Aerosol climatology at Mt. Lulin (2,862m): AERONET and in-situ measurements

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Introduction

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 Ease Asia since 2006. Our aerosol measurement suite, including Cimel sun-photometry, aerosol in-situ system (i.e., PSAP, CLAP, AE31, TSI Nephelometer, TSI CPC), has been operated based on NASA/AERONET and NOAA/GMD protocols, respectively. Our work provides the long-term radiation records to better understand the variability of aerosol optical properties in the lower troposphere over downwind of East Asia.

Take-Home-Messages

- The annual mean AOD is 0.07 with the maximum value of 0.2 observed in March.
- The long-term and monthly trends of AOD and surface extinction coefficients are similar, suggesting the in-situ measurement can represent aerosol optical properties through the column.
- Year variation of high loading month (i.e. March) shows strongly correlated to climate variability.

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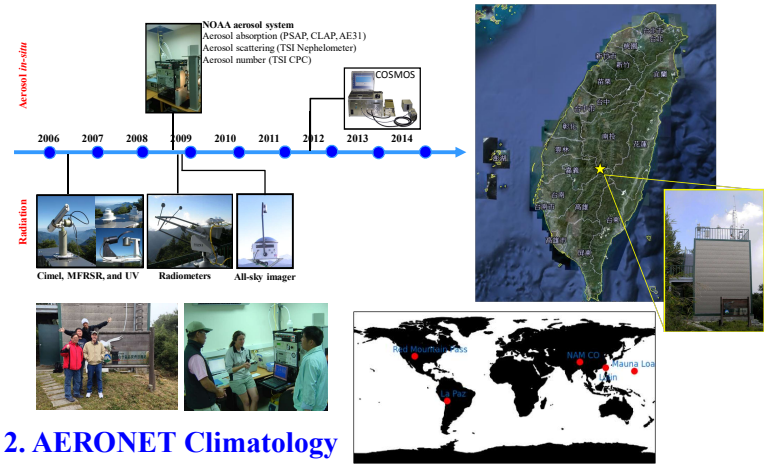
1. Instruments and operation time-line



2. AERONET Climatology

AERONET Level 2 data (2006-2013) was used in the analysis.

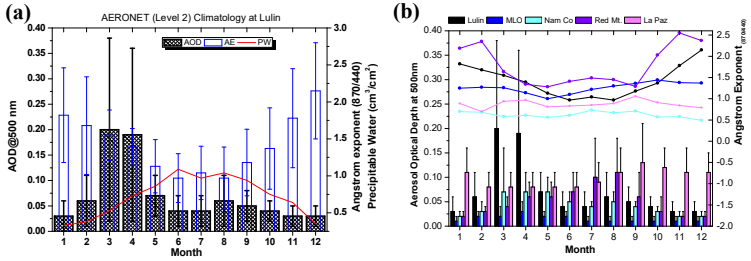


Figure 1. (a) Monthly mean values of aerosol optical depth (AOD) at 500 nm, Ångström Exponent ($AE_{440\text{-}870}$), and precipitable water (PW). Vertical bars indicate standard deviation (only for AOD and AE). **(b)** Monthly mean values of AOD and AE at high elevation AERONET sites.

3. Long-term trend of aerosol *in-situ* data

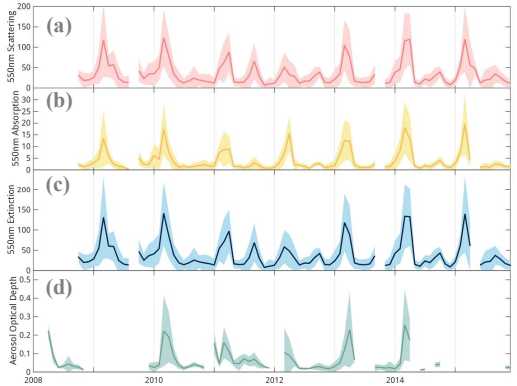


Figure 2. Year-monthly variation of (a) aerosol scattering coef. from TSI Nephelometer, (b) aerosol absorption coef. from PSAP (c) aerosol extinction coef., and (d) AOD_{500nm} from cimel.

"Peak value in March is due to the transported biomass-burning aerosols."

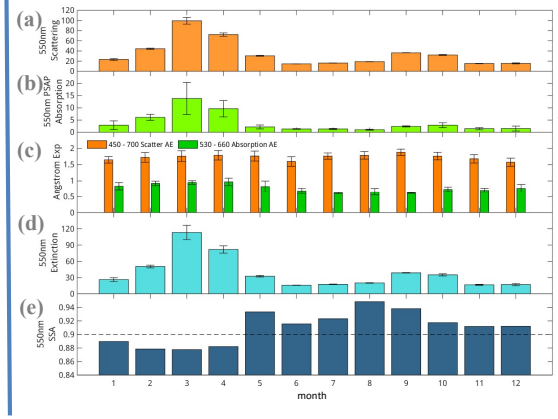


Figure 3. Monthly variations of (a) aerosol scattering coef. from TSI Nephelometer, (b) aerosol absorption coef. from PSAP, (c) SAE and AAE, (d) aerosol extinction coef., and (e) SSA at 550 nm.

4. Yearly trend of March data

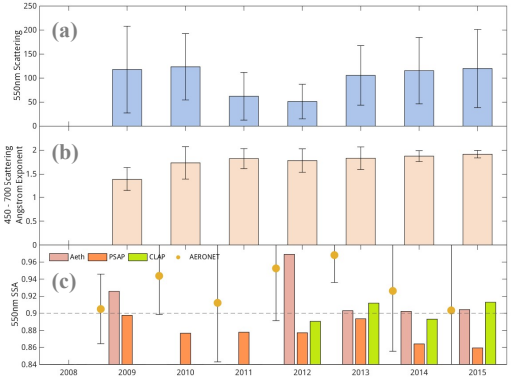


Figure 4. Yearly-March trend of (a) aerosol scattering coef. from TSI Nephelometer, (b) SAE, and (c) SSAs calculated from different instruments.

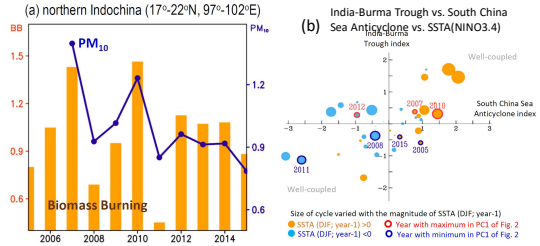


Figure 5. (a) yearly variation of fire counts over northern Indochina vs. PM_{10} conc. at Lulin. (b) Bubble plot of climate indies for different years.

Acknowledgments

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