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Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of simultaneous aerosol and ocean glint retrieval using multi-angle observations" *by* Kirk Knobelspiesse et al.

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This manuscript has an interesting topic of assessing the information content of the MISR multi-angle measurements aiming for a potential simultaneous retrieval of aerosol and wind speed. By using AFRT to generate a lookup table and applying GENRA for ICA, several sensitivity tests are designed to reveal the optimal choices of the retrieval strategy. I think this is a good paper, and I don't have any disagreements regarding the analysis and conclusions; but I do have some questions about the technique, especially how to implement the GENRA approach and perform the sensitivity test.

My general understanding (not sure it is right) of this work is that, instead of using real

MISR data, the simulated MISR measurements for given sets of parameters (r,f,τ,w) at the geometries of the test cases (interpolated from the LUT) would be used as "inputs" to derive the posterior PDF of the parameters (r',f',τ',w'), where the prime indicates the "retrieval space" which is much finer than that of the "input" (as in the LUT), so "the result will have n+n dimensions" (line 253-254).

My first question is for equation 2: what is the "likelihood function"? It is said "Pd(y) is the stochastic measurement distribution (d for data), and Pl(y) is the same for the likelihood function" (line 243). Is the "Pl" has the same function form as "Pd" (equation 12), but using different y'? From Vukicevic's paper (2010), her equation 1 has the stochastic measurement distribution (Pd) and model distribution (Pt) terms, and the "likelihood" is the "combining of the model and measurement pdfs" (section 2.3), which seems to correspond to the "Pd(y)" only, since "the data (Pd) is a PDF created from a single node in the LUT and expectations of measurement and model uncertainty" (line 248-249), as defined in the equation 12, the uncertainty variance (σ) includes both the measurement and model contributions. In this paper, the "likelihood function" is mentioned at five places, but it is hard to me to get a clear understanding of this term.

My second question is about the last two sensitivity tests (sections 3.4 and 3.5). It appears to me (again, might be wrong) that the simulated MISR measurements (from LUT) are calculated with the plane-parallel and scalar wind speed assumptions. It is a little hard to understand how to test the sensitivity to the conditions whose signals are not in the inputs. For the test of the plane parallel assumption (section 3.4), if the simulated Df and Da camera observations are from the plane parallel calculations, then it would be expected that retrieval with them (9-camera) would have a better result than without (7-camera), since the (extra) information contained in these two cameras are consistent with the retrieval assumptions (both assume plane parallel). For the sensitivity test of the glint, discarding the uncertainty associated with vector wind would only lead to the improvement since the inversion would be more consistent with the input (both assume the scalar wind without penalty). If I didn't misinterpret the result,

figure 10 seems indicate that the test without the scalar uncertainty term would have more information content than the test with the uncertainty since the SIC difference is positive.

Other than these two questions, I think the paper is well written and the analysis is thorough and clear. So I would recommend this paper be accepted after some clarification about the above questions are made.

One minor issue, for the equations 4-7, should the summation be make over the parameters with prime (i.e., r', f' etc.)?

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