Cloud Base Height Correlation between a Co-located Micro-Pulse Lidar and a CHM15k Lufft Ceilometer

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MPLCAN is a network of Micro-Pulse Lidars (MPLs) across Canadian sites in Eureka NU, Halifax NS, London ON, Toronto ON and Sherbrooke QC. MPLCAN is part of NASA's global MPLNET. The MPLs have the ability to detect clouds, aerosols and the planetary boundary layer, as well as to differentiate between water and ice in clouds via polarization measurements. The London (Ontario) MPL site operates a Lufft CHM15k ceilometer, which is part of the European Meteorological Network's E-PROFILE project. E-PROFILE makes available measurements from over 280 stations. Common to both MPLNET and E-PROFILE is the determination of the base height of clouds.

Cloud Base height is a data product which in principle should be the same for each instrument, despite the MPL transmitter wavelength at 532 nm as compared to the ceilometer's 1.064 nm wavelength. Using the MPLNET data product compared to the Lufft for the first year of operation (Jan 2021-Dec 2021), the monthly correlation coefficient between cloud base heights varies between 0.78 and 0.95. Below 1 km altitude, the comparison is poor, in part due to aerosol layers and in part due to uncertainties in the instruments' overlap functions. Above this altitude the comparisons are generally good. The overall agreement is improved by using the MPL's ability to detect aerosols using polarization to mask out layers misidentified as aerosols or clouds by the ceilometer. To further improve the comparison an algorithm based on MPLNET's Version 2 Cloud Base product was written and applied to both datasets. It accurately represents low level clouds (<5 km), and for optically thick clouds when compared to the initial results. However, it is less effective when signal to noise gets too low, as is typical for cirrus clouds. The impact of these results on interpreting lidar cloud base heights will be discussed.