Interactive comment on **"Spatial and seasonal variations of aerosols over China from two decades of multi-satellite observations. Part I: ATSR (1995–2011) and MODIS C6.1 (2000–2017)"**

by **Larisa Sogacheva et al.**

Anonymous Referee #3

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We thank the Referee for careful consideration of the manuscript and the positive recommendation. Below we copy the referee's comments in *Italics* and responses are given below each concern.

The authors analyzed the AOD obtained from ATSR dual view observation jointly with MODIS DTDB results over China for the period since 1995. With such a long time series AOD data from two satellite sensors, the seasonal and inter-annual as well as spatial variation of 2 dataset are compared in details. The results would be useful for researchers who are interesting in the historical aerosol information over East Asia region and thus it is worth the publication. The reviewer's concerns are mainly as below:

(1) Over Sichuan basin, its higher AOD has been recognized for a long time. Several ground-based measurement studies also partly confirmed this high AOD region. From Fig.7, this feature is a major characteristic for MODIS results, while it is not clear for ATSR results. Are there validations or explanation on this underestimation?

Response: Indeed the AOD over Sichuan Province is high! Both in the ATSR and the MODIS retrieval Sichuan AOD is higher than its surroundings. However, ATSR AOD is a bit underestimated and the MODIS AOD is a bit overestimated (as shown in Fig. 4 and also discussed in the text above Fig.7). For the comparison in Fig. 7 we used the same colorscale which shows the MODIS AOD over Sichuan more clear than that from ATSR. By lack of AERONET data we cannot do validation specific for this area. Fig. 10 also shows the high AOD over Sichuan, with similar values for each season, and similar to that over NCP, except for the summer AOD which over NCP is higher than in other seasons.

(2) Over Inner-Mongolia, there are large areas of desert and arid regions, about 1/3 of Takla- makan desert in size. It's somewhat strange why ATSR results show nearly none of higher AOD values over this region. In comparison, MODIS results are probably more reasonable. Noticeably, in Fig 3(a), the "red" color region (difference large than ~0.2) is also around this area.

Response: Fig. 3 shows a comparison between MODIS C6.1 and C6, and because we don't have detailed information on the differences between these two MODIS collections from the peer-reviewed literature, we cannot comment on this. The difference between ATSR and MODIS is shown in Figs 7 and 10, and indeed ATSR

does not show the high AOD over the deserts, which we ascribe to the failure of the dual view algorithm to adequately retrieve AOD over bright surface (see, e.g. the text above Fig 7, and references cited there).

(3) As shown in Fig 9, the difference between two dataset depends on geolocations and seasons (Fig.11). Then, how does these two dataset (MODIS & ATSR) could be merged or used together in a continuous basis for a future analyses of long period variation, e.g. 1995-present, as suggested by authors in the summary part.

Response: In the last sentence we indicate that the combination of the ATSR and MODIS time series will be discussed in the companion paper, i.e. Part II. Hence this will not be further discussed in the present paper. Part II is available as a discussion paper in ACP, see https://doi.org/10.5194/acp-2018-288.