



MAX-DOAS observation of atmospheric glyoxal from three different locations in India

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Glyoxal (CHOCHO) is one of the troposphere's smallest and significant dicarbonyl compounds. It is formed in the atmosphere by oxidation of various volatile organic compounds (VOCs). CHOCHO is also an important ingredient for tropospheric ozone formation. Globally, the oxidation of biogenic VOCs contributes the largest proportion (55%) to tropospheric CHOCHO. Isoprene and monoterpenes are the major biogenic precursors of tropospheric CHOCHO, and acetylene is the major anthropogenic precursor. Understanding glyoxal chemistry in the atmosphere provides insight into VOC emissions, sources and tropospheric ozone pollution. However, observations of glyoxal from India are scarce. In this study, we report observations of glyoxal in the atmosphere retrieved using the Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) technique at three different locations in India. These three places are Delhi City, Pune City and Mahabaleshwar. The cities of Delhi and Pune represent urban environments, while Mahabaleshwar represents the forest areas of the Western Ghats mountain range. The average glyoxal mixing ratio was highest in Delhi (0.49 ± 0.05 ppb), followed by Pune city (0.38 ± 0.04 ppb) and Mahabaleshwar (0.1 ± 0.01 ppb) respectively. Higher CHOCHO mixing ratio over Delhi and Pune than in Mahabaleshwar indicates that anthropogenic VOCs contribute more towards atmospheric glyoxal than biogenic VOCs. Seasonal variation in glyoxal mixing ratio was observed across Pune, with higher values in winter and lower values in summer. Delhi and Pune showed similar diurnal variation in glyoxal mixing ratio, reaching a maximum at noon and then gradually decreasing. This demonstrates the photochemical formation of glyoxal from precursor VOCs. Glyoxal vertical column densities (VCDs) were retrieved using radiative transfer model (RTM) Mainz Profile Algorithm. Glyoxal VCDs were compared with satellite retrieved VCDs.