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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of aerosol absorption properties using the AATSR satellite instrument: a case study of wildfires over Russia 2010" *by* E. Rodríguez et al.

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This paper presents a SSA retrieval for the AATSR satellite instrument, compares the ADV SSA retrieval to OMI and AERONET retrievals, presents some case studies over wildfires in Russia, and presents a global SSA map. Since SSA is so elusive in aerosol science, it presents a relevant topic.

The basic premise behind the retrieval is to iterate the mixing ratios of two aerosol models for each size mode. (Weakly and a strongly absorbing aerosol models are used for the fine mode, sea salt and dust models are used for the coarse mode.) Ideally, the retrieval will produce the mixing ratios that best describe the measured radiances at 3-4 wavelengths. (The mixing ratio of dust and sea salt is not retrieved, though; rather,

it is constrained by an Aerocom climatology.)

Unfortunately, the authors have not demonstrated that the retrieval is sensitive to absorbing aerosols in the atmosphere. The AATS measures scattering at two angles, and it is tough to argue that this is enough information to uniquely obtain aerosol absorption. We can get away with this for AOD retrievals because both AOD and the scattering field are mainly sensitive to the real refractive index, and the AOD result does not change too much with reasonable perturbations of the imaginary index. However, the SSA is very sensitive to the imaginary index. In this paper, the imaginary index is strongly linked to the real refractive index, since there are only two aerosol models for each mode. That is, (n,k) = (1.4,0.003) or (n,k) = (1.5,.04). Thus, the retrieval will likely find a solution associated with the "best" real refractive index, and the imaginary index is just an artifact of the chosen aerosol models.

This fundamental problem seems to affect the SSA results. The spatial pattern of fires is quite different in the upper and lower plots of Fig 8. The low SSA of South America seems to be located to the west of the fires shown in the bottom plot, and high SSAs occur in east Brazil where the fire map shows dense fires. Likewise, high SSAs occur in the fire regions of south Africa. There are no fires in Australia on the fire map, but SSA is low in the middle of that country.

How were the aerosol models of Table 1 chosen, anyways? Are these Aerocom or AERONET or field mission climatologies?... In order to properly assess the validity of the ssa retrieval, the authors should test their algorithm with a variety of different aerosol models. What happens if the fine mode weakly absorbing aerosol have k = 0, 0.001, or 0.005? or n = 1.35, 1.45? What if the fine mode radius is 0.1 or 0.15? Or the mode width is different? Similar questions apply to the coarse mode. This would be one way to assess the uniqueness of their SSA solution, but I am sure that there are others.

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