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Ozone in the Antarctic Boundary Layer and over a Site of Intense Anthropogenic Activity in India

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This study deals with temporal and spatial variability of 365 days, hourly mean surface ozone data revealed by ground-based measurements. The temporal and spatial distributions of boundary-layer ozone were compared for three different locations Delhi (India- a site of intense anthropogenic activity), Syowa (Japan Antarctic station) and McMurdo (USA base in Antarctica) stations. Particular attention is given to identifying the diurnal variability of surface ozone in highly polluted boundary layer and over a permanently snow-covered area of polar region. Diurnal variation in O_3 concentration over Delhi shows daytime photochemical production with maximum during noontime. The mean O_3 production rate 7.1 ppb/h (6-12h) is observed during 2001. While In contrast to Delhi, diurnal variation of O_3 reveals photochemical loss of surface O_3 during daytime and high concentration during late night and early morning in Antarctica. The analysis indicates that the mean diurnal variation for 365 days caused 3.9% and 0.8% photochemical loss of surface O_3 during daytime at Syowa and McMurdo stations respectively.

The analysis not only shows a seasonal cycle of surface ozone in Delhi and Antarctica, but also provides statistics of variability on temporal scale. Number of occurrences of hourly ozone more than 80 ppb (WHO ambient air quality standard) was found to be 158 in Delhi during 2001 and the monthly mean of daily maximum values is observed 78 ppb (97% of WHO ozone standard) in April and November, which shows a serious pollution in Delhi. While, the mean of 8-h average (10-17h) of surface O_3 is observed 59% of the WHO air quality standard. The standard deviation of the day-to-day change is observed 4 ppb (15%) and 12 ppb (19%) for the daily mean and daily maximum values over Delhi and 1.1 ppb (4.4%) over Antarctica.

To study the spatial variability in Antarctica, measurement from Syowa and McMurdo stations is compared, which shows a correlation coefficient of 0.90.

Keyword: Surface ozone, temporal variability of O_3 Antarctica