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An unknown maximum lag-correlation between rainfall and aerosols at 140-160 minutes

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Abstract

Rainfall and aerosols play major roles in the Earth climate system and substantially influence our life. Here, the focus is on the local near-surface aerosol/rainfall correlations with time-scales of minutes to days. We investigated 29 experiments including 14 specific rain events, with time resolutions of daily and 60, 30, 10 minutes at ten stations in Israel and California. The highest negative correlations were consistently at a positive lag of about 140-160 minutes where a positive lag means that the aerosol time-series follows that of the rain. The highest negative value is suggested to be the probable outcome of immediate scavenging along with the rise in aerosol concentration after rain depending on aerosol sources, hygroscopic growth and transport. The scavenging dominance is expressed by the mostly negative lag-correlation values in all experiments. In addition, the consistent lack of significant correlation found at negative lags suggest a weak aerosol effect on precipitation (Gryspeerdt et al., 2015).

Plain Language Summary: Rainfall and atmospheric particles (aerosols) play significant roles in the Earth atmosphere and largely influence our weather and climate. The relations between near-surface aerosol and rainfall on time scales of minutes to days are studied, employing correlations in 10 meteorological stations in Israel and California. The highest negative correlations were consistently at a positive lag of about 140-160 minutes. A positive lag means that the aerosol time-series follows that of the rain. The highest negative correlation value is suggested to be the outcome of scavenging along with the rise in aerosol concentration after rain depending on the sources of aerosols, hygroscopic growth and transport. **Furthermore, our approach provides a more fundamental insight into the local, near-surface rain-aerosol interactions, in contrast to many aerosol-rainfall studies that are climatological and with the tele-connection approach (Alpert et al., 2008), which involves other processes over distances of a few km up to even large synoptic scales.**

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