

Proceedings of the 10th International Conference on Engineering and Emerging Technologies (ICEET), Dubai, UAE, 27-28 December 2024

Analysis of Ceilometer LiDAR (CL51) sensor atmospheric profile images for urban environmental monitoring over Pretoria, South Africa

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Clouds are a critical component of the atmosphere, influencing both climate and weather patterns, while their backscatter impacts human activities and lives. The CL 51 Ceilometer LiDAR is one of the advanced atmospheric sensors deployed globally to collect massive data for monitoring environmental conditions. This sensor captures data in digital format, which is subsequently converted into images. However, extracting atmospheric features, such as aerosol distribution along the sensor's path length, requires precise identification for effective analysis. In this paper, we outline the methodology for data acquisition, conversion to image format, and feature extraction of atmospheric components from the CL 51 script. We further analyse the atmospheric images derived from CL 51 seasonal data collected in Pretoria from 2014 to 2015. This analysis of CL 51 ceilometer LiDAR images will enhance our knowledge and understanding of the atmospheric aerosol profile, thereby contributing to urban environmental monitoring efforts.