

Reply to referee #2

First of all, we thank the reviewer for the careful reading of the manuscript and constructive comments. We have revised the manuscript, following the reviewer's suggestions.

We have also removed/added/changed the words, sentences, and figures in the manuscript. The changed and added parts are painted in a red color in the text.

1. Many researchers have discussed the errors of MODIS AOD in China. The author ought to cite those papers to definite the errors range of MODIS AOD in the region.

Reply: We added one paragraph in Sect. 3.2 describing the errors of MODIS-retrieved AOD over China. Please, check out pp. 18:22-19:3.

2. In the paper, the particulate and air pollutants are serious in China, but it is lack of evaluating the accuracy of CMAQ modeling results in region. The comparison in Japan and Korea was not enough, because the emission and climate of two countries are very different with China. The comparison was necessary in China.

Reply: As reviewer pointed out, the evaluation over China is necessary. Basically, we agree with it. The EANET sites in China have not provided the data, as it was mentioned in Sect. 2.2. Therefore, we tried to find the measurement data of particulate species in China and could obtain the CAWNET data through personal contact with Dr. Zhang, because the CAWNET data cannot be downloaded from official site. We added the comparisons between CMAQ-estimated and CAWNET particulate concentrations in Figs. 4-6 and 8. In this analysis, 4 remote CAWNET sites were used, because of the absence of data at the other CAWNET sites and possible large differences between the point measurement data (CAWNET data) and pixel (or grid) data from the CMAQ model simulations (Wald and Baleynaud, 1999), especially at the urban areas due to highly heterogeneous air quality conditions inside the pixels. Please, check out pp. 7:15-7:21, 14:12-14:15, and 15:17-15:24 and Figs. 4-6 and 8.

3. DRF was valid under clear-sky conditions, but not under the cloud or rain conditions because of no sunlight. Why did you calculate DRF under all-sky conditions? Just because the model can calculate the value. But the value is not true.

Reply: Yes, indeed the estimations under all-sky conditions have high uncertainty. Even so, we intended to report that the high DRF by aerosols can be offset by clouds, although the accuracy of cloud effects on DRF is sensitive to the accuracy of cloud information. These types of reports can also be found in many previous studies (e.g. Conant et al., 2003; Zhang et al., 2012; Su et al., 2013).

4. Error range of the retrived results should be made in the figures. (eg. fig 4-6 and so on)

Reply: The error bars of the retrieved results were indicated in Figs. 4-6 and 10-12.

5. Since the simulate AOD and DRF from the model were good consistent with the

AERONET sites and MODIS results, I suggest that the authors evaluate the contributions of all kinds of aerosols to AOD and DRF, not just for ammonium nitrate.

Reply: We added the contributions of all kinds of aerosols to AOD and DRF by aerosols at the end of Sect. 3.3. Please, check out pp. 23:6-23:13 and newly-added Fig. 16.

Additional references:

Su, W., Loeb, N. G., Schuster, G. L., Chin, M., and Ross, F. G.: Global all-sky shortwave direct radiative forcing of anthropogenic aerosols from combined satellite observations and GOCART simulations, *J. Geophys. Res.*, 118 (2), doi:10.1029/2012JD018294, 2013.

Wald L. and Baleynaud J.-M.: Observing air quality over the city of Nantes by means of Landsat thermal infrared data. *International Journal of Remote Sensing*, 20, 5, 947-959, 1999.