

General Comment

The manuscript describes an aerosol retrieval algorithm developed for application to nadir observations by the ATSR-2 sensor. When applied to the ATSR-2 observational record the proposed algorithm will contribute aerosol optical depth data to the period 1995-2000 prior to the deployment of the MODIS and MISR instruments.

The most serious limitation of the algorithm is the use of the Lambertian approximation to characterize the surface reflectance in a spectral region where the need to accurately account for surface effects is well known. The chosen approach is rather puzzling taking into account that the dual viewing capability of the ATSR-2 can be advantageously used to carry out a more realistic and accurate surface reflectance characterization. Given the availability of a multi-view algorithm already documented in the literature by the same author one wonders what is then the purpose of this manuscript, describing a technically limited retrieval approach.

Another serious shortcoming of this paper is the failure to use actually observed ATSR-2 data to evaluate the robustness of the proposed algorithm. The authors have carried out a detailed sensitivity analysis using synthetic data. The results are clearly very useful but not conclusive. A more useful analysis could have been produced making use of actual observations out of the ATSR-2 1995-2001 record instead of synthetic data.

Specific Comments:

-Page 982: The authors need to provide a rationale for the application of a technically limited algorithm to a sensor capable of providing data to be used in a more robust and accurate retrieval approach taking advantage of the dual viewing capability.

-Page 983: The Lambertian surface approximation breaks down rapidly at the wavelengths of the observations. This is especially true over land. The use of actual ATSR-2 observations for the evaluation of this approximation will probably yield a more realistic assessment of the inadequacy of the proposed surface treatment approach.

-Page 984: The authors need to define what 'sufficient accuracy' is. I agree with the authors that the ATSR-2 sensor could provide a valuable data set on aerosol optical depth during the 1995-2000 period. It can be even more valuable if one takes advantage of the full observational capabilities of the sensor.

The Thomas et al paper (2009) documents an existing algorithm that seems to make use of the sensor's dual viewing geometry. If such algorithm has been developed, why is a nadir-only algorithm needed?

-Page 985: The authors rely heavily on the OPAC data set for the aerosol model representation. Are the resulting atmospheric-column model representations consistent with AERONET derived aerosol columnar properties of particle size distribution and refractive index?

-Page 987: It is not clear where the mixing ratio of the *ith* component comes from. Please explain.

The expectation that large changes to the effective radii are not needed to match the observed radiances is clearly unrealistic in the retrieval of dust plumes blowing over the oceans. (See comment on Figure 1 below).

-Page 989: I do not understand the need to report the retrieval results at a wavelength other than the ones of the observations. It makes more sense to report retrievals at 0.67 or 0.87 microns. A converted value to 0.55 microns can also be reported but making clear that it is a converted rather than retrieved value.

The normalization channel should be one of the actual ATSR channels. Any extension to other channels is a modeling exercise beyond the scope of the retrieval algorithm

-Page 992: A more extensive discussion of the geographical distribution of aerosol types shown in Figure 1 necessary. For instance, figure 1 shows the desert dust type only over the continents. Does it mean that the algorithm does not expect desert dust in the middle of the Atlantic and Pacific Oceans as it is often seen by MODIS, MISR and OMI observations? The same can be said about the smoke plumes that frequently flow from the continents to the oceans. Are the optical properties of the continental aerosol type used in the forward model consistent with what is known today (AERONET) for carbonaceous aerosols? It is not clear if aerosol mixtures are considered.

- The reported sensitivity analysis is very useful but not conclusive. The use of actually observed ATSR-2 data will allow the testing of the assumed spatial distribution of the different aerosol types.

Page 995: In discussing Figure 5 the authors refers to precision. I believe the concept they refer to is 'accuracy' rather than precision.

Page 996: Again, I believe the authors mean 'accuracy' rather than precision

Page 998: The Plane parallel approximation should also be listed as a forward model error.

Page 1002: On the last paragraph the authors refer to the large errors in retrieved effective radius resulting from assuming desert aerosol in place of maritime. The opposite case (i.e, prescribing maritime instead of desert type) is probably likely to occur more often in practice. What is the implication on the accuracy of the retrieval?