COMPARISON OF AEROSOL MICROPHYSICAL CHARACTERISTICS OBTAINED FROM AERONET AND GROUND BASED MEASUREMENTS

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INTRODUCTION
A remote sensing aerosol monitoring network AERONET (Holben et al. 1998) is providing data for column aerosol characterization on local, regional, and global scales. An inversion procedure developed by Dubovik and King (2000) enables simultaneous retrieval of aerosol particle size distribution and complex refractive index from the spectral optical thickness and sky radiance measurements at different wavelengths. This strategy allows to employ knowledge on the physics and chemistry of atmospheric aerosol for modeling aerosol optics and, vice versa, to infer some physical and chemical aerosol information from optical measurements. The retrieved aerosol size distributions may be potentially useful also for characterization of ground aerosol, e.g. for assessment of background concentrations of particulate matter in rural areas. Though, spatial representation of AERONET data has not been extensively investigated. While Eck et al. (2001) have found high spatial correlation of aerosol spectral optical thickness at distances of 100 km and 250 km (linear correlation coefficients 0.95 and 0.65, respectively), few information exists on spatial representation of aerosol microphysical parameters available from AERONET. This work investigated the applicability of AERONET data for ground aerosol characterization.

METHODS
The column aerosol size distributions from Tõravere AERONET station (58°16′ N, 26°28′ E) were compared with the size distributions measured in Tallkuse research station (58°31′ N, 24°55′ E) that locates 105 km westwards from Tõravere. Aerosol microphysical characteristics retrieved from optical measurements with the inversion code for spherical particles (Dubovik and King, 2000) were obtained from the Web database http://aeronet.gsfc.nasa.gov/. The data set of Dubovik retrievals includes aerosol refractive index and volume size distribution parameters for fine and coarse aerosol modes, as well as for total aerosol volume. Fine and coarse modes represent the particles with radiiuses of 0.05 – 0.6 μm, and 0.6 – 15 μm, respectively.

Ground aerosol was measured with the electric aerosol spectrometer EAS that enables measuring of particle size distribution in 14 equally divided logarithmic size fractions within diameter range of 0.003 – 10 μm. Overlapping data for the periods June – September 2002 and March - September 2003 were used for the analysis. The EAS 5-minute size distributions were averaged over the daily periods when simultaneous Sun and sky radiance measurements were feasible. Solar zenit angles of analysed AERONET measurements changed between 36 and 78 degrees.

RESULTS AND DISCUSSION
The relationship of the ground aerosol (EAS) and the column aerosol (AERONET) volume concentrations (Fig. 1 and 2) was evidently different for the total aerosol and the fine aerosol. The total aerosol volume concentrations were moderately correlated (R = 0.66), whereas 4 days with outlying column aerosol
concentrations were clearly distinguishable. Moderate correlation of total volume concentrations was not surprising. It can be explained by different measurement methods, spatial distance, relatively high uncertainties of AERONET retrievals (15 – 25%) and natural variability of ground aerosol: in some days the relative standard deviation of EAS coarse particle concentrations reached values of 2.5 – 2.7. Outliers

![Figure 1. Total aerosol volume concentration: AERONET vs. EAS measurements in 2002.](image1)

![Figure 2. Fine aerosol volume concentration: AERONET vs. EAS measurements in 2002.](image2)

in Fig.1 corresponded to the days characterized by extremely high variability of the coarse mode ground aerosol and the prevailing coarse mode in AERONET volume distributions. Comparison of aerosol volume concentrations enabled to evaluate the effective height of atmospheric column filled with homogeneous aerosol. The average height of such a column was assessed to be of 8.6 km.

Unlike to the total aerosol, the fine aerosol volume concentrations obtained from AERONET and ground measurements were highly correlated (R = 0.86) in spite of independent measurement methods and spatial distance. High correlation of fine aerosol characteristics was obviously favored by lower natural variability of fine aerosol (observed relative standard deviations below 1) and efficient vertical mixing in the days when AERONET measurements were feasible.

The investigation has revealed good potential of AERONET for providing reliable information also about the ground fine aerosol. However, assessment of absolute values of ground aerosol concentrations from AERONET measurements requires engagement of information about aerosol vertical profile.

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REFERENCES

