Atmos. Meas. Tech. Discuss., 8, C2917–C2919, 2015
www.atmos-meas-tech-discuss.net/8/C2917/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Sensitivity of thermal infrared sounders to the chemical and micro-physical properties of UTLS secondary sulphate aerosols" *by* P. Sellitto and B. Legras

P. Sellitto and B. Legras

psellitto@lmd.ens.fr

Received and published: 11 September 2015

We would like to thank the Anonymous Referee #1 for his constructive criticism. While we will provide a detailed point-by-point reply when the discussion phase will be over, here we wish to give a quick reply to the general concern expressed in his review.

The specific scope of our manuscript is the analysis of the variability of the spectral extinction signature of UTLS sulphate aerosols, with the approximation of sulphuric acid/water droplets and a mono-modal size distribution, starting from their spectroscopic characterization. This is expressed at P8442, L18-22 of the discussion paper:

"The main target of this paper is to link the optical characterization of sulphate solutions, as available from the published spectroscopic laboratory measurements of, e.g., Biermann et al. (2000), to the empiric observation of aerosols signatures in favourable natural contexts, e.g., for volcanically enhanced sulphates production in the UTLS." Our motivation is to complement the existing literature, that include the papers quoted by the Referee (Bauman et al., 2003; Doeringer et al., 2012; Echle et al.,1998; Steele et al., 2006, Yu and Rose, 2000), and a few others (like Grainger et al.,1993; Clarisse et al., 2013) with a more detailed description of the spectroscopic origin of the detected extinction signatures. These papers all deal with retrieval techniques for specific (limb-viewing or occultation, except for Yu and Rose, 2000; Clarisse et al., 2013) satellite instruments and with specific inversion schemes, generally using spectral fitting techniques to adjust some parameters of a direct radiative model. On the contrary, our work is aimed at providing a clearer connection between the optical properties of known sulphate particles (and their variability with varying chemical and micro-physical properties of the aerosol layer) with the observable spectral extinction signatures. As such, we believe that our paper brings useful elements to the current literature and the related discussion on sulphate sounding.

For the same reason, we did not focus our work to a specific instrument, even if for illustrative reasons we have produced IASI pseudo-observations. This is also why the very basic optical properties of sulphate layers are first analyzed in terms of the extinction coefficient rather than as pseudo-observations. We have proposed that the variability of extinction signatures could be described in a compact manner based only on a few well-separated wavenumbers. This brings useful elements in the context of sulphates observation with broad-band TIR sensors (MODIS, SEVIRI, etc), which have a limited number of spectral channels. Nevertheless, we agree that the second part of our manuscript, where we discuss the high spectral resolution pseudo-observations, should go a step further and be more quantitative. For this reason, we will add a quantitative analysis of the information content, i.e., using Rodgers definitions, in the revised manuscript (in Section 4). We believe that relating the information analysis to

the optical properties described in Section 3 will make our manuscript more complete and more useful.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 8439, 2015.