

## ***Interactive comment on* “Temporal and spectral variation of desert dust and biomass burning aerosol scenes from 1995–2000 using GOME” by M. de Graaf et al.**

**Anonymous Referee #3**

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### General Comment

The paper contributes very little to what is already known on the global distribution and seasonal variability of biomass burning and desert dust aerosols. Section 3.1 of the paper is a repetition of the material discussed in Herman et al (1997) based on the TOMS aerosol data. In section 3.2, the authors discussed the observed relationship between high levels of absorbing aerosols and reduced precipitation. This is actually a very important science issue that goes to the heart of the so-called second indirect effect of aerosols on climate. This observed relationship, which appears to be good

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observational evidence of the precipitation suppression potential of aerosol absorption deserves a lot more attention than given in the paper. Unfortunately, the authors just glossed over the issue, missing a good opportunity of making a real important contribution. Other comments and suggestions are given below.

### 1. Introduction

Pg 1322 Should clarify that the AAI is the longest record of global aerosol measurements over land and ocean. AVHRR is even longer, but only over the oceans.

Pg 1323 The statement 'TOMS AAI data from 1979 to 1993 were converted to optical depths  $\tilde{E}$  (Torres et al, 2002)' is an incorrect characterization of that work. The Torres et al papers (1998, 2002) describe an inversion procedure that uses the measured radiances to derive aerosol AOT. It is not a conversion of AAI to AOT.

### 2. Definition of GOME residues.

Pg 1326 If the authors feel that they need to justify the use of the 380 nm channel as the reference wavelength, they need to provide a better reason than just 'tradition'. There is nothing traditional about using 380 nm. The TOMS version 8 data released a couple of years ago, switched the reference wavelength from 380 to 331nm (for Nimbus7 TOMS) and for 360 to 331nm (for Earth Probe TOMS). The OMI Aerosol Index also uses 331 nm as the reference wavelength. Actually, I would suggest to use 331 nm as the GOME reference wavelength as well so that the GOME record discussed here becomes consistent with the existing record (N7 & EP) and continuing (OMI) record.

Pg 1326 The statement that the negative values of the AI have never been investigated is inaccurate. Several papers in the published literature [Heman et al, 1997; Torres et al, 1998, and others] have documented the relationship between non-absorbing aerosols and negative AI's. See comment below regarding the actual negative AI data

### 3. Temporal behavior of UV-absorbing aerosols.

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### 3.1 GOME regionally averaged residue time series

Pg 1327 By including the negative values of the AI in the averaging, the authors are very likely including geophysical signal unrelated to aerosols especially over the oceans. It is true that non-absorbing aerosols yield negative AI's. But other effects unrelated to aerosols would yield negative residues as well. The surface albedo data in figures 4c and 4d shows that the ocean surface reflectance at 335 is larger (by 0.01~0.02) than at 380 nm. That surface effect would yield an 'spurious' aerosol signal (negative value) in the calculation of the AI that assumes no spectral dependence of the surface albedo. The same situation, to a lesser degree, may happen over certain land types. That is the main difficulty with the negative AI data.

Pg 1328 I failed to see the significance of the sentence 'increased wind speeds when the sun is higher overhead'

Pg 1328 . In mentioning the SCAR-B 1995 observations, a reference call to the Gleason et al paper (already included in the references) should be inserted. SCAR-B was in fact, the first time ever, that the GOME data was used in the calculation of AI.

Pg 1330 What is the interpretation of a global mean value that includes both aerosol and non-aerosol related effects? The authors should elaborate more on the suggested 'geophysical cause' of the observed sinusoidal seasonal variation.

### 3.2 GOME residue-African Monsoon relationship

Pg 1332 What is meant by the statement 'Ésuppressing local precipitation and hence suppressing negative residuesÉ' ? The way it reads, it suggests precipitation produces negative residues.

Pg 1334 A series of statements related to aerosol-cloud interaction are presented here without any sustentation. If these are based on published works, please provide the references:

1.BBA have a black carbon core which is highly absorbing (ref?)

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2. its internal and physical properties change quickly during the first few hours to days after its creation (ref?)

3. The black carbon cores of the aerosols absorb solar radiation and heat the atmosphere inhibiting cloud growth(ref?)

The explanation on page 1334 that the ocean-land difference of the average BBA spectra is a result of difference in aerosol properties overlooks the fact that over the South Atlantic cloud decks are present persistently. The BBA aerosols move from land to ocean over the clouds. As a result the AI signal is stronger but the reflectance is large because the aerosols are being observed against a bright background. To actually be able to say something about the land-ocean spectral behavior of the absorbing aerosol you have to exclude from your analysis the effect of the clouds by rejecting the high reflectivity data associated with cloud presence.

Page 1336 Suggest to change section title from 'Selection Criteria' to 'Aerosol Type Identification'

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