

Interactive comment on “Measurement report: Evaluation of sources and mixing state of black carbon aerosol under the background of emission reduction in the North China Plain: implications for radiative effect” by Qiyuan Wang et al.

Anonymous Referee #1

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The manuscript by Wang et al. focused on the source apportionment and mixing state of black carbon in the North China Plain. The objectives of the study were to (a) determine the contributions of different sources and regions to the BC mass, (b) identify the chemical composition of BC coatings, and (c) evaluate the impacts of BC on regional radiative forcing. The authors used various methods to achieve these objectives. The major methods include a multi-wavelength optical approach combined with the source-based absorption Ångström exponent, WRF-Chem model, ART-2a, and SBDART model. The authors found that (a) the contribution of traffic emission was

C1

dominant to BC mass in the study region; (b) BC-containing particles existed in six classes to the mixing state of organic and inorganic substances; (c) the estimated BC forcing was positive with $+18.0 \text{ W m}^{-2}$ and a heating rate of 0.5 K day^{-1} in the study region. The designed experiments were comprehensive, and the results were robust. The new data generated from this study should be valuable to understand the present status of the regional air quality and radiative forcing affected by BC in the North China Plain under the background of emission reduction. Therefore, I would suggest the manuscript for publication after the authors address the following specific comments.

(1) Although a photoacoustic instrument was used to correct the impact of filter matrix scattering of AE33 aethalometer, the PAX was operated at a single wavelength of 532 nm, which may bring uncertainty for other wavelengths of AE33 absorption. This should be pointed out in the study.

(2) A Nafion dryer was used for ACSM. How about the AE33, PAX, and SPAMS? High ambient humidity can also influence the measurements of these instruments. A schematic of the measurement system should be used to show the setup of each instrument.

(3) The authors should provide more information on bench tests, as the vehicle emission is a crucial component of the BC sources; relevant references should be cited.

(4) Insufficient detail is given regarding the radiative forcing calculations. The radiative forcing is related to the vertical information of the atmosphere. The authors used the OPAC model to retrieve the vertical optical parameters used in the SBDART model, but the brief description makes the calculation unclear. More information about the OPAC model should be added in the supporting information

(5) One finding of this study is the change of BC source in winter NCP through comparison with previous studies in this region. The authors considered this as a successful example of coal-to-gas switching to reduce pollutants under the new regulations by the Chinese State Council released in 2013. It would be useful to see a thorough compar-

C2

ison between the results of this study and those conducted before 2013 in this region. There should be relevant data from previous measurements by others in this region.

(6) The term 'Aethalometer model' gets misused in places. This refers to the data analysis technique, not the instrument itself.

(7) The map of Fig. S6 does not make much sense to someone unfamiliar with Chinese geography. Suggest showing a zoomed-out version showing the wider region.

(8). The authors may improve the manuscript content by avoiding grammar and spelling errors throughout the text. I'm not going to list them, but the manuscript should be checked carefully and polished by a native English speaker.

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