Lidar Remote Sensing of Stratospheric Aerosols and Comparison with Simulations from Whole Atmosphere Community Climate Model (WACCM)/Community Aerosol and Radiation Model for Atmospheres (CARMA)

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The quiescent volcanic period of the last ten years has provided a unique opportunity to observe the background state of stratospheric aerosols. Observations from this period of aerosol backscatter collected by Rayleigh/Mie lidars located in Lauder, New Zealand, Mauna Loa, Hawaii and Boulder, Colorado were explored with an emphasis on analyzing the seasonal cycles and decadal trends in the aerosol layer above 20 km altitude. The results from this analysis show an increasing trend in the backscatter cross-section over the last decade at all three sites that is modulated by a strong seasonal cycle with a winter maximum.

To further understand the differing roles of transport, chemical and microphysical processes of the aerosol layer, the results of the lidar data analysis are compared to output from a base run of the WACCM coupled to the CARMA that has been structured to include sulfate aerosols and meteoritic dust. This comparison shows overall agreement within the standard deviation of the annual mean aerosol profile at all three lidar locations. Correlation of the model aerosols and model N_2O, lead to the conclusion that the observed seasonal cycle of stratospheric aerosols is controlled by the seasonally varying quasi-isentropic eddy transport associated with planetary wave breaking in the extratropical stratosphere. Comparisons between model profiles and observations also suggest that pollution from the Asian monsoon may be a leading cause of the observed trends in the aerosol record.

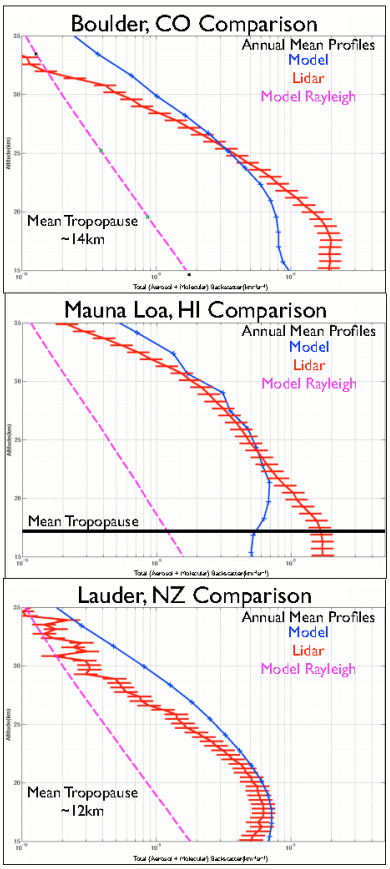

Figure 1. Comparison of the annual mean backscatter profile from each lidar and WACCM/CARMA (averaged at the model grid point closest to the corresponding lidar location).