Scattering properties of aerosols at an urban station over the Indo-Gangetic Basin: Meteorological impacts and implications to regional climate

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Keywords: Scattering coefficient, backscatter coefficient, scattering Ångström exponent, radiative forcing.
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The Indo-Gangetic Basin (IGB), located in the northern part of India, is one of the densely populated and industrialized regions where atmospheric aerosols not only affect the Indian summer monsoon but also the global climate system. The region IGB experienced the enhancement in aerosol emissions mainly from anthropogenic sources, fossil-fuel, biofuel/biomass combustion (Srivastava et al., 2012), which along with the long-range transport of natural dust aerosols from surrounding Desert regions (mainly during summer seasons) have led to severely turbid atmosphere (Kaskaoutis et al., 2013, Srivastava et al., 2011, 2014). Several studies on absorption characteristics of these aerosols have been carried out over the region in recent past; however, studies on its scattering properties have not been addressed so far, which also play equally important role in radiative transfer model to address aerosol-cloud-climate impacts.

In the present study, we discussed the results of scattering properties of aerosols such as the scattering and backscattering coefficients, obtained from Nephelometer measurements during one-year period from October 2011 to September 2012 at an urban megacity Delhi on the western IGB region. We also estimated other crucial aerosol scattering parameters using three wavelength (λ=450, 550 and 700 nm) integrating Nephelometer (Model 3563, TSI) measured scattering coefficients and discussed the possible impacts of surface meteorological variables along with its major implications to regional climate system.

Results and Discussion

The magnitude of σ_{sp} was found to be about an order of magnitude higher than that of σ_{bsp} during the entire study period. The mean value of σ_{sp} and σ_{bsp} (at 550 nm) was found to be about 791±539 and 137±88 Mm^{-1}, respectively during the study period, which was relatively higher compared to the values reported at other stations in India. Seasonally, σ_{sp} was about 2-3 times higher during the post-monsoon and winter periods as compared to the values observed during the summer and monsoon.

The average value of SAE (BAE) over the station was about 0.69±0.94 (0.32±0.62) during the study period, which suggests dominance of sub-micron size aerosol particles over the station. However, an average value of *b* and AP was estimated to be 0.17±0.07 and 0.52±0.12, respectively, which was found to vary opposite with each other.

Table 1: Seasonal mean values of derived aerosol scattering properties (SAE, BAE, *b* and AP) at Delhi during October 2011-September 2012.

Season	$SAE_{450-700}$	$BAE_{450-700}$	b_{550}	AP_{550}
PM	1.51	0.76	0.14	0.56
WIN	1.41	0.81	0.13	0.58
SUM	0.20	-0.06	0.15	0.56
MON	-0.08	0.10	0.25	0.38

PM: post-monsoon; WIN: winter, SUM: summer; MON: monsoon

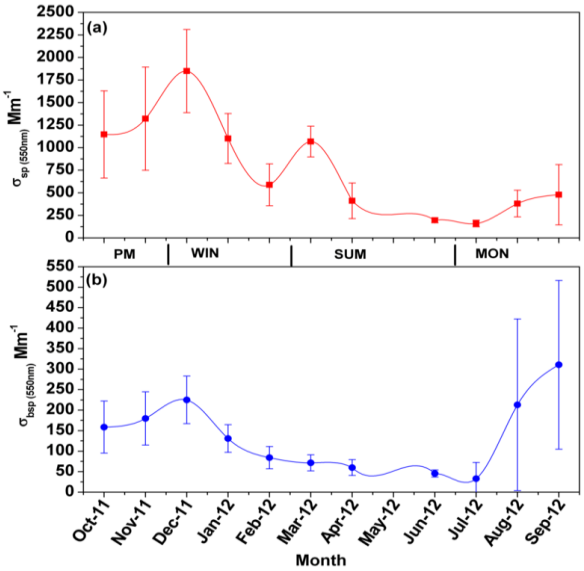

Figure 1: Monthly mean variability of (a) σ_{sp} and (b) σ_{bsp} coefficients at 550 nm at Delhi.

A significant relationship was noticed between the scattering coefficient and the ambient meteorological parameters, which may cause crucial impacts on associated aerosol radiative forcing over the station.

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