



Angström Turbidity in the Lower Layers of the Troposphere

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We know :

The Angström turbidity is the optical parameter which characterizes the air masses and consequently air quality.

Motivation

To establish the air quality and the horizontal visibility we have calculated the Angström turbidity for Magurele.

Angstrom turbidity :

$$A(\lambda) = \beta \lambda^{-\alpha} \quad \longrightarrow \quad \text{Turbidity}$$

α - Angström exponent

λ - wavelength

β - turbidity coefficient

Data from :



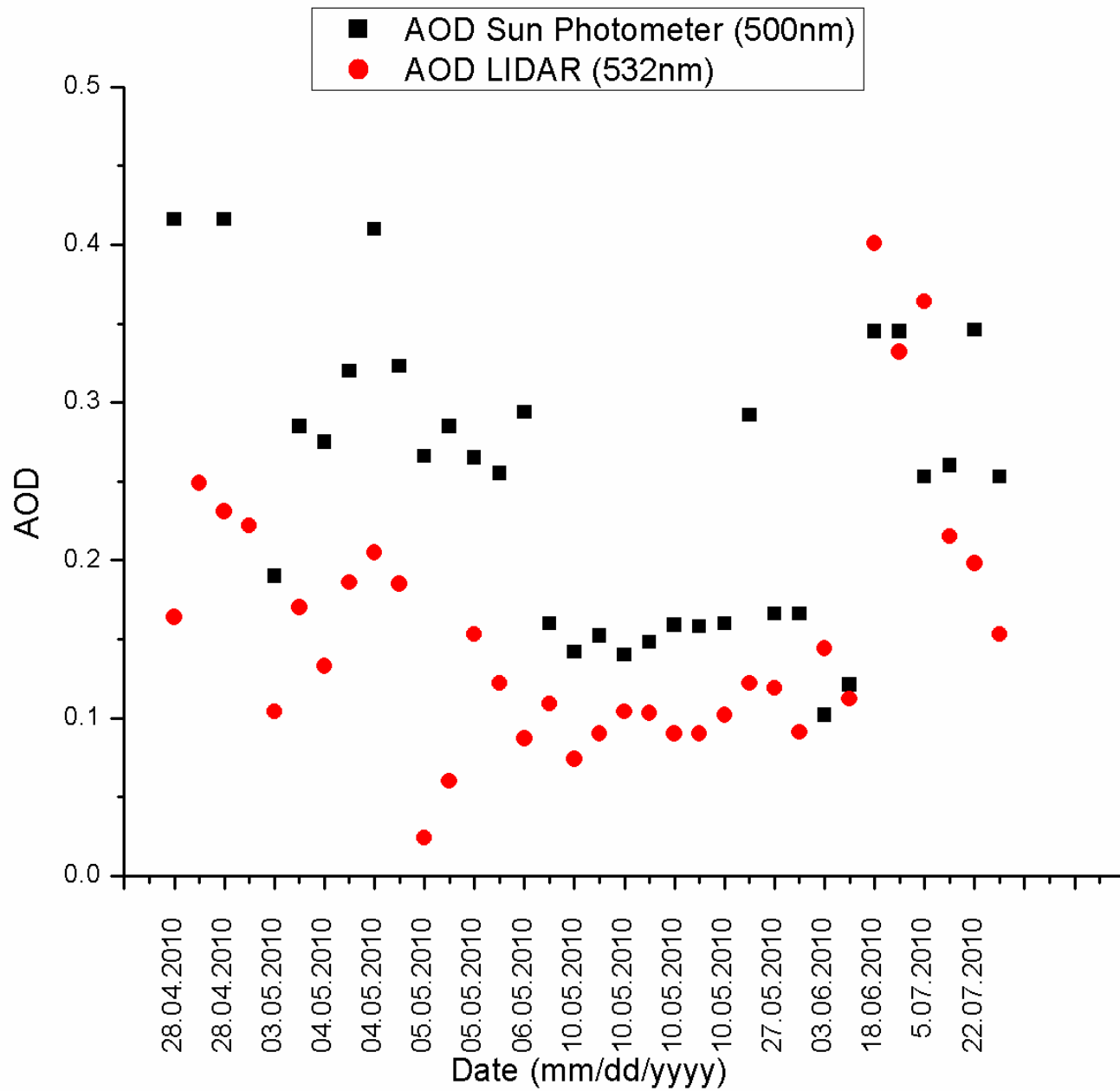
Sun Photometer (AERONET)



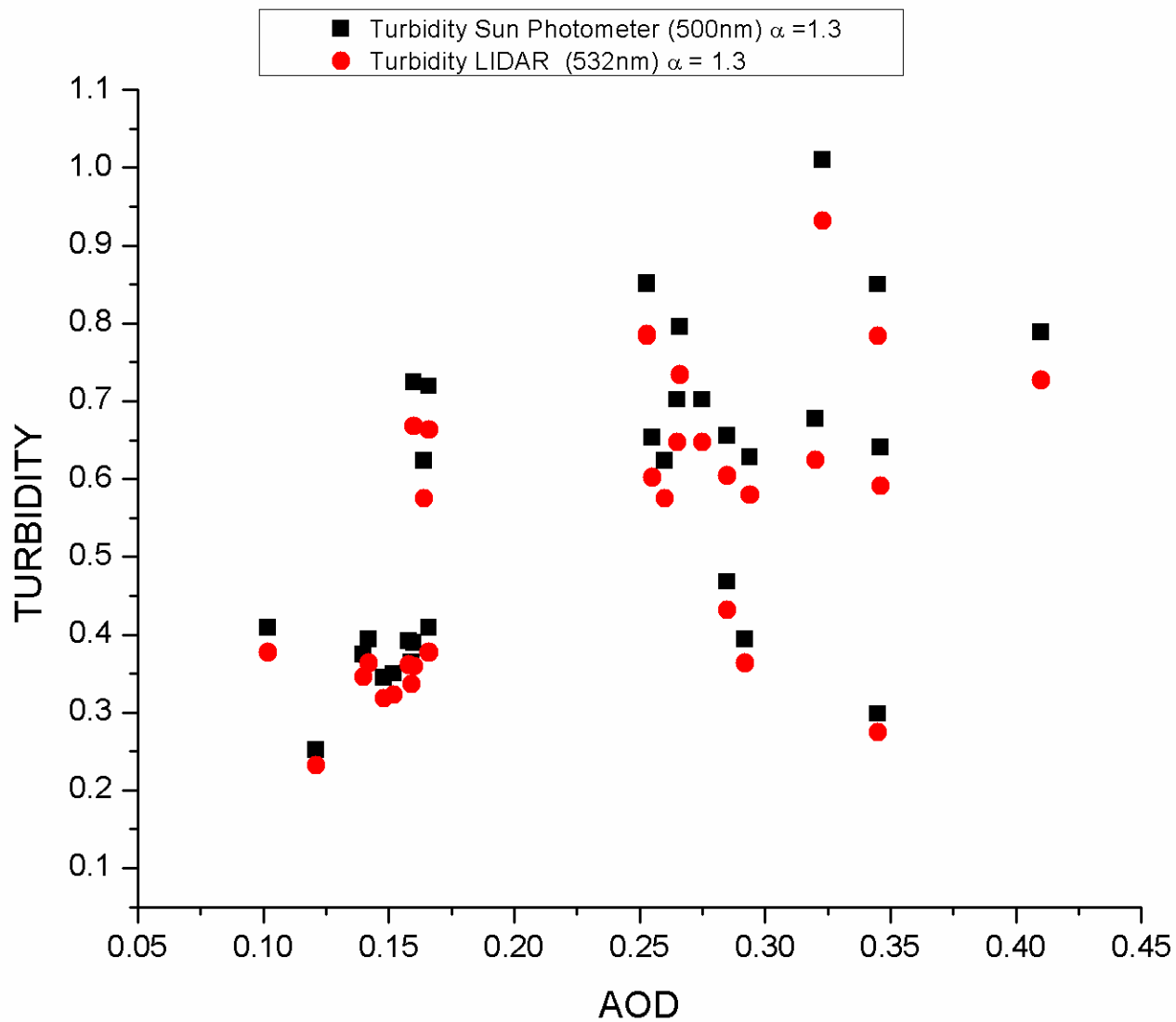
Raman LIDAR (INOE 2000)

The Angstrom turbidity coefficient has been determined only for 20 days where simultaneous measurements with Lidar and Sun-photometer were available.

Values for AOD



Values for turbidity :



Why this differences ?

- **Different Wavelengths** - Sun Photometer - 500 nm
 - Lidar - 532nm

***Solution** : shifting the wavelength*

- **Full overlap > 1 km** – under 1km the LIDAR doesn't see an important part of the PBL
- During the day for the LIDAR **the extinction coefficient is estimated** using the LIDAR Ratio.



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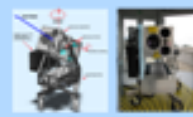
ABSTRACT

The Angström turbidity is the optical parameter which characterizes the air mass and consequently air quality. It can be determined using OOD (Ozone Optical Depth) for one wavelength and Angström exponent. In this paper the OOD obtained from sun photometer data and from Lidar data for comparison were used. The expected results for turbidity were similar but not the same.

The explanation comes in the difference between methods used for obtaining of the OOD. The preliminary results show that in summer the averaged Angström turbidity has the value 0.160 for Magurele (44°21'N 26°13'E) similar with values obtained in scientific literature for the site with similar geographic characteristics. In addition, the dependence of the turbidity on temperature and wind for Magurele was presented.



Sun Photometer (LIDARNET)



Raman LIDAR

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INTRODUCTION

The attenuation of solar energy through atmosphere gives an indicator of the atmospheric turbidity which is an important parameter in predicting the availability of solar radiation and daylight luminance under clouded skies. There have been studies on atmospheric turbidity.

The Angström turbidity coefficient represents the amount of aerosols in the atmosphere in the vertical direction. The value of turbidity coefficient varies typically from 0 to 0.5. The coefficient may also be closely related to the horizontal visibility called the meteorological optical range.

$$I(\lambda) = I_0 \lambda^{-\alpha} e^{-\beta/\lambda}$$

α -wavelength exponent
 λ -wavelength
 β -turbidity coefficient

DATA AND METHODS

The OOD data from Sun photometer (LIDAR) and extinction coefficient from Lidar (Raman), equipment of Ramon Sanjujo Lab of INCE 2000, Magurele (44°21'N 26°13'E), were processed to obtain turbidity.

The 20 days from May 2010 were selected to analyze the turbidity in atmosphere over Magurele. For the selected days there were simultaneous measurements with sun photometer and Lidar.

The columnar values of OOD from the extinction coefficient vertical profiles from Lidar were computed by using a program in Matlab.

Angström (1964) and Canada et al. (1992) demonstrated that the turbidity values are insensitive to Angström coefficient and therefore, all the turbidity values calculated in this work are based

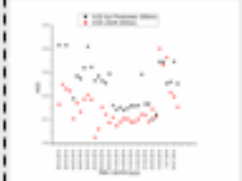


Fig.1. Angström turbidity coefficient determined from the extinction coefficient vertical profiles

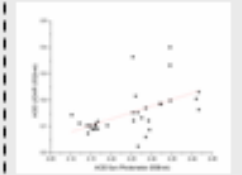


Fig.2. Angström turbidity coefficient dependence on temperature and wind for selected days in summer (temperature: 18-28°C, wind: 0-10 m/s)

RESULTS

The comparison for OOD values obtained from sun photometer and from Lidar extinction coefficient (Fig.1) shows differences. The explanation comes in the large Lidar overlap which affects the integral columnar aerosol optical depth.

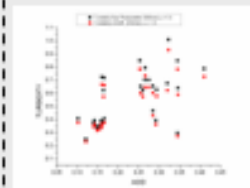


Fig.1. Angström turbidity coefficient determined from the extinction coefficient vertical profiles

In order to compare the diurnal variation of the two OODs the values are given for each of the observation hours for May 10 in Fig.2

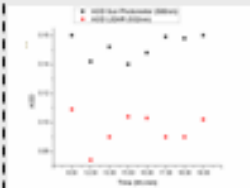


Fig.2. Angström turbidity coefficient dependence on temperature and wind for selected days in summer

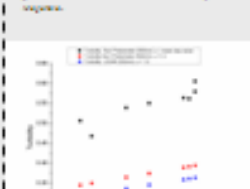


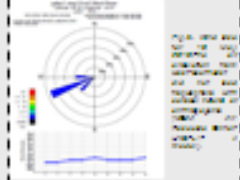
Fig.3. Angström turbidity coefficient dependence on temperature and wind for selected days in summer

The value of turbidity in the OOD to 0.16 range are due generally to aerosol particles in the 0.2 to 1.2 μ m radius range.

The averaged value of the turbidity for May month is 0.08 in case of OOD measured with the sun photometer and 0.06 in case when the OOD was obtained from extinction coefficient.

The results for May are similar to the results from scientific literature (Canada et al., 1992).

DISCUSSION



The meteorological conditions determined by all these characteristics may influence the turbidity. The wind influences very much the local turbidity because it enhances the turbulence and consequently the aerosol dispersion. The wind direction and intensity for the days with measurements can be obtained in wind rose (Fig. 4) for 10 May 2010. The maximal values of the turbidity are in calm conditions (north-east).

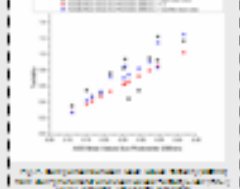


Fig.4. Angström turbidity coefficient dependence on temperature and wind for selected days in summer

CONCLUSIONS

The Angström turbidity coefficient has been determined also not only for 20 days for which there were simultaneous measurements with Lidar and Sun-photometer.

The values of turbidity determined from Sun Photometer OOD are larger than those inferred from LIDAR extinction coefficient. The explanation is related to overlap of the LIDAR that affects the columnar OOD.

The mean values of the turbidity in range of

Acknowledgements

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For more information and results:

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