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Atmospheric Measurement Techniques
Discussions
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Interactive comment on "Sensitivity of PARASOL multi-angle photo-polarimetric aerosol retrievals to cloud contamination" *by* F. A. Stap et al.

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Dear referee,

First of all we would like to thank you for your constructive review as well as your suggestions for the paper. We agree that we do not offer any information or reason in the case of an unsuccesful retrieval. This is because we are somewhat skeptic about our ability to differentiate between the different causes for an unsuccesful retrieval. To differentiate we would at least have to detect the presence or absence of a cloudbow (if the 140 degree scattering angle range is covered). Figure 1 of the paper shows an observation with a clear cloudbow and a good fit except at the cloudbow, were the contribution to the χ^2 is large. While this example is usefull in conveying the idea of the

goodness-of-fit filter there are many situations where the goodness-of-fit is seriously affected at multiple angles by so called 'stereo effects' due to scene inhomogeneity. This may also happen at 140 degrees even in presence of an ice cloud. Also, the goodness-of-fit may be poor at other viewing angles in the presence of a liquid cloud because the algorithm does reach a global minimum. Therefore, we did not manage to find objective criteria to identify causes for poor goodness-of-fit due to e.g. water clouds, ice clouds, algoritmic reasons, or combinations of those.

In future, we will investigate the possibility to train a neural network in detecting cloudbows in observations, recognizing observations affected by stereo-effects, etc. This neural network would also be better suited in differentiating between causes of unsuccesfull retrievals.

comment 1 We agree that this technique is currently only appropriate for the oceans and will change the abstract to indicate this. Testing this approach on observations over land would be a logical next step. Like the reviewer, we expect that polarization measurements may indeed be even more benificial for cloud screening over land.

comment 2 I've changed the sentence accordingly.

comment 3 We refer to this study by Hasekamp et.al. in the introduction in the 5th paragraph.

comment 4 Thank you for the suggestion. We agree this would be a very interesting case and are currently running retrievals on scenes with high aerosol loading (up to AOT = 2.3 at 550nm).

comment 5 In the simulations the viewing angle of the instrument was fixed, but the simulations were performed for 3 different solar zenith angles, resulting in measurements with 3 different geometries. The sampling of the cloudbow is different in all 3 geometries. I've attached a figure of the synthetic measurement of the same scene under these 3 geometries. The AOT at 550nm = 0.4, in the partly clouded scenes the

COT at 550nm = 5.0 and the effective radius of the droplets is 12micron. Note that the cloudbow is clearly distinguishable by eye for the case with SZA = 60.0, but not missed in the geometry with SZA = 20.0 . While the number geometries explored in the synthetic data-set is limited, we think sampling of the cloudbow in this data-set is fair and representative of that which is found in the actual data-set.

comment 6 The polarimetric uncertainty of 1%-2% is indeed often quoted, and is mostly limited by scene inhomogeneity because of non-simultaneous polarization measurements. For non-cloudy ocean scenes, that are homogeneous, we expect an uncertainty of 0.005 to be representative. If the uncertainty is higher because of inhomogeneity due to partial cloud cover, this helps the algorithm identify cloud contamination as the χ^2 will increase.

comment 7 I have changed the wording and titles of subsections in section 4 to reflect that we only consider liquid water clouds in the synthetic study.

comment 8 I've added a reference to the work of Di Noia et.al. in paragraph 2 of section 4.2

comment 9 The threshold on time difference is only applied when comparing the AOT, AE and SSA to AERONET. Figure 5 & 8 contain all data-points in the vicinity of AERONET stations (no time constraint). I've changed the last sentence of paragraph one to better convey this, the sentence now reads; The retrieval results for these different cloud screenings are then compared to the AOT and Ångström exponent (ÅE) from the AERONET direct sun product ($\Delta t \leq 1$ h) and the micro-physical aerosol properties and Single Scattering Albedo (SSA) retrieved from the AERONET diffuse sky product ($\Delta t \leq 12$ h).

comment 10 See our response to comment 6. For inhomogeneous scenes (i.e. partial cloud cover) the error would indeed probably be larger. This would result in a larger χ^2 improving the ability to screen for clouds.

comment 11 Thank you. We will perform some simulations with larger coarse mode particles.

comment 12 The caption was not clear here. There is no cloud above the full resolution PARASOL pixel. There are clouds 4 km away. These are included in the medium resolution PARASOL pixel of which the observation is shown in the panel on the right. I've changed the caption.

comment 13 I've better explained the cirrus mask that is used here in the caption of figure 7 and added a sentence in section 2.2 which explains the bands used in the detection of cirrus by MODIS.

comment 14 I've adjusted figure 11 to list the number of data-points.

comment 15 Indeed figure 12 shows the medium resolution data. I've adjusted the caption. For consistency, we would prefer to keep the time-series plots of the refractive index and SSA.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 10673, 2014.

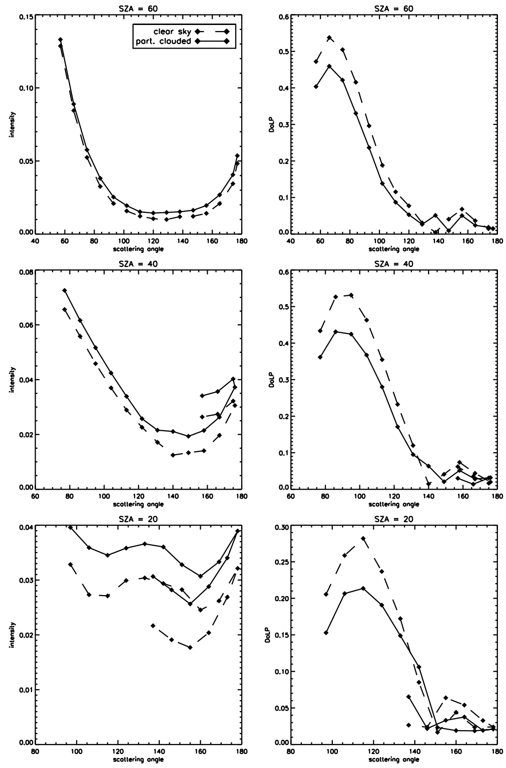
SZA = 60
clear sky
part. clouded
intensity
scattering angle
SZA = 60
DoLP
scattering angle
SZA = 40
intensity
scattering angle
SZA = 40
DoLP
scattering angle
SZA = 20
intensity
scattering angle
SZA = 20
DoLP
scattering angle

Fig. 1.