Atmos. Chem. Phys. Discuss., 9, C8078–C8080, 2009
www.atmos-chem-phys-discuss.net/9/C8078/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Recent increase in aerosol loading over the Australian arid zone" *by* R. M. Mitchell et al.

Anonymous Referee #1

Received and published: 8 December 2009

The manuscript presents an interesting study on the temporal aerosol concentration in the Australian Outback based on 10-year sun photometer and nephelometer measurements. The authors found an increase in the aerosol load over the Australian arid zone and attributed them to mainly to rising dust activity.

Comments

(1) While in general the findings are well presented the use of two statistical models ("trend" and "step function") was not fortunate. The authors might enhance the clarity of the manuscript if they decide which mathematical model is most appropriate for the data and adapt the text.

(2) Section 2.1 should have a comment on cloud screening procedure, because high

aerosol loads and/or large temporal variations of aerosol concentrations may lead to a misclassification of an “aerosol measurement” as a “cloud measurement” (see e.g. Smirnov et al. “Cloud screening and quality control algorithms for the AERONET database”).

(3) Comment on Section 3.4 It is well known that columnar aerosol load and surface aerosol concentrations are only weak correlated and that the correlation is best if all aerosol particles are located within the mixed boundary layer and that there is no correlation at all if lofted particle layers are present. The so-called scale-height used in models requires a logarithmic decrease of the aerosol concentration with height. Such a vertical profile might exist if there is only one aerosol layer present, but in case of several aerosol layers the vertical aerosol concentration profile differs significantly from the log-profile. Therefore I don’t agree with the author’s final statement of the section “provide a guide to representing the vertical distribution. . ..in models”. However it might be useful to calculate the scale-height for different synoptic and/or aerosol load situations. I recommend calculating the scale-height for days with significant dust load and days without significant dust load which should correspond to a separation of days where all particles are present in the mixed boundary layer and days with lofted particle layers. Furthermore it should be clarified which data were used for the calculation of the scale height because sun photometer and nephelometer measurements are operated with different time resolutions. Examples are: (a) instantaneous values for the nearest matching time, (b) daily averages, (c) daytime averages?

(4) The reason given in chapter 3.5 line 21 is not a cause. It is more likely that the observations are correlated by a different cause. More frequent dust events or more intense dust events do not automatically imply an increase in particle size. But a change in certain conditions (e.g. droughts) might cause an increase of the size of aerosol particles as well as frequency and intensity of dust events.

(5) Fig. 2: an x-axis tick and label for 97 is missing

ACPD

9, C8078–C8080, 2009

(6) Fig. 5: the given standard deviations correspond to the standard deviation for single values or to the standard deviation of the mean (sometimes called standard error). For comparing averages the standard error (of the mean) should be used and not standard deviation for single values.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 21619, 2009.