

## ***Interactive comment on “Retrieval of Gridded Aerosol Direct Radiative Forcing Based on Multiplatform Datasets” by Yanyu Wang et al.***

### **Anonymous Referee #1**

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Atmospheric aerosols play a crucial role in regional radiative budgets. The changes in surface radiation induced by aerosols significantly impacts the surface temperature, crop growth and solar energy availability. However, the current assessment of aerosol direct radiative forcing (ADRF) remains highly uncertain. This paper proposes the method for ADRF simulation in East China based on a combination of MODIS and MERRA model reanalysis data. The comparison with surface measurements ensures the accuracy of this retrieval, and it is the highlight of this research along with detailed discussion about error analysis. The analysis of ADRF distribution provides valuable information about the aerosol radiative effect in the heavily polluted region, East China, and in the period when it experienced an unprecedented economic boom. This method is helpful to study aerosol-induced changes in the surface radiation un-

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der climate change and agricultural economic impact over China. The research makes an interesting and potentially useful contribution. However, there are several points need to be addressed and revise carefully. Overall, I recommend this manuscript for publication in AMT with Minor Revision.

General comments:

1. The most important factor affecting ADRF simulation is the accuracy of MERRA -2 SSA in East China. I notice that the chosen sunphotometers all locate in the northern China, these sites may not represent the whole East China, what comparison results in other sunphotometers of East China?

2. It seems chaotic in the error analysis of ADRF. In section 4.2, the author analyses the error sources between simulated  $F_{d\_sur}$  and the observations (cloud contamination, different spatial and temporal representativeness...). Is this associated with ADRF errors? In section 4.4, the author also conducts the uncertainty analysis of different aerosol optical parameters. The difference between this should be clarified, more explanations and structure adjustment are also needed.

3. In Line 313, “the magnitude of ADRF is higher than the most cities in the world, such as Spain (Esteve et al., 2014), Gasan (Kim et al., 2006) and Karachi (Alam et al., 2011)”. It is suggested to add some more discussions about the comparison between East China and other countries. For example, why is ADRF in East China higher than other countries?

Specific comments:

1. Line 68: “Furthermore, aerosol microphysical parameters are crucial in ADRF simulation, including single scattering albedo and the asymmetry parameter (ASY), but their retrieval remains challenging.” It is suggested to adjust word order for readability, for example, it is better to be written: “Furthermore, the retrieval of aerosol microphysical parameters remains challenging, including single scattering albedo and the asymmetry

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parameter (ASY).”

2. Line 161: “Before ADRF simulation, one of the inputs, SSA from MERRA-2, was evaluated firstly”. Why does the author evaluate SSA first in the Results? Please make some more explanation about the goal of the SSA evaluation at the beginning of the Results.

3. Line 276: “MERRA-2 SSA is always underestimated in these conditions, potentially leading to the negative errors in the simulated  $F_{d\_sur}$ ”. Why?

4. There are some mistakes in grammar in this paper, please check them carefully. For example, Line 19: “has” should be “have”; Line 57 “restricted” should be “are restricted”; Line 92: “including” should be “includes”.

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