Long-term Measurements of Solar Radiation and Aerosol Optical Depth at Mt. Lulin (2,862m) in East Asia

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The Lulin Atmospheric Background Station (LABS) located at Mt. Lulin in central Taiwan was established to monitor the atmospheric compositions and radiation in the lower free troposphere of East Asia since 2006. Our radiation measurement suite, including Cimel sun-photometry, Multi-Filter Rotating Shadowband Radiometer, broad-band Shortwave/Longwave/Ultraviolet/Photosynthetically Active Radiation radiometers, and sky imager, has been operated based on National Aeronautics & Space Administration/Aerosol Robotic Network (AERONET), NOAA/Global Monitoring Division, and World Meteorological Organization/Global Atmosphere Watch protocols. In this presentation, we will focus on the overall climatology of solar radiation and Aerosol Optical Depth (AOD) at LABS during the period of 2006-2013. The annual mean AOD is 0.07 with the maximum value of 0.2 observed in March. The higher AOD is associated with high loading of biomass-burning aerosols transported from Indochina in spring. In comparison with other AERONET high-elevation sites, the Lulin site shows a significant seasonal variation and is relatively sensitive to influences of continental outflows. In a clear-sky condition, the downward solar radiation flux at surface decreases as AOD increases. A 1-D radiative transfer model is applied to enclosure measurement results and further to estimate the direct Aerosol Radiative Forcing (ARF). As a result, the mean downward shortwave ARFs at the surface are -14.6 ~ -6.5 W m-2 (Global), 11.0 ~ 14.1 W m-2 (Diffuse), and -23.2 ~ -17.1 W m-2 (Direct), respectively.

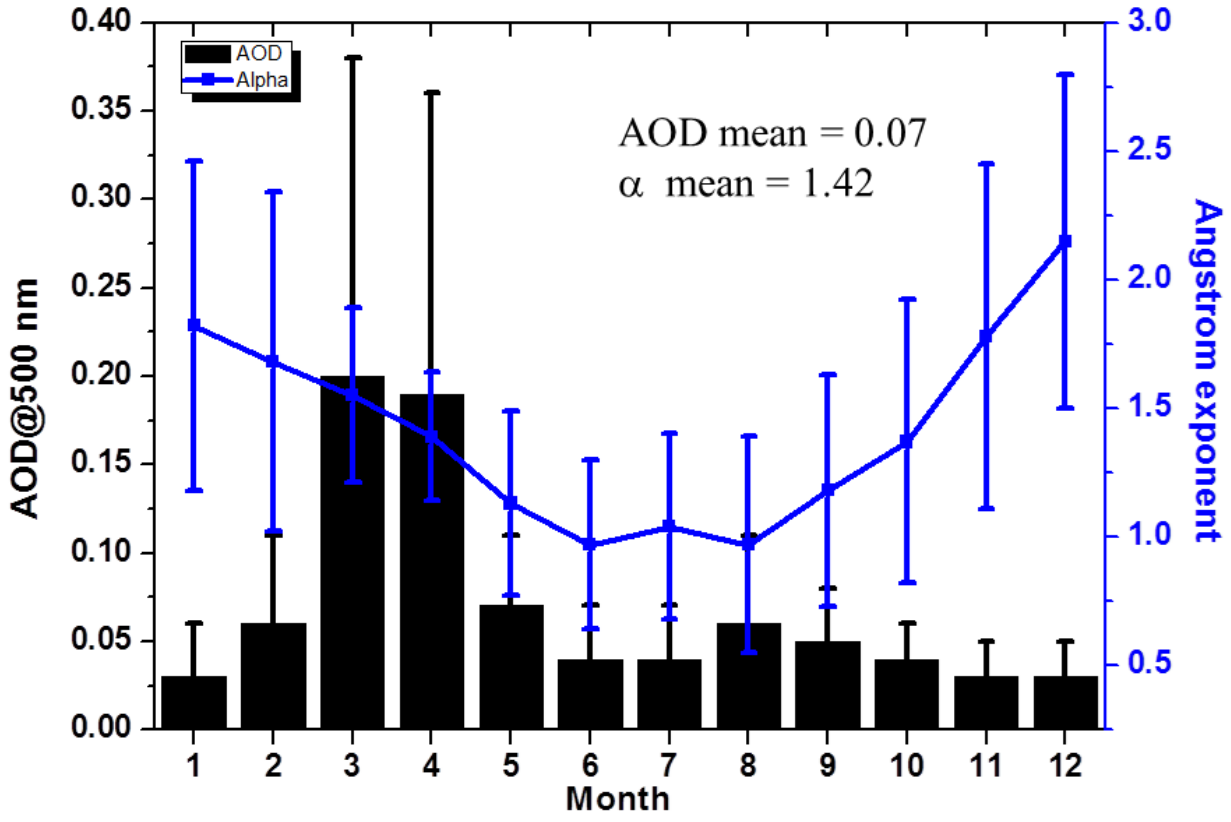

Figure 1. Monthly variations of AOD and angstrom exponent at Mt. Lulin.