Interactive comment on “Combined neural network/Phillips-Tikhonov approach to aerosol retrievals over land from the NASA Research Scanning Polarimeter” by Antonio Di Noia et al.

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This is a well-designed and well-written study. The neural network (NN) is trained based on the radiative transfer simulations first, and then used to arrive at first guess solution for the following Phillips-Tikhonov minimization when processing RSP data. The NN-accuracy is demonstrated based on synthetic data, and the algorithm is applied to process PODEX and SEAC4RS flight campaign data. The paper is a good contribution to the field, and should be published after authors make a couple of corrections below. I have just one question which should be outlined, perhaps, in the Abstract or summary, and was not really clear to me after reading the paper. Of all
field campaign data, what % of experiments did you process in the end? Paper says \sim10\% based on convergence to \text{chi}^2<2. From \text{chi}^2>2, what % is due to failure from the surface retrievals? You can evaluate \text{chi}^2 from the surface alone based on simulated experiments. My feeling is that adding surface spectral covariance as a constraint may not serve you well. Also, the retrieval accuracy of \sim0.01 surface reflectance (perhaps larger since 0.01 is rmse) in the visible bands is not good enough for the land applications, e.g. vegetation studies, and it creates a considerable uncertainty for the aerosol retrieval, although of course, aerosol-surface parts are not separated in the described algorithm.

1. P.5, Ln. 12: The backscattering azimuth is 180-\phi (you have 180+\phi). 2. P.5, Ln.27: “This term is equivalent to the classically defined surface albedo.” This is incorrect – please remove here and correct everywhere in the paper. Surface albedo is “classically” defined as a ratio of reflected and incident surface fluxes. This ratio will equal \text{f}_\text{iso} ONLY if hemispheric integrals of terms containing \text{K}_\text{vol} and \text{K}_\text{geo} in the boundary condition of RT are zero, and they are not. For the same reason, surface albedo is a function of \text{SZA} (e.g., see Lyapustin, 1999, JGR).

Sincerely, Alexei.