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Organic aerosol composition and chemistry during foggy and non-foggy episodes over Indo-Gangetic Plain

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Foggy episode is a conspicuous feature under predominant north-westerly wind-system during wintertime over the Indo-Gangetic Plain (IGP). Multiple factors including emissions from ground level and secondary transformations in the atmosphere, shallower planetary boundary layer height and low temperature result into haze and fog formation, and thus, degrade the air quality during winter over IGP. In this study, our major focus is to assess the role of fog in influencing the organic aerosols chemistry and composition. Measurements of various other chemical species like EC, water-soluble inorganics and mineral dust have been utilized to augment the observations on fog-processing. Briefly, we have collected 50 PM1 (particulate matter of aerodynamic diameter $\leq$ 1.0 μm) samples of which 17 were collected during foggy episodes. PM1 mass concentrations during non-foggy episodes (NF, Avg.: 247 μg m-3) were relatively high as compared to that during foggy condition (F, Avg.: 107 μg m-3). Lower fractional contribution of SO42- (NF: 15.9%, F: 8.3%), NO_3- (NF: 9.1%, F: 3.3%) and NH4+ (NF: 8%, F: 3.2%) during foggy episode results into lower abundance of PM1 mass highlighting their scavenging into fog droplets. Interestingly, in a sharp contrast the co-enhancement in OC/PM1 (NF: 0.25, F: 0.39), OC/EC (NF: 8.3, F: 13.4), WSOC/OC (NF: 0.44, F: 0.83) and SOC/OC (NF: 0.73, F: 0.84) ratios indicates role of fog-processing in SOAs (secondary organic aerosols) formation leading to change in atmospheric sub-micron aerosol composition and its properties. Mass absorption efficiency (MAE at 660 nm) of EC was higher by 30% (9.0 m2 g-1) during foggy episode whereas the mass fraction of EC remained quite similar ($\approx$ 3% of PM1). Thus, it is evident from our study that fog-processing could lead to quite significant enhancement in organic matter contribution and in MAE of EC with a parallel decrease in SO42-, NO_3- and NH4+ mass fractions. Mass fraction of mineral dust also exhibits a remarkable decrease from 14.1% to 9.2% during non-foggy and foggy conditions, respectively whereas the characteristic ratios of Fe/Al, Ca/Al and Mg/Al remained similar.