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Reactive Nitrogen Phase Distribution in the Urban Atmosphere of Indo Gangetic Plains during winters

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The photo chemically produced reactive nitrogen (N_r) species and their cycling have been imperative to the determination of atmospheric oxidative potential that are becoming increasingly pivotal in linking air quality with acid deposition and altered biogeochemical processes. However, due to multiple phase conversion processes occurring simultaneously between their precursor gases (NO_x, NH_3) and secondary transformation products (HNO_3, NO_3^-, NH_4^+), their N budget estimates remains constricted with large uncertainties. The present study attempts to resolve such interaction at tropical site where meteorological parameters becomes a crucial prerequisite in understanding the reactivity of their homogeneous phases over urban regions. For this purpose, diurnal sampling of gaseous and particulate Nr species was carried out for elucidating the molar ratios and photochemical control of their spatio temporal variability. The results showed the dominance of Nr precursor gases over their corresponding particulates where percent fractions of different Nr species were characterized by the free availability of NH_3 over the study region. Such observations were confirmed for their limited photochemical conversions where less than 1 ratios of the mass concentrations during day and night measurements (D/N) for the different Nr fractions suggested an influence of boundary layer dynamics at the background site. These phase conversion processes were further corroborated with the molar ratios of NO_x/NO_y and NH_3/NH_x where incomplete titrations of NO_x and NH_3 emissions were observed irrespective of their diurnal phases along the sampling transect. Correlation matrix of such results confirmed the gas phase oxidation occurring independently of the ambient temperature and relative humidity during winters.

Their calculations with equilibrium based approaches for a NH_3-HNO_3-NH_4NO_3 system, on the other hand, were characterized by delays in equilibrium attainment where plots of their below deliquescence K_m and K_P values with 1000/T confirmed the role of lower temperatures in the formation of NH_4NO_3 aerosols. Together, these parameters would be helpful in building a comprehensive estimate of the changes responsible for the balance between oxidized and reduced Nr inputs as well as their sweeping significance in the regional and global air pollution chemistry.