements are met are too optimistic. Nevertheless, despite the simplifying approach, the results demonstrate the great potential that multi-angle photo-polarimetric have to distinguish between aerosols and residual cloud fraction. Something important to note is that polarized radiances are likely less affected by 3-dimensional radiation transfer effects than total radiances, because the polarized radiance signal is mainly determined by single scattering. All aspects above are included in the discussion added to the revised version of the paper. (same response to reviewer 1 and 3)

2) I believe that a discussion on climate research requirements related to surface reflectance goes far beyond the scope of this paper. Concerning aerosol height distribution, the aerosol layer height is fitted in my retrievals but to my knowledge no quantitative requirements for this are available in literature. Actually, the main reason to include aerosol height in my retrieval is because fixing this parameter would result in biases in the retrieved aerosol properties. For climate studies probably aerosol height from an active sensor would be much more useful. This consideration is added to the revised paper. Concerning ground pixel resolution and spatial coverage, these are aspects that cannot be treated with retrieval simulations. I interpret the comment of the referee such that pixel size and coverage are additional factors that should be taken into account when comparing actual instruments. I agree with that but would like to emphasize that the instrument concept comparisons in section 4.1 and 4.2 are based on generic instruments and are not PARASOL/APS versus MISR versus MODIS comparisons.

Details

1. p1234, lin3 24: In the revised paper I replace the name 'dust' with 'coarse spherical', because indeed dust aerosols should be modeled as non-spherical particles.

2. p1236, line13: It is only the spectral dependence of the refractive index that is taken from d'Almeida et al. (1991), no other aerosol properties. Further, relative abundance is not exactly what is retrieved, but it is really scaling coefficients of the refractive index spectra.

3. p1237, line 1: suggested phrase added in revised version, and typos corrected.

4. p1238, line 8: See above: In the revised paper I replace the name 'dust' with 'coarse spherical', because indeed dust aerosols should be modeled as non-spherical particles.

5. p1245: This comment refers to the 3-dimensional radiation transfer discussion. See my response to the 1st general point above.

6. p1246: Indeed, these accuracies correspond to a spatially homogeneous scene. I think one cannot speak about "typical variability across an instrument field-of-view". This depends on geo-location, season, and of course the instrument field-of-view itself. Also, these errors are very hard to quantify because it would require reliable aerosol information on a sub-km scale which is not available.

7. p1247: As long as the aerosols are located far enough above the cloud deck, some variations in e.g. cloud top altitude would be acceptable.

The reviewer is acknowledged for his/her comments on the paper.