

Interactive comment on “Correcting for trace gas absorption when retrieving aerosol optical depth from satellite observations of reflected shortwave radiation” by F. Patadia et al.

Anonymous Referee #1

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Important small detail for consistent climate data records

The paper discusses corrections to mid-visible satellite aerosol retrievals for the impact of the small but non-negligible trace gas absorption. It rightfully states that this well-known correction remains often at the side of publications on aerosol retrieval and not much detail is provided. The authors make a thorough quantitative assessment of the impact of different absorbing trace gases on window channels used in AOD retrieval. They relate the strength of absorption to typical AOD uncertainties and clearly show that while on global average trace gas absorption in window channels remains within AOD uncertainties, on regional scale it clearly does exceed them. The authors demon-

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strate the importance of such an accurate trace gas correction for consistent climate data records by assessing the consequences of tiny differences between similar spectral channels of two similar but not identical sensors MODIS and VIIRS which can be used to constitute a long-term AOD record. This fully falls into the scope of AMT and sheds detailed light on such a “small” but still important aspect of long-term climate quality data records. The paper is well written with clear arguments and conclusions supported by substantial data presented in appropriate tables and figures. Title and abstract summarize clearly the content of the paper and its essence. The scientific methods used are state of the art and clearly referenced where suitable.

I therefore recommend to accept the paper after some technical corrections.

I have only three more general suggestions and a number of small issues (see detailed comments). 1) I recommend to consistently use the term “atmospheric gas correction” rather than “atmospheric correction” since the latter is commonly used when correcting surface observations for the impact of atmospheric scattering (molecules and aerosols) and trace gas absorption. 2) Regarding references I suggest to add a few references for leading European aerosol retrieval algorithms, mainly in context of the ESA Climate Change Initiative CCI: a) In addition to the reference to Hollmann et al. 2013 (overview paper of the entire CCI program with its 13 ECVs) a paper on the Aerosol project in CCI should be added: “Popp, et al., Development, Production and Evaluation of Aerosol Climate Data Records from European Satellite Observations (Aerosol_cci), Remote Sensing, 8, 421; doi:10.3390/rs8050421, 2016” or “de Leeuw, et al., Evaluation of seven European aerosol optical depth retrieval algorithms for climate analysis, Remote Sensing of Environment, 162, 295-315, doi: 10.1016/j.rse.04.023, 2015” b) When referring to the GCOS requirements, the latest GCOS implementation plan 2016 with its Annex A ECV Product requirement tables (aerosol on page 281) should be added: GCOS-IP 2016: GCOS Implementation Plan 2016. GCOS-200. Available at https://library.wmo.int/opac/doc_num.php?explnum_id=3417 c) As leading algorithm for the AATSR instrument the Swansea algorithm should be added to the references:

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“Bevan, et al. (2012), A global dataset of atmospheric aerosol optical depth and surface reflectance from AATSR. Remote Sensing of Environment, 116, 119-210” and “North, et al., Retrieval of land surface bidirectional reflectance and aerosol opacity from ATSR-2 multiangle imagery, IEEE Trans. Geosci. Remote Sens. 1999, 37, 526–537. 3) Regarding figures, I suggest to increase axis legends of fig. 1, colour bar legends of fig. 6a

Detailed comments: l. 82: “[MISR ATBD]” – please add http link, date and version to make a unique reference l. 111: please also add the width of VIIRS channels l. 178 / 179: two conflicting namings for G_i are made (airmass factor or path length), which could be confusing readers l. 270 ff: here ten gases are discussed, while in l. 169 only 5 are identified as relevant – please harmonize or explain (see also l. 346 and 462/463) l. 304 ff: I had to read this several times and found it confusing (my first impression was that liner relationship will do then is learned that it will not do) – maybe you can rearrange to start with the clear statement that a quadratic fit is needed l. 310 ff: Can you state whether the H₂O airmass factors include any effect of multiple scattering (since water vapour prevails in the lower troposphere)? l. 318: instead of “ G_i ” and “gas i” it should be “GO₃” and “O₃” l. 332: What is the temporal resolution of the NCEP analysis? l. 386: table 4 contains also another line on Rayleigh OD, which should also be mentioned and brought into perspective in the text l. 415: correct in the middle: “that that” l. 486: Another aspect of interest would be whether an overlooked long-term trend in water vapour or ozone concentrations (e.g. by using a static climatology) could create an artificial AOD trend – if you could add a statement on this (whether its relevant or negligible) based on an assumed possible decadal trend in concentrations, this would be very useful? Fig. 7 legend vs. text in l. 427: differences are smaller than 0.08 (figure) or 0.07 (text) – can you harmonize? Table 4 / Rayleigh OD, 2nd column: correct “Fiter” to “Filter”

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