Association of Synoptic Circulation on the Seasonal Variability of Near-Surface Ozone and NO_x at a Tropical Coastal Site

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Tropospheric ozone has a major role in tropospheric chemistry playing a key role in determining the oxidizing power of the atmosphere and acting as a greenhouse gas by absorbing infrared radiation at 9.6 μm. It has implications on human health and vegetation. Free tropospheric ozone is either transported from stratospheric altitudes or formed in the planetary boundary layer. Tropospheric ozone is formed by the oxidation of CO, CH_4, hydrocarbons and volatile organic compounds (VOCs) depending on the concentrations of NO_x and hydrogen oxide radicals (OH and peroxy). Continuous measurements of near-surface ozone, NO_x ($NO + NO_2$) and meteorological parameters have been carried out at the tropical coastal location, Trivandrum (8.55°N, 77°E) in India by using UV photometric ozone analyzer (Model 49C, Thermo Electron Corporation, USA), Chemiluminescent nitrogen oxide analyzer (Model AC32M of Environment S. A., France) and automatic weather station, respectively. One year data collected during 2009 has been used to study the seasonal trends of ozone and its precursor NO_x and their interdependence. Highest concentration is observed during the winter months when wind is from the inland locations as observed from the air flow patterns and airmass back trajectory analysis carried out using HySplit model. Lowest concentration is observed in the monsoon season when marine airmass prevailed over the site. Washout of precursor gases could also have resulted in the reduction of ozone. It is also noticed that daytime ozone concentration depends strongly on nighttime concentration of NO_x on monthly basis with a correlation coefficient of 0.90. The meteorological parameters namely temperature, relative humidity/water vapour content, wind speed and direction also play a vital role in the production, transport and temporal variation of ozone and its precursors in the lower region.