

## ***Interactive comment on “Spatial distribution of aerosol microphysical and optical properties and direct radiative effect from the China Aerosol Remote Sensing Network” by Huizheng Che et al.***

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Reviewer 1 General comments: This study makes an extensive and comprehensive national distribution of the aerosol optical properties and direct radiative effect during 2008-2017 in China over decade change. The aerosol key optical parameter obtained from CARSNET, and this ground-based observation net was established independently with Chinese characteristics. The instrument calibration and inversion algorithm from CARSNET has been recognized by the international community, and the results have also been compared by the global ground based observational organizations such as AERONET, etc. Generally, five regions including 50 ground stations nationwide were

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defined in this study, covers almost the whole region of China, which is of great research value contributed to the regional aerosol optical properties in China, East Asia or the whole world. An emphasis on the estimation of the aerosol optical properties over China vast and varied terrain under different background and aerosol sources driven by the meteorological factors and climatology changes have been employed. The objective of the paper is challenging to use the National scale, ground-based measurements of aerosol microphysical and its optical properties as well as direct radiative effect obtained from the sunphotometer with good quality and large databases. The paper is well written with most importance to complement and support the climatology for aerosol microphysical and optical properties of China and provide better understanding of the aerosols' climate effects over the different types of sites covering a broad expanse of China. Thus, I would suggest a minor revision before it is considered for publication as following. Response: Thanks for the reviewer's important comments; some important revisions and the grammar have been corrected according to the reviewer's suggestions.

Special comments: 1. Line 40, the time period for the data at the observation site need a brief description in the Abstract. Response: Thanks for the suggestions. The time period for the data at the observation site has been briefly described as "Multi-year observations of ..." in the Abstract. 2. Line 60-61, the word "useful" could be changed as "important" to avoid repetition. Response: The word "useful" has been changed as "important" to avoid repetition in the manuscript. 3. Line 95-96, some references could be added there. Response: Following the suggestion of reviewer, some references have been added in the revised paper as "...in many regions of China (Che et al., 2009c, 2018; Zhao et al., 2018)". 4. Line 126-127, "aerosol size distribution" could be changed as "aerosol size distribution (volume and aerosol effective radii)". Response: The words "aerosol size distribution" has been changed as "aerosol size distribution (volume and aerosol effective radii)" in the revised manuscript. 5. Line 196, "Ångström" should be changed as "Ångström exponent" to make consistency in the text. Response: Thank for the suggestions of reviewers. The words "Ångström" has

been changed as “Ångström” and this change applied to the rest of the manuscript. 6. Line 271, “. . . was found to be substantially. . .” should be better revised as “. . . was found substantially. . .”. Response: According the reviewer’s suggestions, the words “. . . was found to be substantially. . .” has been modified as “. . . was found substantially. . .”. 7. Line 297, “. . . also was high,  $0.30 \mu\text{m}^3/\mu\text{m}^2$ .” should be better revised as “. . . also was high to  $0.30 \mu\text{m}^3/\mu\text{m}^2$ .”. Response: Thanks for the suggestion. The words “. . . also was high,  $0.30 \mu\text{m}^3/\mu\text{m}^2$ .” has been modified in the revised manuscript as “. . . also was high to  $0.30 \mu\text{m}^3/\mu\text{m}^2$ .”. 8. Line 331-332, please specify the results of Zhao et al. (2018) in detail. Response: Follow up on the reviewer’s suggestion, the sentences has been changed as “Zhao et al. (2018) also reported the effect of sea salt aerosol on the aerosol absorption and radiative effects in the coastal region over northeastern China.” in the revised manuscript. 9. Line 375, “. . . in and around. . .” should be better revised as “. . . in or around. . .”. Response: Done. The words of “. . . in and around. . .” was changed as “. . . in or around. . .” in the revised paper. 10. Line 432, “. . . these particles originate from a multitude of sources. . .” should be better revised as “. . . these particles originate from multitude sources. . .”. Response: The sentence “. . . these particles originate from a multitude of sources. . .” has been changed as “. . . these particles originate from multitude sources. . .”. 11. Line 437, “were more than likely” should be better revised as “were more likely”. Response: The words “were more than likely” have been changed as “were more likely” in section 3.3. 12. Line 442, “(EAE 0.25)” should be better revised as “(EAE = 0.25)”. Response: The words “(EAE 0.25)” has been changed as “(EAE = 0.25)” in the revised version. 13. Line 474, “. . . the aerosol was more absorbing in fall, . . .” should be better revised as “. . . the aerosol was more absorbing in autumn, . . .”. Response: The words “. . . the aerosol was more absorbing in fall, . . .” has been changed as “. . . the aerosol was more absorbing in autumn, . . .” and this change applied to the rest of the manuscript. 14. Line 482-483, “Therefore, the different SSA440nm distributions in the two regions may be attributed by the special aerosol composition.” Is the special aerosol composition because of the industrial structure of different regions Like the Northeastern China was once the significant heavy industries

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base in China. Response: According to the suggestion, the sentences “Therefore, the different SSA440nm distributions in the two regions may be attributed by the special aerosol composition” has been changed as “Therefore, the different SSA440nm distributions in the two regions may be attributed by the special aerosol composition related to the urban-industrial background of northeastern China (lower SSA440nm) and more anthropogenic sources in the eastern China environmental (higher SSA440nm).” in the revised manuscript. 15. Line 542, “aerosol direct radiative effect” in the section title should be better revised as “direct aerosol radiative effect”. Response: Thanks for the suggestions. The title of the section 3.5 has been changed as “direct aerosol radiative effect” to consistent with the rest of revised manuscript. 16. Line 554, “-22.13 and -17.43” should be better revised as “-22.13 and -17.43 W/m<sup>2</sup>”. Response: According to the suggestion, the “-22.13 and -17.43” has been changed as “-22.13 and -17.43 W/m<sup>2</sup>” in the revised manuscript. 17. Line 583, “A notably small” should be better revised as “A notably small positive”. Response: Thanks for the reviewer’s suggestions. We checked the value of DARE-TOA in Akedala carefully, and found that it should be corrected as -0.42 W/m<sup>2</sup> in the text by a typing mistake. Moreover, the value was correct in the relevant descriptive sentences, Table and charts through the text. 18. Line 588, “(SSA 0.92)” should be better revised as “(SSA = 0.92)”. Response: Done. The words “(SSA 0.92)” has been changed as “(SSA = 0.92)”. 19. Line 607, “as” should be deleted. Response: The word “as” have been deleted in the revised paper.

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