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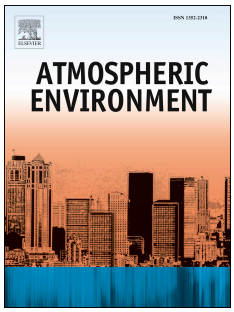

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Influence of biomass burning on mixing state of sub-micron aerosol particles in the North China Plain

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Abstract

Particulate emissions from crop residue burning decrease the air quality as well as influence aerosol radiative properties on a regional scale. The North China Plain (NCP) is known for the large scale biomass burning (BB) of field residues, which often results in heavy haze pollution episodes across the region. We have been able to capture a unique BB episode during the international CAREBeijing-NCP intensive field campaign in Wangdu in the NCP (38.6^{o}N, 115.2^{o}E) from June to July, 2014. It was found that aerosol particles originating from this BB event showed a significantly different mixing state compared with clean and non-BB pollution episodes. BB originated particles showed a narrower probability density function (PDF) of shrink factor (SF). And the maximum was found at shrink factor of 0.6, which is higher than in other episodes. The non-volatile particle number fraction during the BB episode decreased to 3% and was the lowest measured value compared to all other predefined episodes. To evaluate the impact of biomass burning on aerosol single scattering albedo (SSA), SSA at different RHs was simulated using the measured aerosol physical-chemical properties. The differences between the calculated SSA for biomass burning, clean and pollution episodes are significant, meaning that the variation of SSA in different pollution conditions needs to be considered in the evaluation of aerosol direct radiative effects in the NCP. And the calculated SSA was found to be quite sensitive on the mixing state of BC, especially at low-RH condition. The simulated SSA was also compared with the measured values. For all the three predefined episodes, the measured SSA are very close to the calculated ones with assumed mixing states of homogeneously internal and core-shell internal mixing, indicating that both of the conception models are appropriate for the calculation of ambient SSA in the NCP.

Keywords: biomass burning; sub-micron aerosol particles; mixing state