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On relationship between aerosols and $PM_{2.5}$

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Since aerosol optical thickness (AOT) is a key parameter of aerosols and description of the Earth's radiation budget, it is widely measured from ground sun photometer network NASA/AERONET [Holben et al., 1998] and from satellite. Fine and surface level aerosol particle called $PM_{2.5}$, whose diameter is 2.5 μm or less, is a well-known parameter for understanding polluted level of air. Smirnov et al. reported a good agreement between ground based AERONET AOT (870 nm) and dust concentrations at Barbados [Smirnov et al., 2000]. Wang and Christopher founded a good correlation between satellite based MODIS AOT product and $PM_{2.5}$ in Alabama area [Wang and 2003]. Long range transported dusts, particularly Asian dust events, are easy to change the vertical profile of aerosol extinction. The vertical profile is important to estimate PM information because both AOT information measured from ground or satellite are integrated value of aerosol extinction from ground to space, i.e. columnar AOT. Thus, we have also proposed correlations between ground level $PM_{2.5}$ and AERONET AOT (670 nm) in two cases of ordinary air condition and dusty days [Sano et al., 2010].

In this work, we investigate the relationship between $PM_{2.5}$ and AERONET AOT considering LIDAR measurements. Note that all of instruments are set up at the roof of the University building (50 m) and collocated in 10 m area. Surface-level AOT is derived from AERONET AOT multiplied by an averaged vertical aerosol extinction given by LIDAR. Note that the definition of surface-level AOT in this work is assumed as AOT up to 500 m height. Introduction of surface-level AOT enables to avoid the contamination of dusty aerosol signal existing at high altitude from columnar AOT.

The cloud aerosol imager (CAI) on GOSAT satellite has four observing wavelengths, 380, 670, 870 nm, and 1.6 μm. In this work three channels are selected to estimate aerosol information. Look-up table (LUT) method is applied to estimate the optical properties of aerosols, i.e., AOT, volume fraction of fine and coarse mode particles, also single scattering albedo. Here is brief description of our aerosol retrieval and $PM_{2.5}$ estimation.

1. Atmospheric correction is applied for each channel image based on AERONET measurements, Averaged surface albedo is calculated based on 1 month window,

2. Aerosol optical properties are estimated by using surface albedo and satellite imagery.

3. Obtained columnar AOT information is converted to surface AOT with LIDAR data.

4. $PM_{2.5}$ distribution is obtained from the relationship given in the above item 3.

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