11th EMS Annual Meeting/ 10th European Conference on Applications of Meteorology (ECAM)
12-16 September 2011, Berlin, Germany

Estimation of aerosol optical properties and their effect on UV irradiance at Uccle, Belgium

E. Nikitidou (1), V. De Bock (2), H. De Backer (2) and A. Kazantzidis (1)

(1) Laboratory of Atmospheric Physics, University of Patras, Greece (akaza@upatras.gr)
(2) Royal Meteorological Institute of Belgium

Introduction

In this study, the effect of aerosols on UV irradiance reaching the ground and the single scattering albedo are derived, at Uccle, Belgium. The results are compared with data from the Aerosol Robotic Network (AERONET).

Data and Methology

- Measurements of ozone, UV and AOD at 320nm were provided from the Brewer#178 instrument at Uccle.
- UV data were cosine corrected
- AOD data from a collocated Cimel sunphotometer (AERONET) were also used
- Only synchronized data of the two instruments were used to avoid cloud contamination
- Period of study : July 2006 – May 2010
- UVSPEC code of the LibRadtran package was used to estimate the aerosol radiative forcing at 320nm and the aerosol single scattering albedo

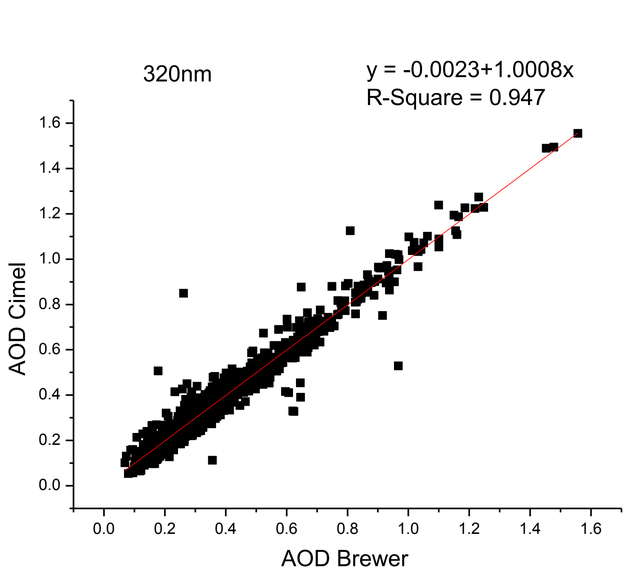

Figure 1: Comparison of AOD from Cimel and Brewer#178 at 320nm. The linear regression has an intercept=-0.0023 and slope=1.008, while the correlation coefficient is very high (0.97)

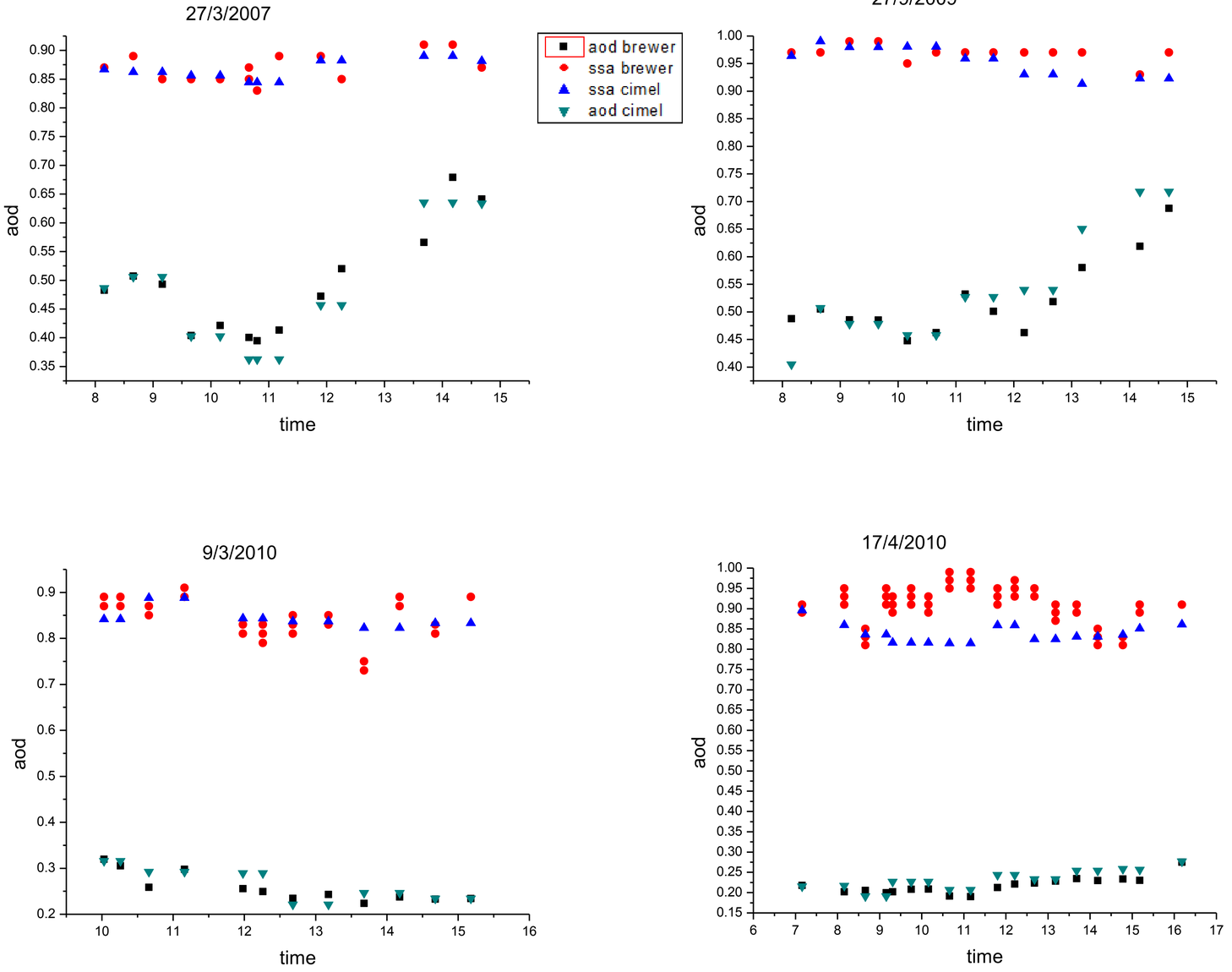

Figure 3: Aerosol single scattering albedo at 320nm, as derived from the Brewer estimations for four days and comparison with the Cimel values. The Cimel values are at 440nm. The AOD values can also be seen in the graphs. The top two days (27/3/2007 and 27/9/2009) are described by high aerosol loads while the top two down (9/3/2010 and 17/4/2010) have lower AOD values. When the AOD is higher, the range of the estimated Brewer ssa values decreases.

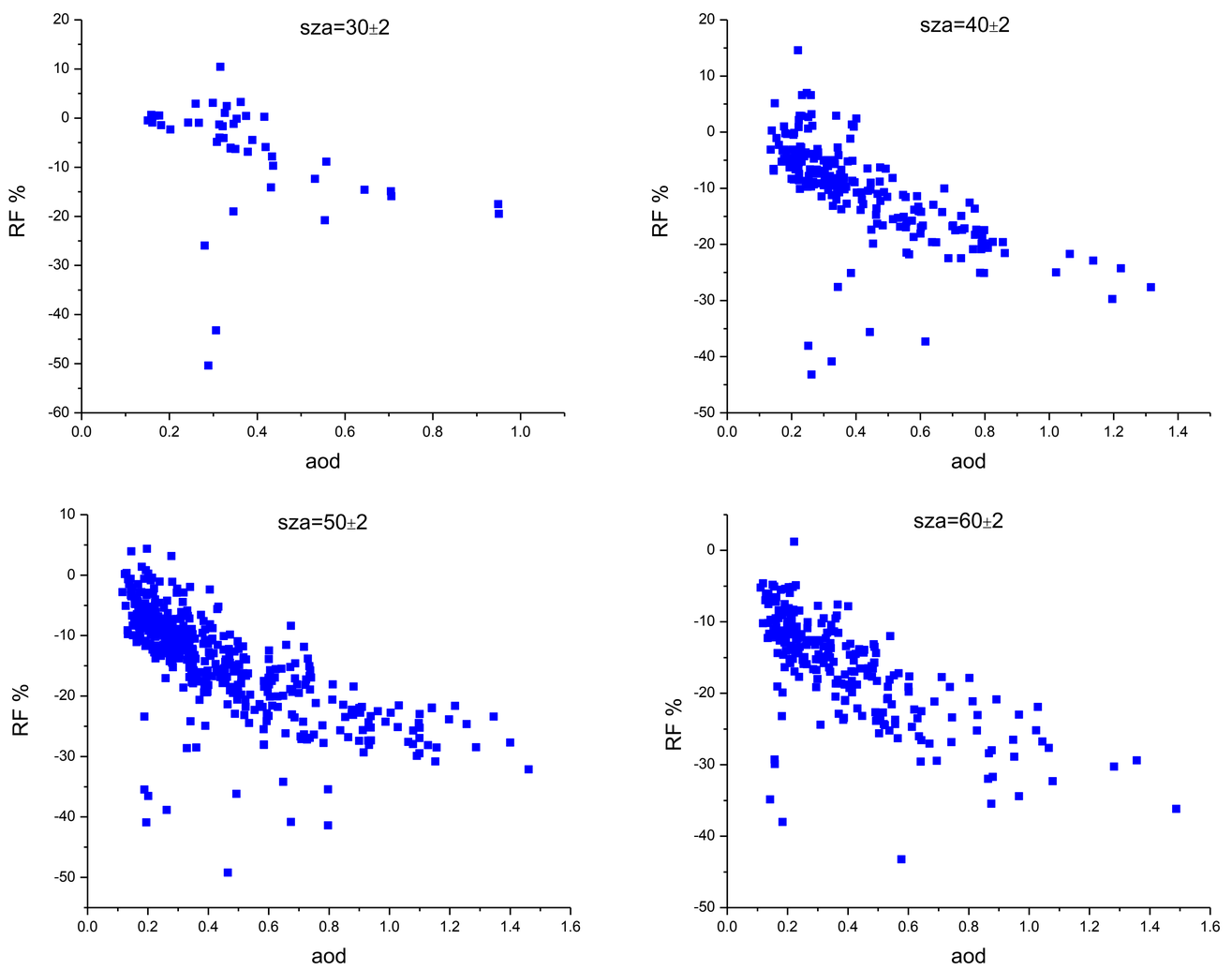

Figure 2: Aerosol radiative forcing (%) depending on the solar zenith angle. The forcing increases with the solar zenith angle, as the light has a greater path through which to interact with the aerosols. For high aerosol loads the radiative forcing can reach values of -20 to -30%.

Conclusions

- Comparison of aerosol optical depth from the Brewer#178 and Cimel instruments at 320 nm shows very good agreement, with a correlation coefficient of 0.97 (Fig.1)
- The aerosol radiative forcing at 320 nm can reach values of -20 to -30% for high solar zenith angles (which are common in Belgium) and high aerosols loads (Fig.2)
- Comparison between the estimated single scattering albedo from the theoretical calculations and the Brewer data and the one provided by Cimel depends on the corresponding AOD values. When the day is described by low AOD, the range of the estimated single scattering albedo can be high. The accuracy is better as the aerosol load increases. (Fig.3)
- Small differences in the single scattering albedo of the two instruments can be expected due to the different wavelengths. The estimated values form Brewer are at 320nm while the Cimel data are at 440nm

Acknowledgements

The authors would like to thank the principal investigator of the Brussels AERONET station, for providing the data.

This study was mainly conducted and funded by project “Hellenic Network of Solar Energy” (HNSE), funded by the General Secretariat for Research and Technology, Greek Ministry of Education, Lifelong Learning and Religious Affairs.

The LibRadtran team (www.libradtran.org) is acknowledged for providing the model algorithm.