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Continental aerosol characterization by lidar measurements and numerical modeling

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Several studies have been devoted in the last years to the aerosol characterization over the south-east Mediterranean area since a net direct radiative forcing by sulphate aerosols (anthropogenic) is predicted to occur in this area by various models. The east Mediterranean basin is a crossroad where aerosols from different sources converge: besides mineral dust from North Africa, urban/industrial aerosols and seasonal biomass burning from Central and Eastern Europe, maritime and long-range transported polluted air masses from the Atlantic Ocean, and sea spray from the Mediterranean Sea itself. This paper intends to contribute to the aerosol characterization over the Mediterranean basin providing results on the impact of continental pollution: back-trajectory studies have revealed that continental-aerosol advection patters are predominant over the south-east Mediterranean. Raman lidar measurements performed along the EARLINET Project (May 2000-February 2003) are used to characterized continental aerosols by backscatter and extinction coefficient, and lidar ratio vertical profiles. Four-day analytical backtrajectories provided by the German Weather Service are used to infer the presence of continental aerosol types. It is shown that optical properties and vertical distributions of continental aerosols depend on seasons: aerosol load and height reduce from summer to winter. We believe that the seasonal variability of the continental aerosol characteristics is quite affected by the seasonal dependence of aerosol removal processes. The weather stability typical of summer regimes favors the accumulation of atmospheric particles all over Europe that represents the main source region of continental aerosols advected over the south-east Mediterranean. As a consequence, the contribution of long-range transported particles is expected to be larger on summer regimes. Moreover, aerosol wet removal processes are practically absent over the south east Mediterranean basin in summer and the larger amount of solar radiation reaching the earth's surface may favor photochemical reactions that affect optical and microphysical properties of the accumulated atmospheric particles. A numerical model, based on a Monte Carlo approach and literature data characterizing continental aerosol particles, is used in this study to compute extinction and backscatter coefficients and lidar ratios in order to support experimental findings.