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Climatological aspects of aerosol optical properties in Northern Greece

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Abstract. Measurements of aerosol optical properties (aerosol optical depth, scattering and backscattering coefficients) have been conducted at two ground-based sites in Northern Greece, Ouranoupolis (40° 23' N, 23° 57' E, 170 m a.s.l.) and Thessaloniki (40° 38' N, 22° 57' E, 80 m a.s.l.), between 1999 and 2002. The frequency distributions of the observed parameters have revealed the presence of individual modes of high and low values, indicating the influence from different sources. At both sites, the mean aerosol optical depth at 500 nm was 0.23. Values increase considerably during summer when they remain persistently between 0.3 and 0.5, going up to 0.7-0.8 during specific cases. The mean value of 65±40 Mm^{-1} of the particle scattering coefficient at 550 nm reflects the impact of continental pollution in the regional boundary layer. Trajectory analysis has shown that higher values of aerosol optical depth and the scattering coefficient are found in the east sector (former Soviet Union countries, eastern Balkan countries), whereas cleaner conditions are found for the NW direction. The influence of Sahara dust events is clearly reflected in the Ångström exponents. About 45-60% of the observed diurnal variation of the optical properties was attributed to the growth of aerosols with humidity, while the rest of the variability is in phase with the evolution of the sea-breeze cell. The contribution of local pollution is estimated to contribute 35±10% to the average aerosol optical depth at the Thessaloniki site during summer. Finally, the aerosol scale height (aerosol optical depth divided by scattering coefficient) was found to be related to the height of the boundary layer with values between 0.5-1 km during winter and up to 2.5-3 km during summer.

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