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MULTI-YEAR LIDAR AND RADIOMETRIC MEASURMENTS FOR CLIMATE STUDIES AT IITM, PUNE, INDIA: PAST, PRESENT AND FUTURE SCENARIOS

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ABSTRACT

Atmospheric aerosols and pre-cursor gases affect the radiative forcing of the Earth's climate, but their variable concentrations in both space and time complicate our understanding of their local/regional/global influence. Several studies using remote sounding data of these constituents from ground-based LIdar and RADiometric (LIRAD) techniques in conjunction with satellite data and radiative transfer models has been in progress since 1985 at the Indian Institute of Tropical Meteorology (IITM), Pune ($18^{o}32'$N, $73^{o}51'$E, 559 m AMSL), a tropical urban station in India. Different multi-spectral Lidars and Solar Radiometers have been developed for quantitative determination and multi-dimensional mapping of aerosols, clouds and gases. In addition, these facilities have been employed in several National and International campaign / collaborative programs and collected extensive datasets over different environments.

The results clearly indicate a systematic seasonal variation with maximum aerosol loading during the pre-monsoon and minimum during south-west monsoon months, and also reveal an increasing long-term trend. Further, this trend appears to vary from year to year and has a strong bearing on the surface generated aerosol and meteorological processes over the station. Comparison between boundary-layer aerosol content and total columnar loading indicates that the observed increasing trend is not confined to the boundary-layer alone but extends to higher altitudes also, with a contribution of about 20 per cent from the former to the latter. The results of the wavelet analysis of the above multi-year aerosol data reveal a significant Quasi Biennial Oscillation (QBO) – a forcing parameter useful for predicting climate change. The multi-year datasets of aerosol and trace gas vertical/columnar distributions archived with the above remote sensing facilities for real-time monitoring of their radiative forcing affecting the Earth's climate will be presented. With the recent augmentation of Dual Polarization Micro Pulse Lidar (DPMPL), some of the complex processes involved in fine-scale aerosol and cloud structures up to upper atmospheric altitudes, and their role in aerosol-cloud-chemistry-climate interactions are being studied. Several new LIRAD measurement approaches and concepts for enlarging the scope of the above studies are being pursued include portable Radars and other *in-situ* techniques will be highlighted.