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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A global aerosol classification algorithm incorporating multiple satellite data sets of aerosol and trace gas abundances" *by* M. J. M. Penning de Vries et al.

Anonymous Referee #1

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Review of manuscript titled "A global aerosol classification algorithm incorporating multiple satellite data sets of aerosol and trace gas abundances" by Penning de Vries et al.

General comments:

The current manuscript deals with aerosol type classification using multiple satellite dataset including MODIS, GOME and MOPITT. This is a nice piece of work incorporating multiple methods, i.e. classification by aerosol parameters and by their correlation with trace gases. Contents are well organized and presented with thorough discussion.

However authors need to note relevant work in the past. There have been studies to classify aerosol type either by multiple channel algorithm (e.g. Higurash and Nakajima, 2002; Lee et al., 2010), or by using aerosol parameters such as AI, AE, FMF from different satellite instrument (e.g. Jeong and Li, 2005; Kim et al., 2007).

Lee, J., Kim, J., Song, C. H., Ryu, J.-H., Ahn, Y.-H., and Song, C. K.: Algorithm for retrieval of aerosol optical properties over the ocean from the geostationary ocean color imager, Remote Sens. Environ., 114, 1077–1088, doi:10.1016/j.rse.2009.12.021, 2010.

Jeong, M.-J. and Z. Li, Quality, compatibility, and synergy analyses of global aerosol products derived from the advanced very high resolution radiometer and Total Ozone Mapping Spectrometer, J. Geophys. Res., 110, D10S08, doi:10.1029/2004JD004647, 2005.

Kim, J., J. Lee, H. C. Lee, A. Higurashi, T. Takemura, and C. H. Song, Consistency of the aerosol type classification from satellite remote sensing during the Atmospheric Brown Cloud–East Asia Regional Experiment campaign, J. Geophys. Res., 112, D22S33, doi:10.1029/2006JD008201, 2007

Furthermore, it is not clear how the threshold values are determined. Those should be based on physical reason and/or previous work, other than stated as 'empirical'. As authors have dealt with all the satellite dataset, they can look into the details. Other detailed comments are as below.

Detailed comments:

Introduction There have been studies to classify aerosol type using aerosol index from TOMS (or OMI) and AE (or FMF) from AVHRR(or MODIS) as listed above. Thus, it is appropriate to mention such work, which are relevant to the current studies.

284-285 What is the threshold value of HCHO/NO2 and how is the value determined? I have similar questions on other threshold value as listed in Table 3 for example. Al-

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though the values were stated to be 'empirical', it is desirable to have reference or physical reason. Are the values global or regional ?

329-339, Table 3 The threshold values of SO2 and HCHO suggested in this table is below the measurement uncertainity. How these can be justified in classifying aerosol type other than volcanic SO2?

311-313, 398-401 It is not physical to allow SS classification over land other than coastal area. Furthermore, AOD of SS tends to be very low, as indicated in the manuscript, thus is beyond the detection limit, especially over land where the AOD retrieval uncertainty is higher than over ocean.

357-363 What about the aerosol type over western U.S. during summer when wild fires are frequent? The algorithm seems to detect such features. Please add statements.

409-414 Unusual behavior in smoke plume in Southwestern coast of Africa can be a mixture of small and large particles such as dust lifted together from ground surface by large buoyancy with fire.

Section 5.3 There have been studies to classify aerosol type from AERONET beyond the fine/coarse mode, as listed below for example. At least it should be noted as previous works in classifying aerosol type from AERONET.

Mielonen, T., Arola, A., Komppula, M., Kukkonen, J., Koskinen, J., de Leeuw, G., Lehtinen, K.E.J., Comparison of CALIOP level 2 aerosol subtypes to aerosol types derived from AERONET inversion data. Geophys. Res. Lett. 36, L18804. doi:10.1029/2009GL039609, 2009.

Lee, J., et al., Characteristics of aerosol types from AERONET sunphotometer measurements, Atmospheric Environment (2010), doi:10.1016/j.atmosenv.2010.05.035

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