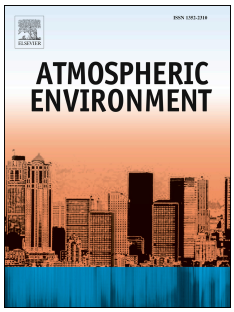
Accepted Manuscript



Black carbon and wavelength-dependent aerosol absorption in the North China Plain based on two-year aethalometer measurements

L. Ran, Z.Z. Deng, P.C. Wang, X.A. Xia

PII: S1352-2310(16)30533-7

DOI: 10.1016/j.atmosenv.2016.07.014

Reference: AEA 14740

To appear in: *Atmospheric Environment*

Received Date: 11 March 2016

Revised Date: 4 July 2016

Accepted Date: 6 July 2016

Please cite this article as: Ran, L., Deng, Z.Z., Wang, P.C., Xia, X.A., Black carbon and wavelength-dependent aerosol absorption in the North China Plain based on two-year aethalometer measurements, *Atmospheric Environment* (2016), doi: 10.1016/j.atmosenv.2016.07.014.

Black carbon and wavelength-dependent aerosol absorption in the North China Plain based on two-year aethalometer measurements

L. Ran[1], Z. Z. Deng[1], P. C. Wang[1], X. A. Xia[1,2]

[1]Key Laboratory of Middle Atmosphere and Global Environment Observation, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, 100089, China
[2]Collaborative Innovation Center on Forecast and Evaluation of Meteorological Disasters, Nanjing University of Information Science & Technology, Nanjing, 210044, China

Correspondence to: P. C. Wang (pcwang@mail.iap.ac.cn)

Abstract. Light-absorbing components of atmospheric aerosols have gained particular attention in recent years due to their climatic and environmental effects. Based on two-year measurements of aerosol absorption at seven wavelengths, aerosol absorption properties and black carbon (BC) were investigated in the North China Plain (NCP), one of the most densely populated and polluted regions in the world. Aerosol absorption was stronger in fall and the heating season (from November to March) than in spring and summer at all seven wavelengths. Similar spectral dependence of aerosol absorption was observed in non-heating seasons despite substantially strong absorption in fall. With an average absorption Angström exponent (α) of 1.36 in non-heating seasons, freshly emitted BC from local fossil fuel burning was thought to be the major component of light-absorbing aerosols. In the heating season, strong ultraviolet absorption led to an average α of 1.81, clearly indicating the importance of non-BC light-absorbing components, which were possibly from coal burning for domestic heating and aging processes on a regional scale. Diurnally, the variation of BC mass concentrations experienced a double-peak pattern with a higher level at night throughout the year. However, the diurnal cycle of α in the heating season was distinctly different from that in non-heating seasons. α peaked in the late afternoon in non-heating seasons with concomitantly observed low valley in BC mass concentrations. In contrast, α peaked around the midnight in the heating season and lowered down during the daytime. The relationship of aerosol absorption and winds in non-heating seasons also differed from that in the heating season. BC mass concentrations declined while α increased with increasing wind speed in non-heating seasons, which suggested elevated non-BC light absorbers in transported aged aerosols. No apparent dependence of α on wind speed was found in the heating season, probably due to well mixed regional pollution. Pollution episodes were mostly encountered under low winds and had a low level of α, implying aerosol absorption should be largely