

Diurnal and seasonal variability of total column ozone over Cochin - A comparative study of Microtop II Ozonometer measurements with reanalysis and Satellite observations

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The temporal and spatial variability of atmospheric ozone play a vital role in the earth-atmospheric radiative balance and impact on regional climate. In this study we used the Sun Photometer (Microtop II Ozonometer), a hand held portable instrument to retrieve the daily total column ozone (TCO) over Cochin (9.95°N & 76.27°E) and made a comparison of in-situ TCO with ECMWF reanalysis for the period January 2015 to January 2018. To study the diurnal and seasonal variability of TCO, we considered 239 clear sky days from the three years period of measurements. We performed the standard error analysis for the TCO and filtered the TCO with airmass smaller than 2.6 to avoid the pointing errors and airmass dependence of ozone measurements. The daily mean values of Microtop TCO ranged from 237 DU to 317 DU over Cochin during the period of study with seasons. The annual mean of TCO over Cochin is computed as 279.81 DU with a standard deviation of 17.9 DU, with relatively smaller day to day variability from the three-year period of measurements. A near normal frequency distribution is obtained for TCO measurements with most probable values ranges between 280 to 290 DU and 50% ranges between 265 DU to 292 DU during the period of measurements.

Diurnal variation of TCO shows gradual increase after sun rise, maximum during noon to afternoon hours with a gradual decrease during evening hours over Cochin. This pattern is considered to be due to changes in the rate of photochemical production of ozone during day time with sunlit conditions. The percentage of variability in diurnal pattern is found to be high in monsoon (~7%) time and low in winter (~3%). The seasonal mean and standard deviations of TCO respectively over Cochin are, 262 DU & 9.6 DU for winter, 290 DU & 12 DU for pre-monsoon, 295 DU & 9 DU for summer monsoon and 279 DU & 12 DU for post monsoon seasons during the period of study. This seasonal pattern of TCO variability are in conformity with the solar radiations received at the tropical stations and also may influenced by the monsoonal circulation. The ground based Microtop measurements of TCO are very well correlated with those obtained by OMI-AURA satellite (0.60), TOMS (0.73) and ECMWF reanalysis (0.68) for the period of study.

Key words: total column ozone, sun photometer, tropical station