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Atmospheric Measurement Techniques Discussions

Interactive comment on "Influence of aerosol and surface reflectance variability on hyperspectral observed radiance" *by* C. Bassani et al.

Anonymous Referee #5

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* General comment

The aim of this paper is to study the variability of the combined atmospheric aerosol and surface reflectance contributions to the top of atmosphere (TOA) hyperspectral radiance in the spectral range (400 – 2500) nm, making use of simulated observations performed by the 6SV1 Radiative Transfer Model (RTM).

Two very different 6S aerosol models (urban/continental), in particular in terms of spectral single scattering albedo (SSA), and two very different 6S spectral surface reflectance (sand/clear water) within the instantaneous FOV (viewed target) and as assigned to surrounding pixels (adjacent targets) are considered.

The main interesting feature of the paper is to perform a sensitivity analysis of TOA simulated PRISMA (Hyperspectral Precursor of the Application Mission) radiance to the aerosol optical thickness (AOT) variability at 500 nm in the range (0 - 2), considering the effect of the lambertian surface reflectances of surrounding pixel (adjacency effect). Result on the relative variability of simulated TOA radiance are compared to the nominal SNR of the PRISMA instrument with the aim to better address in the next future the use of the PRISMA observations for the satellite aerosol retrieval.

As referee, I suggest to take into account the following remarks before to publish the paper in AMT.

* Specific Comments

- Selected study area

The authors take into account the importance to refer the simulations to realistic situation, but they select the typical location for their study as 'coastal areas' (see, for instance, abstract, Chapters 2,4,5) with an instantaneous FOV over Rome (see Chapter 3). In this context, the choice of urban and continental aerosol for a coastal area cannot be properly done without considering at least a background of maritime aerosol (for both models the oceanic/sea-salt component is null, as indicated in Table 1). On the other hand the author have to better discuss the concept of surrounding pixel if the selected location is a viewed pixel of (30x30) m2 over Rome and the related surface reflectance is 'sand' and the related surrounding pixels are typically 'clear water' (without chlorophyll). A proper selection and discussion of the area (viewed and adjacent targets) are necessary.

- Aerosol Models

The path radiance due to the aerosol can be considered proportional to the product of the three aerosol parameters: phase function, SSA and AOT. So, it can be useful to add, for instance in the Fig. 1, the plot of SSA as function of wavelength for the 2

aerosol model employed. For each observed geometry also the spectral trend of the phase function is important. The employed models are hygroscopic aerosols. What is the value of the Relative Humidity? This is necessary to reconstruct the related aerosol optical properties.

- PRISMA acronym

The better english translation would be “Hyperspectral Precursor of the Application Mission” (see for instance http://www.asi.it/en/flash_en/observing/prisma).

- 6SV1 RTM

This RTM is extensively employed. It is necessary to justify this choice for the selected application and provide information on the exact version employed (6SV1.1 or V1.2).

- PRISMA instrument

Also the choice to simulate and provide results only for PRISMA-like data up to 1000 nm must to be better justified. It depends also on the spectral trend of the selected aerosol class and surface reflectances?

About this point the authors consider this domain as those for which the aerosol effects are relevant. The opinion of the referee is that also selected PRISMA wavelengths greater than 1000 nm will be employed for the aerosol retrieval (or atmospheric correction). See for instance the difference within the range (1000 - 1500) nm of the spectra of top plates of Fig. 2 as function of the AOD variation.

It is necessary remember what is the slit function employed in this case: Is it a simply box function with a specific FWHM ? Is this choice done because specific instrumental data are not yet accessible?

- Observation geometry

It is not clear the choice of the at-nadir-viewing angle.

- On the radiative impact of aerosol loading on the observed radiance (sec. 3.1)

The most significant quantity for the discussion about the sensitivity and impact of aerosol loading on the observed radiance is “DeltaRad / Rad” as function of the wavelength, being DeltaRad the difference between the TOA radiance simulated in presence (AOD not equal zero) and in absence (AOD equal zero) of each type of aerosol loading.

Thus, regarding the Fig.2, the referee suggest to check and support the considerations reported between line 15 and line 20 in Sec. 3.1 after plotting for the 4 cases of Fig. 2 the ratio “DeltaRad/Rad” as function of the wavelength. We expect that for a continental aerosol the sensitivity to the aerosol loading of TOA radiance is better over dark surface respect to the bright surface.

* Technical corrections

Table 1 : Use the same name “sea salt” or “Oceanic” in the caption and in the table.

Table 3: Please, add a reference at the end of the caption.

In general, for the plots of the same figure it would be better to have the same scale of the y-axis and to have the same numerical value for the LUT of the grayscale of the last 3 figures.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 7211, 2011.