Analysis of temporal evolution of Angstrom coefficients derived from spectrometric measurements of New Year 2013 aerosols in Manila Observatory (14.67N, 121.07E)

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Spectrometric measurements were done during New Year of 2013 at Manila Observatory (14.67N, 121.07E) for the purpose of characterizing optical properties of New Year aerosols. Intensity measurements from xenon lamp located ~150m from the spectrometer were gathered from 22:00 (local time) of 31 December 2012 to 09:00 (local time) of 01 January 2013, using a USB 2000 Ocean Optics Spectrometer. The sources of New Year aerosols were from burning firecrackers and firework activities from nearby residential areas. From 22:00 to 23:30, sporadic fireworks were observed and the frequency of burning and firework activities increased as the New Year approached. Data were acquired every 1 minute to look at the temporal evolution of optical characteristics of aerosols. The aerosol optical thickness were derived from 8 wavelengths: 387.3, 400.0, 440.0, 472.1, 600.0, 616.2, 764.3, and 823.1 nm. The reference intensity used to measure aerosol optical thickness was the measured intensity at 22:07 when the air could be considered as relatively clean even though isolated burning of firecrackers was observed. The aerosol optical thickness at a particular wavelength is computed from the negative of the logarithm of the ratio of the intensity and the reference intensity. The Angstrom coefficient, which is a measure of the dominance of fine or coarse particles, is obtained from the slope of the line fitting the logarithm of optical thickness and the logarithm of wavelength. Higher (>2) and lower (<1) Angstrom coefficients correspond to the dominance of fine and coarse particles, respectively. Figure 1 shows the Angstrom coefficient values from 23:30 of 31 December 2012 to 02:30 of 01 January 2013. The computed Angstrom coefficients before 23:30 and after 03:00 were not valid because there are no clear differences between the measured intensities and the reference intensity. From 23:30 to 1:00, Angstrom coefficient values noticeably increased and this could be attributed to the increase in firework activities near and just after New Year. The maximum intensity of firework activities is at around midnight. The spike of Angstrom coefficient at 00:30 can be attributed to aerosols transported to the place of measurement from a source where intense firework activities at midnight happened. The visibility at 550nm increased up to 5 km and stayed constant until 12:30. After that, the visibility started to decrease gradually up to 1 km until 01:45. The Angstrom coefficient is roughly constant at a value of 1.5 from 01:00 to 01:30 even though the visibility started decreasing to 1 km. From 01:30 to 02:30, a gradual decrease of Angstrom coefficient up to ~1.0 is observed. This can be attributed to increasing relative humidity in this time interval. Increase in relative humidity can bring about an increase in aerosol size by coagulation (Seinfeld and Pandis, 2006). This suppresses and increases the number of fine and coarse particles in the atmosphere, respectively. This would imply that aerosols would take less space to block light and this is manifested in the increase in visibility (up to 2.5 km) during this time interval. Even though fine particles were generated during the firework activities, the measured Angstrom coefficient values are still relatively low indicating a possible bimodal size distribution of aerosols in the atmosphere (Schuster et al, 2006).

References:

Seinfeld, J. and Pandis, S. (2006). *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change 2nd ed.* Wiley-Interscience, USA.

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