A brief appreciation of the lidar ratio

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Pioneering developers of lidar remote sensing techniques recognized the lidar ratio as a valuable quantity for retrieving the optical properties of aerosols and clouds. Because it depends on the size, shape, and composition of the particulates being measured, it also provides the capability to differentiate between the various aerosol types in Earth's atmosphere. Over the five decades since its formulation, researchers have improved our understanding of what the lidar ratio can tell us and how it can be used to improve the science derived from lidar-based measurements. This talk is a brief introduction to the insight provided by the lidar ratio and a survey of recent advances that have improved our understanding of lidar ratios found in nature.

Mapping aerosol lidar ratios over ocean for CALIPSO using MODIS AOD-constrained retrievals and a global aerosol model

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The CALIPSO aerosol algorithms currently assign one lidar ratio value for each of the seven tropospheric aerosol types. In a future data products release, the CALIPSO project aims to improve these algorithms by developing regional and seasonal lidar ratio climatologies. In this study, aerosol lidar ratios are inferred through Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) backscatter profiles constrained by collocated aerosol optical depth from Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) datasets. The analysis is subsampled for only those profiles that are cloud-free and contain one aerosol type (based on CALIOP feature classification). In addition, the CALIOP profiles are collocated with aerosol volume fractions simulated by the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model. In this talk, the twelve-year (2006-2017) mean spatial distributions of inferred aerosol lidar ratios for CALIOP-classified marine aerosols and the corresponding modeled sea salt volume fractions (SSVF) will be shown. Model-assisted climatological lidar ratio maps on a seasonal scale will also be presented, developed from the empirical relationship found between the modeled SSVF and lidar ratios. A comparison with past studies will be provided as well as results of a sensitivity study regarding the variability of retrieved lidar ratios as a function of horizontal averaging resolution. While the majority of this talk will focus on lidar ratios for CALIOP-classified marine aerosols, preliminary results will be shown for other aerosol types over ocean, such as dust and elevated smoke.