Atmos. Meas. Tech. Discuss., 5, C1060–C1062, 2012
www.atmos-meas-tech-discuss.net/5/C1060/2012/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Implications of satellite swath width on global aerosol optical thickness statistics" *by* P. R. Colarco et al.

Anonymous Referee #2

Received and published: 21 May 2012

Review of "Implication of satellite swath width on global aerosol optical thickness statistics" by Colarco et al.

This paper attempts to quantify the effect of swath width (i.e. the spatial coverage) on global aerosol optical depth estimates from low Earth orbit satellite (sun-synchronous) instruments, by comparing spatio-temporal averages of AOD retrieved from different portions of the MODIS swath. The question of sampling biases is undoubtedly an important one in the measurement of aerosol, especially when attempting to determine the global mean aerosol field. Furthermore, the results presented in this paper are certainly interesting, particularly for users of MODIS aerosol data; however, the paper does not successfully address the issue of swath-width dependence in global averages

of AOD from LEO satellites.

The main problem with the analysis done in the paper is that, while the dependence of MODIS aerosol retrievals on instrument zenith angle is acknowledged and investigated by the Authors, they make no attempt to separate it from the sampling issue they claim to be investigating. The use of AERONET data to correct MODIS AOD for instrument zenith angle effects would only make sense if AERONET showed no dependence on the MODIS zenith angle at the time of overpass – the fact that it does greatly complicates the interpretation of this type of analysis.

If we assume that the AERONET zenith angle dependence in AERONET-MODIS match up AOD, is in fact a time-of-day dependence (one of the possibilities provided by the Authors), then the results presented are dominated by diurnal differences in the different MODIS sub-samples (M1-3, C1-3 and SM), not by their differences in swath-width. The second possible explanation of this AERONET dependence (that it is actually due to a latitudinal bias introduced by the absence of the tropical deserts in the MODIS dataset) is not at all clear to me and needs further explanation.

If the swath-width itself (i.e. the spatial sampling of the AOD field) was the dominant effect being seen in the analysis, then one would expect to see pseudo random differences between the datasets shown in figures 4 and 6, as the smaller swaths would be under-sampling the highly variable aerosol field seen in the full swath. Instead, Figure 4 and, in a less direct way, Figure 6 essentially reflect the satellite zenith angle dependence of AOD shown in the right hand panels of Figures 2 and 3.

My suggestion to the Authors is that they determine what the cause of the AERONET AOD dependence on MODIS zenith angle during an overpass is – if it is due to the change in local solar time from one side of the MODIS swath to the other, then they may have stumbled on an interesting way to investigate the effect of diurnal sampling in determining spatio-temporal averages of aerosol properties. However, the results presented here hold very little relevance for the ability of a narrow swath instrument

to give an accurate estimate of global, monthly average AOD for a given overpass time – that we should find some small bias in a similar average taken from a similar instrument at a different overpass time (even neglecting viewing geometry effects) is not overly surprising.

In addition to the above points, I would also like to add my support to comment 2 made by Referee #1. The results shown in this paper do not support the conclusion that narrow swath instruments do not have a role to play in improving our understanding of the radiative impacts of aerosol. What is needed is a more sophisticated analysis of improved aerosol properties (in terms of accuracy, reliability and number of parameters), which takes into account the sampling provided by each instrument.

For these reasons, I feel this paper should not be published in AMT in its present form. I would encourage the Authors to pursue this analysis further and investigate what is the cause of the zenith angle dependence of AOD they are seeing.

Further to the general discussion above, I have two further specific comments the authors might find helpful:

Fig. 1. When printed (on my printer at least) the dark grey, deep purple, deep red and deep green points all appear essentially black.

Fig. 5. I am confused by this figure. The authors state that the global annual mean AOD for sub-swath C1 is almost identical to the full swath over both ocean and land. Fig. 2 shows this assertion to be incorrect – the C1 line lie well above the full-swath line over land for 2010.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2795, 2012.