Extinction-to-backscatter ratio of Asian dust observed with a combined Raman elastic-backscatter lidar in Seoul, Korea

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The extinction-to-backscatter ratio (so called, lidar ratio), which is a key parameter in the issue of backscatter-lidar inversions, of Asian dust was observed with a combined Raman elastic-backscatter lidar in Seoul, Korea. The lidar ratio at 532 nm is calculated by the comparison of lidar-derived aerosol optical thickness (AOT) with sunphotometer-derived AOT for 4-year measurements (2006-2010). Here, the value of AOT 532 nm is calculated by the Ångström relationship using measurements at five wavelengths (400, 500, 675, 870, and 1020 nm). The annual mean lidar ratio (with standard deviation) is found to be 61.7±16.5 sr, and weak seasonal variations are noted with a maximum in summer (68.1±16.8 sr) and a minimum in winter (57.2±17.9 sr). The lidar ratios for clean, dust, and polluted conditions are estimated to be 45.0±9.5 sr, 51.7±13.7 sr, and 62.2±13.2 sr, respectively. While the lidar ratio for the polluted condition is appears to be consistent with previous studies (50-70 sr), clean and dust conditions tend to have larger values, compared to previous estimates (clean: 30-40 sr, dust: 40-50 sr). This discrepancy is thought to be mainly due to the anthropogenic aerosols existing in the atmospheric layer throughout the year around Seoul, which may cause increased S_a even for clean and dust conditions. For instance, the lower values of lidar ratio at 532 nm was directly estimated from Raman (inelastic) signals. The values of lidar ratio averaged for Asian dust layer was ranged from 25 and 40 sr on two Asian dust days (October 20, 2009 and March 15, 2010), with 10 ~ 20% of particle depolarization ratio.

Dependence of adiabaticity of stratiform clouds upon stability, and its relationship to aerosol-cloud interactions

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The buffering mechanisms in the modifications of cloud microphysics and cloud albedo by cloud-active aerosol are only vaguely understood and are thought to include a myriad of processes that vary regionally and confound the application of simple physical models of cloud-aerosol sensitivity [1].

This study presents the relationship of aerosol-cloud interaction to cloud environment condition (adiabaticity and stability), using data from the Atmospheric Radiation Measurement (ARM) Southern Great Plain (SGP) site and the Pt. Reyes (PYE) deployment of the ARM Mobile Facility (AMF). Adiabaticity is defined as the ratio of the observed liquid water path (LWP) to corresponding adiabatic value in this study. The stability indicates the differences of potential temperature between 500 m above the mixed layer tops and the mixed layer tops. Strong inversions above the PYE cloud are shown to buffer marine stratocumulus from the effects of mixing with drier, warmer inversion air. This buffering reduces the variability of the cloud LWP and enables the clouds to remain nearly adiabatic. The critical comparison of cloud adiabaticity with static stability demonstrates the more adiabatic LWP in the condition of the stronger stability above the cloud. Weaker inversions above the SGP cloud promote variability in the LWP and sub-adiabatic LWPs. Aerosol-cloud interactions are probably more dominant in stratiform clouds that remain nearly addiabatic [2] and exhibit less variability in the LWP. This study implies static stability and adiabaticity are important controlling factors in the enhancement or attenuation of aerosol-cloud interactions.

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[1] Stevens & Feingold (2009) *Nature* **461**, 607–613. [2] Kim *et al*. (2008) *J. Geophy. Res*. **113**, D05210.