Utilizing surface-based observations from the Micro Pulse Lidar Network (MPLNET) for validation of space-based satellite missions

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Starting with the Lidar In-Space Technology Experiment (LITE) in 1994, spaceborne lidars have provided highly detailed global views of the vertical structure of clouds and aerosols. And since that time, surface-based lidar, as well as aircraft lidar, have been used for validation through correlative measurements. While the validation of space-based lidar systems by surface-based lidar observations is not straightforward, protocols for doing so are well-established and have shown good agreement in many instances.

The Micro Pulse Lidar Network (MPLNET) is a federated, global network of Micro Pulse Lidar systems deployed worldwide to measure aerosol and cloud vertical structure, and mixed layer heights. The data have been collected continuously, day and night, for more than 20 years from sites around the world with multiple sites containing 5+ or 10+ years of data. MPLNET is also a contributing network to the World Meteorological Organization (WMO) Global Atmospheric Watch (GAW) Aerosol Lidar Observation Network (GALION). The use of common instrumentation and processing algorithms within MPLNET allow for direct comparisons between sites. Thus, long-term MPLNET measurements can be used to verify the fidelity of geophysical parameters measured throughout the lifetime of individual satellite missions (e.g. CALIPSO, CATS, EarthCARE, CALIGOLA, and AOS) and provide a metric for intercomparisons between different space-based lidar missions when gaps between satellite missions occur.

In this presentation, we use multiple years of comparisons between MPLNET and the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) flown aboard CALIPSO. For these comparisons, we use newly developed Level 3 MPLNET products consisting of monthly, diurnal statistics for cloud and aerosol retrievals covering a representative range of conditions and locations. Furthermore, we compare top-of-the-atmosphere cirrus cloud radiative forcing derived from these two complementary platforms. Finally, using results from an upcoming validation rehearsal, we demonstrate how these procedures will be utilized during the EarthCARE mission, scheduled to launch in May 2024.