

# ***Interactive comment on “Retrieval of Aerosol Fine-mode Fraction over China from Satellite Multiangle Polarized Observations: Validation and Application” by Yang Zhang et al.***

## **Anonymous Referee #2**

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### GENERAL COMMENTS

This manuscript by Zhang et al. conducted the fine mode fraction (FMF) retrieval from multi-angular polarimeter (PARASOL). Technically, the total AOD is determined from intensity measurements, and fine mode AOD is derived from multi-angular polarized measurements. Then the ratio of AOD and fine mode AOD derives FMF. This method generally sounds, and has been published in Zhang et al. (2017, 2018).

This manuscript is mainly focus on the validation of retrieved FMF using AERONET, MODIS, PARASOL/GRASP products. The main concern here is that each product may have different definition of their FMF, this should be fully considered before conducting

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validation and inter-comparison. For example, MODIS FMF over land is the ratio to reflectance instead of total AOD; therefore MODIS FMF over land has little physical meaning. Over ocean, by single scattering approximation, FMF can be approximated as weighted for AOD (see discussions in Remer et al., 2005). Additionally, the objective is not clear why the authors pay close attention to FMF instead of fine mode AOD, the uncertainties in both AOD and fine AOD could significantly worsen the FMF quality, and a good FMF doesn't necessarily produce a good estimation of fine mode AOD. Overall, I think this manuscript is within the scope of AMT. Some comments and concerns are required to be addressed and clearly stated before being published. The specific comments are listed as follow.

### SPECIFIC COMMENTS

Line 39: please be cautious to interpret MODIS FMF over land, it is weighted of reflectance instead of AOD (see discussions in Remer et al., 2005; Chen et al., 2020);

Line 53: This is not true. Please check Chen et al., 2020 (10.5194/essd-2020-224)

Line 71-72: 'there is a problem of low retrieval value for high aerosol loading' ??? Could you specify it, underestimation for high AOD or FMF?

Line 82: thesis?? -> study

Line 148: 3x3 window ? is it equivalent to 3x18km?

Line 154: is there any intention or reference to use  $\pm 0.1 \pm 10\%$  EE for FMF?

Line 158: Section name is wrong.

Figure 3: is this all points from 2006-2013? Any filter scheme used, please clarify.

Line 177: errors ... are stable... ?? please consider 'uncertainty'

Line 182: the definitions of AERONET FMF and retrieved AOD<sub>f</sub>/AOD are not identical

Table 3: Number of points is critical, as well as other parameters (r, rmse, etc.)

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Line 220: Please identify products name and version, and last access, etc. (This is necessary for all products used in the manuscript)

Line 222: what do you mean normalized FMF?

Section 3.3: why only 2013 data is compared? It would be interesting to check more data 2006-2013 and other related parameters, e.g. AOD and fine mode AOD, to make the conclusion more solid.

Figures 6, 7, 8: it is important to mention the spatial resolution, visually, the derived FMF in figure 6 has much coarser resolution than others

Figures 9, 16: the quality of figures showing differences can be improved by using more adequate colorbar

Line 346: throughout the manuscript, no place specified the MODIS (TERRA or AQUA or both) dataset

Line 370: Is there any specific reason to pay close attention to FMF instead of fine mode AOD? On one hand, the uncertainties in both AOD and fine AOD could significantly worsen the FMF, on the other hand, a good FMF doesn't necessarily produce a good estimation of fine mode AOD, which can compensate by AOD and fine AOD, right?

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