

## ***Interactive comment on “Radiative absorption enhancement of dust mixed with anthropogenic pollution over East Asia” by Pengfei Tian et al.***

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Aerosol particles have been found to dramatically affect the weather and climate in East Asia, a hot spot region in term of dust and anthropogenic aerosol emissions. However, the effect of aerosol radiative enhancement due to the mixing of dust and anthropogenic aerosol remains to be poorly understood. Based on long-term AERONET observations along with radiative transfer model calculation, the mixed-type aerosols are found to exhibit a significantly larger BOA cooling radiative efficiency and ATM warming radiative efficiency compared with either dust or anthropogenic aerosols. This strong gradient of radiative effect in the vertical could be one of the factors explaining the deterioration of air quality in East Asia (including India and China). The paper is well written and structured. The classification method is robust by combining the SSA

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and angstrom coefficient. And the estimation of BOA radiative efficiency is much better compared with previous methods through explicitly accounting for the nonlinear dependence between aerosol direct radiative forcing and AOD. Therefore, I recommend this paper be accepted for publication in ACP pending minor revision. Response: We are grateful to Referee #3 for the constructive and helpful comments. All the comments and concerns raised by the referee have been explicitly considered and incorporated into the revised manuscript. For clarity purpose, we have listed the reviewers' comments followed by our responses.

Specific Comments:

1. Line 93: “mixing” -> “mixed”

Response: Agreed and corrected in the revised manuscript.

2. Lines 102-103: can “under different air quality conditions” be changed to “under pristine and polluted conditions”?

Response: Agreed and corrected in the revised manuscript.

3. Lines 108-109: “the radiative absorption enhancement by the aerosol mixtures in East Asia has not been assessed.” is not accurate since there is a lot of work involved in the radiative absorption enhancement, e.g., Cui et al. 2016 (doi: 10.1016/j.scitotenv.2016.02.026).

Response: According to the reviewer's comment and our research, we replaced “the radiative absorption enhancement by the aerosol mixtures in East Asia has not been assessed.” with a more proper description “further studies are urgently demanded to better understand the key role that the East Asian aerosol mixtures play in the formation mechanism of regional air pollution.” We cited Cui et al. 2016 (doi: 10.1016/j.scitotenv.2016.02.026) in the revised manuscript.

4. Line 240: Fig. 4a -> Fig.3a

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Response: Agreed and corrected in the revised manuscript.

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