Mapping Aerosol Lidar Ratios for CALIPSO

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Elastic-backscatter lidars (like CALIPSO) depend upon a priori knowledge of aerosol properties to convert lidar backscatter measurements into aerosol extinction profiles. Presently, CALIPSO Version 4 aerosol retrievals use a single lidar ratio for each CALIPSO aerosol type, but there is a significant range of plausible lidar ratios for many of the CALIPSO aerosol types. Additionally, constrained retrievals using CALIPSO backscatter profiles with the Synergized Optical Depth of Aerosols (SODA) optical depths show regional variability for most of the CALIPSO aerosol types (Li et al., 2022).

We leverage nearly 12 years of collocated CALIPSO-MODIS data to create climatological lidar ratio maps for the marine and dust aerosol types. We find much higher lidar ratios for the CALIPSO marine aerosol type near populated coastlines, which indicates that pollution is mixing with the marine aerosols. We also find that coastal pollution plumes vary seasonally with wind direction and windspeed, and this can cause large seasonal variability in the CALIPSO marine lidar ratio. Additionally, since our technique requires the existence of a single aerosol type in the column (in order to assign lidar ratio by type), constrained retrievals are not available for all seasons in some regions. Thus, we use the GEOS/GOCART model to assist our interpretation of the lidar ratio in those cases.