

Review of the manuscript “*Consistency of dimensional distribution and refractive indices of desert dust measured over Lampedusa with IASI radiances*” by Liuzzi et al.

The paper presents the comparison between observed (IASI) and calculated ( $\sigma$ -IASI-as) radiances during a dust event affecting Lampedusa Island. The novel  $\sigma$ -IASI-as radiative transfer model takes into account the effects of aerosols on extinction.

**General comments:**

1) First of all I would encourage the authors to explain better the differences between  $\sigma$ -IASI and  $\sigma$ -IASI-as models. If I have well understood the  $\sigma$ -IASI computes the atmosphere spectral radiance both for clear and cloudy sky and the  $\sigma$ -IASI-as model includes also the effects on spectral radiance due to atmospheric aerosols. The authors state that the effects of particles and clouds on extinction are based “on the same physics”. However, for example, multiple scattering has a major importance in clouds rather than in a dust layer. Some of the equations reported in this manuscript (Liuzzi et al., AMTD) have been already discussed in Amato et al. (2002) however there are some differences which I do not understand. For example equation 1 in the present manuscript corresponds to equation 7 in Amato et al. (2002) but there are two differences in the third right term of the equation:  $\tau_0$  is  $\tau_0^2$  in Amato et al. (2002) and  $\tau_*^f$  is  $\frac{1}{\tau}$  in Amato et al. (2002). What are the reasons for these differences? The same in the equations 3 and 4 in Liuzzi et al. AMTD (corresponding to equations 12 and 13 in Amato et al. (2002)). Equation 2 in Liuzzi et al. AMTD is exactly the equation 8 in Amato et al. (2002) but a different nomenclature is used ( $R_C$  instead of  $R_0$  and  $R_N$  instead of  $R_{\text{clid}}$ ). Is there any reason for this? This is a bit confusing and the same nomenclature as in Amato et al. (2002) should be used in this manuscript, unless the terms included in the equations of Liuzzi et al., AMTD are different, but this is not clear.

2) Is it possible to know  $\omega(\sigma)$ ,  $b(\sigma)$  and  $g(\sigma)$  computed by the model and compare these intensive aerosol properties with their experimental determinations reported in literature for dust?

3) Pag. 11, Lines 19-22. It is nice to see that the radiance computed with  $\sigma$ -IASI-as, which includes the impact of dust aerosols, reproduces quite well the observed IASI radiance compared to the simulated clear-sky radiance. However, the authors state that the slope due to the peak in the complex refractive index around  $1000 \text{ cm}^{-1}$  “is well manifested both in the computed and observed radiances”. However, I cannot clearly see the effect of dust absorption on the simulated radiance in Fig. 6 and 7 because of the absorption due to  $\text{O}_3$  in the same spectral region. Moreover, I do not see any effect of dust absorption at  $1500 \text{ cm}^{-1}$  in Figs. 6 and 7. Is this due the fact that the absorption by  $\text{H}_2\text{O}$  is dominant in this spectral region?

4) Not sure if this was already discussed in Di Biagio et al. What is the reason for the lack of peak in the imaginary part of RI for Algeria dust around  $1500\text{ cm}^{-1}$ ?

5) The English must be improved

6) Uncertainties of  $\sigma$ -IASI-as outputs should be discussed.