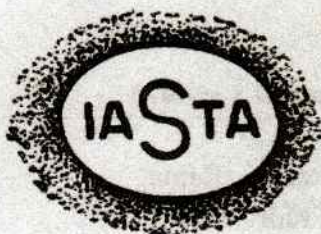
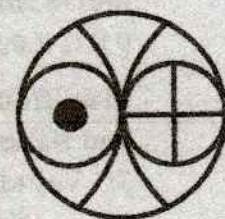


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Insights and Challenges



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SPATIO-TEMPORAL VARIABILITY OF AEROSOLS AND TRACE GASES OVER NORTH-EAST INDIA BY USING REMOTE SENSING DATA

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INTRODUCTION

Atmospheric aerosol particles affect directly the Earth's climate by scattering and absorbing shortwave radiation and indirectly by their effect on cloud albedo, clouds lifetime and precipitation patterns (Yu et al., 2006). They are one of the climate forcing agents among the various agents like greenhouse gases, atmospheric ozone etc., which contributed the global climate change with large uncertainty. Aerosols exhibit heterogeneity in nature depending on the spatio-temporal variations of physical and chemical properties with their amount and residence time. Precise knowledge is needed on the complex relation between the aerosol compositions, the emissions of precursor gases, along with primary aerosol emissions to explain the past and current climate and then to forecast the Earth's climate change. Atmospheric trace gases are one of the challenging environmental issues in urban and industrial areas (Wang and Hao 2012). Amongst, Nitrogen dioxide (NO₂) and Sulfur dioxide (SO₂) has the second and third highest exceedance rate in India, respectively, after PM₁₀ (particulate matter less than 10 μm), as per the National Ambient Air Quality Monitoring Program (NAAQMP) (CPCB 2012). The spatio-temporal variation of aerosols and trace gases over a region is very important to improve our understanding to the regional variation in radiative forcing thereby the implications on global radiative forcing and thus on the global climate change. Proper evaluations of aerosols as well as trace gases are necessary for ongoing global climate simulations because these are vital components for Earth's climate change process. The Indian subcontinent experiences tropical and subtropical climatic condition which results extreme temperatures, rainfall and relative humidity. These features provide the large variability in both the aerosols as well as trace gas characteristics over this region. The North-East (NE) India region, nestled among the southeastern Tibetan Plateau on the north, the Indo Myanmar range of hills to the east, plains of Bangladesh to the south, and the Indo-Gangetic plains (IGP) to the west, has a unique topography and population inhabitation pattern (Bhuyan et al., 2014). The NE India resides at the foothills of Himalaya with unique topography having three sides blocks by mountain and open in the west give an excess to enter the long range transported aerosols from highly polluted regions like Indo-Gangetic plains (IGP) and produces a complex environment together with local aerosols. In the recent decades, anthropogenic emission of pollutants increases over this region due to rapid industrial and economic development and change of lifestyle. Biomass burning due to the practice of shifting cultivation in the hills of this region is a major source of particulate and gaseous pollution. The atmosphere of this region is dominated by atmospheric convection throughout the year (Rao et al., 2013) which provides a sharp regional gradient of aerosols.

Though a few ground based aerosol measurement observatories under the ARFINET (Aerosol Radiative Forcing over India Network) of Indian Space Research Organization have been established over NE India, the satellite base remote sensing is the suitable method to study the regional variation of aerosols at different temporal scales. Studies of trace gases either by using ground based instruments or satellite remote sensing is also limited in this region except few reports by Bhuyan et al., (2014); Kalita and Bhuyan (2011) etc. In this paper, we report the long-term spatio-temporal variation of Aerosol Optical Depth (AOD) Spatio-temporal variation of Sulfur dioxide (SO₂) and tropospheric columns of Nitrogen dioxide (NO₂) over NE India by using the satellite remote-sensing data sets obtained from the Moderate Resolution Imaging Spectroradiometer (MODIS) and Ozone Monitoring Instrument (OMI).