Abstract

Columnar Aerosol Optical Depths (AOD) over an urban area (Chandigarh) and a rural area (Khera, Fatehgarh Sahib district) situated in the Indo-Gangetic Plains (IGP) of India were analysed to study their temporal heterogeneity in terms of interannual, seasonal and monthly variations. Over the last few decades, IGP has become one of the global hotspots of air pollution due to the increased anthropogenic activities such as traffic, industries, agricultural waste burning etc. Level-2 AODs (550 nm) were retrieved from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors onboard NASA's Terra and Aqua satellites, for a period of 14 years (2005–2018). The climatological mean Terra-MODIS (Aqua-MODIS) AOD over the urban location was ~0.497 ± 0.238 (0.474 ± 0.228), whereas over the rural location it was 542 ± 0.269 (0.534 ± 0.282). Linear trend analysis estimated an increase in annual mean Terra-MODIS (Aqua-MODIS) AOD at a rate of ~0.009 (0.013) per year over the urban site; whereas over the rural location the rate of increase was ~0.003 (0.004) per year. Results show that the observed increase is ~1.49% (2.41%) of climatological mean AOD over the urban location for Terra-MODIS (Aqua-MODIS), whereas, over the rural location, it was ~0.50% (0.67%). Using the HYSPLIT trajectory model, it was concluded that, during post-monsoon, the observed high AODs can be related to massive crop residue burning in the IGP region. These AOD trends can also be used to track the regional anthropogenic air-pollution changes. An empirical relation between AOD and PM_{10} was established, which can be used to estimate PM_{10} over the urban and rural areas of IGP (using MODIS AODs), complementing the sparse ground-based monitoring. Further, satellite-based air pollution data can be used for baseline assessment and understanding the impact of control policies such as National Clean Air Programme and to support formulate evidence-based pollution control strategies.