Review of ACPD manuscript amt-2015-390: Real time retrieval of volcanic cloud particles and SO2 by satellite using an improved simplified approach

This paper describes improvements of an existing procedure, Volcanic Plume Removal (VPR) that retrieves optical depth, effective radius, and mass of volcanic ash particles as well as Sulphur Dioxide (SO2) mass. The improved approach makes use of empirically established relationships between the Planck emission at the mean volcanic temperature ($B(T_p)$) and other volcanic plume properties in scenarios with and without SO2 presence using radiative transfer calculations. The topic of the paper is of scientific interest but, as currently written, the paper appears confusing and incomplete. Comments and suggestions for addressing these issues are given below.

Nowhere in the manuscript are the retrieval of ash particles properties and SO2 concentrations discussed. The title should not make reference to the actual retrieval of ash particles and SO2 concentrations which are not really addressed in the paper.

The paper is really about the use of radiative transfer calculations to develop linear relationships between the volcanic plume's Planck function at its mean temperature and empirically established fitting parameters (B_{up} and B_{dn}) and between $B(T_p)$ and the volcanic plume transmittance (τ_t) in the absence of sulfur dioxide. In the presence of SO2, linear relationships are established between $B(T_p)$ and a confusing constant B_s that depends on multiple parameters (i.e., plume temperature; an undefined plume position, and also an undefined state of the atmosphere above the plume) and, therefore, not a constant by definition.

The connection between the above mentioned linear functions and the actual retrieval of ash particle properties and SO2 is not established. It is left up to the reader to figure out what the 'subsequent steps of the VPR procedure' are. As currently written the paper resembles more a technical document to be circulated between members of a closed research community who are familiar with the intricacies of the VPR, and not a document of interest to a larger community interested in general aspects of the ash retrieval problem but unfamiliar with the details of the VPR. My suggestion to the authors is to either narrow down the scope of the paper to the parametrization exercise mentioning its application to improve VPR, or expand the discussion part of the paper to describe succinctly but clearly the remaining aspects of the VPR with references to the previously published work.

Other comments:

What is the physical meaning of α in Equation 1? What are its units?

Terms τ' and τ'' are not explicitly defined in the text.

An explanation for the transition from Equation 1 to Equations 2 and 3 is lacking. It appears that in arriving to the simplified expressions in Equation 2, the term α becomes zero, τ'' becomes unity, and the term $L_{uo}^{``}$ vanishes. A short explanation on the physical basis associated with the algebraic transformation should be added.

On page 6 it should be added coefficients *a* and *b* are, respectively, the slope and y–intercept of the linear fits illustrated in Fig. 4a.

The use of the term ‘volcanic particles’ is confusing. Use either ‘volcanic ash’ or ‘sulfate aerosols’ in the appropriate context. Although they are both generated by the eruption, their properties, lifetimes, and importance are quite different.