Abstract

The role of anthropogenic carbon dioxide (CO_2) in global warming is a serious issue of climate change. Developing precise monitoring systems for greenhouse gases including CO_2 has got tremendous impetus during the last two decades. The physical principle of modern CO_2 sensors is to quantify the extent of absorption of solar radiation depending on the gaseous concentration at specific wavelengths of molecular absorption. The techniques of hyperspectral remote sensing, popularly known as 'imaging spectroscopy' have achieved immense significance in this connection.

The present work has investigated on the assessment of atmospheric CO_2 profile using a combination of ground-based solar radiance measured with spectroradiometer of high spectral resolution, radiance spectra retrieved from airborne hyperspectral images and the statistics derived from the database produced by satellite-borne hyperspectral global CO_2 sensors. The studies are conducted from different points of view: at local level, particularly in the Indian context and at global level. Both the atmospheric column average and the ground level concentrations of CO_2 and their relationships are explored. The spatial as well as the temporal variations of the column concentration are addressed. In brief, attempts are made to divulge all the facets of the present CO_2 situation and its relationships with human activities. Along with CO_2, the urban aerosol is considered to be related closely to man-made events and the aerosol optical depths are estimated from hyperspectral images. The main highlights of the work are spectral calibration of CO_2 absorption profile under the influence of water vapour in the tropical atmosphere of India, new techniques for estimating CO_2, aerosol and water vapour concentrations, spatial variation of CO_2 with detection of point source, correction for the airborne sensor height, seasonal and temporal changes of CO_2 and aerosol and the present trends of CO_2 in Indian and Global context.