Atmospheric Chemistry and Physics Discussions

Interactive Comment

Interactive comment on "Nine years of UV aerosol optical depth measurements at Thessaloniki, Greece" by S. Kazadzis et al.

Anonymous Referee #1

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The manuscript presents and analyses measurements of spectral aerosol optical depth obtained nearly continuously during the time period 1997 to 2005 in Thessaloniki, Greece by different instruments. The methodologies used for the aerosol optical depth retrieval are essentially well known and are therefore not described in the manuscript. The measurements spanning the 9 year period are 2 Brewer spectrophotometers which have been calibrated by 2 different methods, and the measurements are validated over a six-month period by a comparison to a CIMEL sunphotometer belonging to the AERONET. For the interpretation of the data record, back trajectories are used to determine the origin of the air masses over the measurement site; in addition, local PM10 measurements over the same time period are used to explain the downward trend in aerosol optical depth found in Thessaloniki.

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The manuscript presents a very interesting and valuable data record from the eastern Mediteranean, in a location where local pollution is significant. In addition the backtrajectories show how the measurement site is influenced from the surrounding region.

The manuscript is properly structured, clearly written and concise. The figures are informative and provide additional information to the text. The only comment in that respect is the unusual notation of the Angstroem exponent a, instead of the greek letter. I would advise the authors to modify the notation.

The references seem complete and previous contributions to this subject are for the most part acknowledged. However reference Gröbner and Meleti, 2004 should be mentioned twice on page 541, since it uses both methodologies (absolute calibration using an extra-terrestrial spectrum in the UV, and langley- plots in the visible).

General comments:

1) The use of langley-plots to calibrate an instrument for atmospheric total column retrieval (be it total column ozone or aerosol optical depth) requires extremely stable atmospheric conditions during the calibration period. If that is not garantied, langley-plots should not be used as calibration methodology. This is the reason why the ozone calibration of Brewer spectrophotometers is obtained by Langley-plots at high altitude, low latitude sites (i.e. Izana, Canary Island, Mauna Loa, Hawaii). The use of Langley-plots for calibrating the MKII Brewer at Thessaloniki in the UV region where ozone and aerosols are important is thus highly questionable, and should be used with great caution. Any results from such an analysis should be used with great care and cannot be used to validate measurements by the MKIII Brewer. The continuous measurement record of the MKII is however important since data gaps exist for the MKIII instrument due to the participation at various campaigns outside of its home site. One suggestion to use the MKII data would be to calibrate its measurements by direct comparison to the MKIII over the whole period, and thereby fill the gaps when the MKIII is not available.

2) Regarding the long term trend of aerosol optical depth at Thessaloniki, I believe that

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the conclusion reached by the authors is inconsistent and needs some further clarifications: The Cluster Analysis of the backtrajectories shows 5 Clusters, of which only Cluster 5 represents local sources (see page 548). As stated in the last paragraph of this section, the long term monthly means of AOD over Thessaloniki are however dominated by aerosols of Cluster 4, i.e. of origin in the eastern directions (biomass burning from the northern coast of the Black Sea and SO2 from power plants in Bulgaria and Romania).

In contradiction to this statement, the authors claim on page 551 (last paragraph of section 6) that the PM10 aerosols are a major contributor to the total column of the AOD over Thessaloniki.

This contradiction also puts into question the origin of the downward trend in aod over the period, as illustrated in Figure 8. A possible cause of this downward trend could also be a reduction of aerosols from Eastern countries.

My suggestion would be to: A) Investigate the long term trend in Angstroem exponent alpha. A trend in this component could indicate if there is reduction of PM10 particles or of particles of different sizes, and this might help in finding the cause of the observed downward trend. B) Make a statistical significance test of the trend to make sure that it is not an artifact. C) Make trend analyses for different seasons, since the Cluster 4 aerosols seem to be more predominant during the summer season (see page 549, lines 13-19).

3) One criterium of ACP is if the description of experiments and calculations are sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? I believe that the aod data presented in this study is not publicly available, and therefore does not meet the above criterium. However the WMO has created a World Data Centre for Aerosols, located in Ispra, Italy, where any information concerning atmospheric aerosols can be submitted and thus provide access to the data for other scientists. (http://wdca.jrc.it/) The authors might consider submitting their data to

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this database.

Specific comments:

page 545, line 7, the number of data points are much closer to 3000 than 2900 (2983), so I would suggest modifying this number to 3000. Figure 2 shows the comparison between the MKII and MKIII aod values. In that plot the fitted linear line does not show any offset of 5% as mentioned in the text, and actually goes nearly exactly through the origin. Where does the 5% of the text come from?

page 545, line 11. The uncertainy levels of the instruments are mentioned in the manuscript but have never been described and stated. I would appreciate a short paragraph stating the overall uncertainty budget of the aod retrieavl of the MKII and MKIII Brewers. This will also strength the case with respect to the significance of the observed trend in aod over the time period.

page 547: The equation of the Angstroem power law is missing a negative sign in the exponent, it should be reading tau=beta lambda^(- alpha). In addition, the unit of the wavelength should be mentioned, since this defines the value of beta (even if not used in the manuscript).

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 537, 2007.

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