Aerosols Optical Properties and Radiative Forcing over Mohal-kullu in the Northwestern Himalaya, India

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Aerosols have significant effect on the regional climate causing cooling as well as heating effect on the Earth's surface. Aerosols affect a normal prevailing climate leading to global warming and melting of worldwide glaciers and sea-ice. With the help of Multi-wavelength Radiometer (MWR), columnar aerosols with its characterization from April 2006 to December 2009 over Mohal (31.9ºN, 77.12ºE, 1154 m amsl) in the northwestern Indian Himalaya was carried out. The aerosol optical depth (AOD) at 500 nm wavelength ranged from 0.10 (December 27, 2006, March 6, 2007, March 8, 2007) to 0.50 (June 4, 2009) and found to decrease at the rate of 7.4% per year. A ratio of accumulation to fine mode aerosols indicate that the influx of fine aerosols contributed to AOD with an increase at the rate of 3.7% per year. When a correlation coefficient of MWR and MODIS AODs obtained, it was ~0.70. The Angstrom parameters, i.e., α and β were found to be varied from 0.33 (June 9, 2006) to 1.88 (October 29, 2007) and 0.04 (December 27, 2006) to 0.33 (June 9, 2006) respectively. There was a change found in particulate load gradient indicating coarse size particles which were continuously increasing in winter. Optical depth due to black carbon (BC) was estimated as much as 3.9% and 4.1% of the total averaged AODs in 2006 and 2007 respectively. During observation period, radiative forcing due to aerosols at top of the atmosphere, surface and atmosphere varied in a range of -3.2 to -21.5 Wm^{-2}, -13 to -58.9 Wm^{-2} and 8.3 to 48.7 Wm^{-2} respectively. Their corresponding mean values were -8.9 ± 0.28 Wm^{-2}, -31.7 ± 0.76 Wm^{-2} and 22.7 ± 0.68 Wm^{-2}. The heating rate was found to be in a range of 1.37 to 0.23 K day^{-1}. While the mean atmospheric absorption (+22.7 Wm^{-2}) was translated into an atmospheric heating of 0.64 K day^{-1}.