



The impact of particulate matter on the precipitation in Athens, Greece

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The objective of this study is to investigate the short-term relationship between particulate matter concentrations and daily precipitation features in Athens, Greece, within the warm period of the year (April-September), during the period 2001-2010. The mean daily surface mass concentrations of particulate matters with a diameter of less than $10 \mu\text{m}$ (PM10) or less than $2.5 \mu\text{m}$ (PM2.5), were acquired from the air pollution-monitoring network of 7 monitoring stations of the Greek Ministry of the Environment, Physical Planning and Public Works (Directorate of Air and Noise pollution Control). Besides, daily precipitation totals (mm) and duration (h) from the National Observatory of Athens (NOA) and satellite observations of cloud properties (such as cloud effective radius, cloud optical depth, cloud top pressure) from MODIS Terra and Aqua Daily Level-3 Data, were used in the analysis.

The results showed that on monthly scale, PM10 and PM2.5 concentrations are positively correlated with the frequency of moderate precipitation ($10\text{--}20 \text{ mm day}^{-1}$) days but is negatively correlated with the frequency of light precipitation ($<5 \text{ mm day}^{-1}$) days. As far as rain days (number of days with rain $>1 \text{ mm}$) are concerned, PM10 / PM2.5 are positively / negatively correlated with the rain days. Using superposed epoch analysis, it was found that high PM10 concentrations existed few days before the occurrence of moderate / heavy precipitation. Satellite observations of cloud properties show that higher aerosol concentrations are positively correlated with the increase in cloud effective radius, cloud optical depth, and cloud-top heights. Based on the examined period, is likely that, the increase in aerosol concentration results in the increase of precipitation frequency within the warm period in Athens via enhanced coarse nucleation in the middle troposphere.