We would like to thank the three referees and the editor for their time reviewing the manuscript, and for the helpful feedback provided. The detailed responses to all referees are provided below.

Reviewer #1:

The study is well-organized, and the results demonstrate good agreement with other datasets. However, several concerns need to be addressed, and providing additional information will further strengthen the paper.

Response:

We would like to thank the reviewer for your time reviewing the manuscript and appreciate the constructive comments on our paper.

1. Are the images in Figures 4 and 5 averaged over the entire 18-month period? While it is clear that data was processed and made publicly available for 18 months, averaging all 18 months together may lead to an unbalanced seasonal representation, where certain seasons dominate the dataset. This results in an image that is neither an annual mean nor a seasonal mean, making it difficult to interpret. Additionally, the AERONET validation later in the paper appears to use only one year of data. This raises the question of whether it is necessary to average all 18 months in these figures. Also, I think it would be better to have more descriptions for Figure 4 and 5

Response:

Yes, the images in Figures 4 and 5 are averaged over the entire 18-months of processed POSP data. Basically, Figures 4 and 5 are illustrations of the main aerosol and surface products provided in the POSP/GRASP level 2 product. The spatial distribution of averaged 18-months of data is to keep consistency with Figure 3, in which the total number of valid retrievals over the entire 18-month period is present. The 2022 annual mean of the main POSP/GRASP aerosol and surface products are present in Figures A1 and A2. Note, the annual mean map of POSP AOD, AODF, AODC at 550 nm and BHRiso at 442, 670, 865 and 2254 nm are also shown in Figures 11, 13 and 15. Therefore, we would keep the Figures 4 and 5 as an illustration of the main aerosol and surface products. We have added more descriptions to Figures 4 and 5.

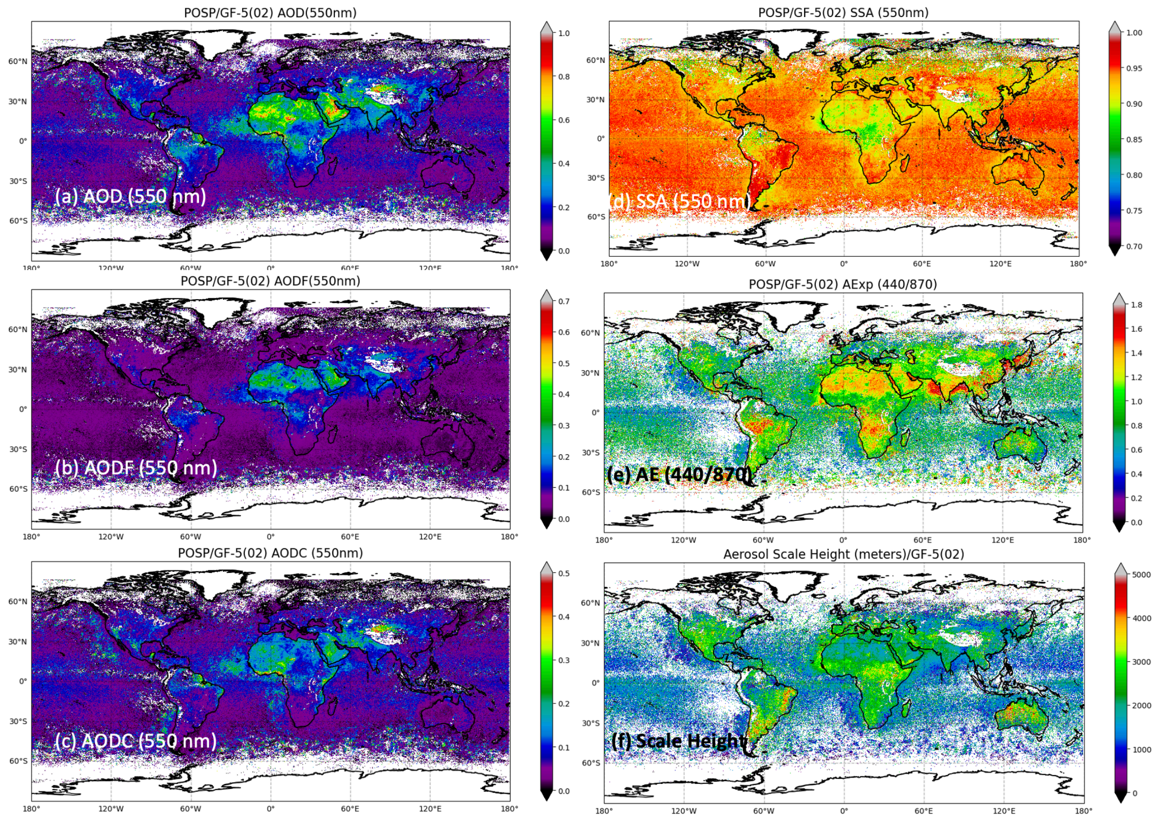

Figure A1. Spatial distribution of POSP/GF-5(02) 2022 annual mean main aerosol products: (a) Aerosol Optical Depth – AOD; (b) Fine mode Aerosol Optical Depth – AODF; (c) Coarse mode Aerosol Optical Depth (AODC); (d) Single Scattering Albedo – SSA; (e) Ångström Exponent – AE (440/870); (f) Scale height of aerosol vertical profile – ALH; Note AOD, AODF, AODC, SSA are spectral dependent and provided at UV, VIS, NIR and SWIR spectrum.

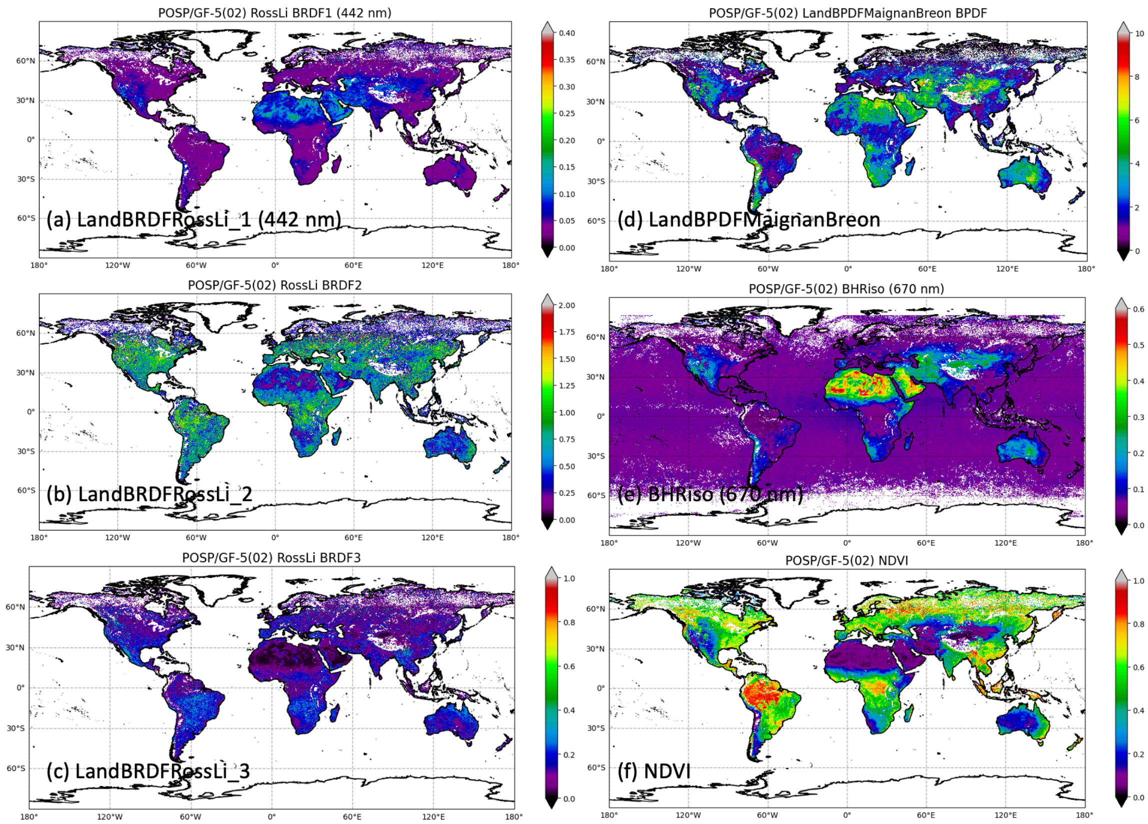

Figure A2. Spatial distribution of POSP/GF-5(02) 2022 annual mean main surface products: (a) Ross Li BRDF isotropic parameter; (b) Ross Li BRDF normalized volumetric parameter; (c) Ross Li BRDF normalized geometric parameter; (d) Maignan-Bréon BPDF; (e) Surface Isotropic Bihemispherical Reflectance – BHRiso or White Sky Albedo; (f) Normalized Difference Vegetation Index – NDVI. Note BRDF1 and BHRiso (White Sky Albedo) are spectral dependent and provided at UV, VIS, NIR and SWIR spectrum.

2. In line 293, it is mentioned that SSA data was matched within ±180 minutes, which is different from the other validation datasets. It would be helpful to explain why this specific time window was chosen.

Response:

Thanks for the suggestion! In this study, 3 types of AERONET Version 3 Level 2 aerosol products are used to verify the results obtained from POSP/GRASP processing, including direct-Sun, SDA and Inversion products. The AERONET CIMEL sun-photometer carries out direct-Sun measurements about every 15 mins and generate the direct-Sun spectral AOD, AE products and derived SDA fine/coarse mode AOD products. While, the AERONET inversion products are generated based on the sky-scanning Almucantar measurements which are carried out hourly from 9:00 to 15:00 local time or optical air mass equals to 4, 3, 2, 1.7 both in the morning and the afternoon. Therefore, the inversion products of SSA, complex refractive index, particle size distribution are provided less frequent than the direct-Sun measurements of AOD, AE, AODF and AODC. In order to collocated satellite overpass time and AERONET products, we use +/- 30 mins for AOD, AE, AODF and AODC validation and +/- 180 mins for SSA validation. Also, several studies (Sayer, 2020; Schutgens et al., 2016) suggest that aerosol type related parameter, such as SSA, vary temporally slowly than that aerosol concentration related parameters, such as AOD.

Schutgens, N. A. J., Partridge, D. G., and Stier, P.: The importance of temporal collocation for the evaluation of aerosol models with observations, *Atmos. Chem. Phys.*, 16, 1065–1079, https://doi.org/10.5194/acp-16-1065-2016, 2016.

Sayer, A. M. (2020). How long is too long? Variogram analysis of AERONET data to aid aerosol validation and intercomparison studies. *Earth and Space Science*, *7*(9), e2020EA001290.

3. In lines 316–318 and 369–370, the paper states that the results are similar to previous studies. However, instead of just stating that they are similar, it would be more effective to include specific numerical comparisons in the form of figures or tables to support this claim.

Response:

Thanks for the suggestion! We have added a table (Table A1) to list some key statistical parameters for one-year AERONET validation of AOD, AE, and SSA obtained from POSP, OLCI and TROPOMI for intercomparison. Basically, in most of statistical metrics, TROPOMI product outperforms the other two products. POSP AOD validation performance is comparable with OLCI, while AE over land and SSA from POSP seems slightly better than OLCI.

Table A1. Intercomparisons of OLCI/Sentinel-3A, TROPOMI/Sentinel-5p and POSP/GF-5(02) one-year AOD (550 nm), AE (OLCI and POSP: 440/870; TROPOMI: 412/670) and SSA (550 nm) one-year validation metrics with AERONET reference dataset. The best performance metric is indicated in bold.

	Sensor (num. pairs)	R	RMSE	BIAS	Optimal%	Target%
AOD 550 nm (Land)	OLCI (3205)	0.870	0.090	-0.01	47.9	-
	TROPOMI (**7732**)	**0.885**	**0.078**	0.01	**56.9**	**67.9**
	POSP (1667)	0.813	0.114	**0.004**	47.6	57.0
AOD 550 nm (Ocean)	OLCI (217)	0.872	**0.047**	**0.01**	67.3	-
	TROPOMI (**880**)	**0.881**	**0.047**	**0.01**	**71.3**	**81.1**
	POSP (219)	0.861	0.091	-0.012	54.3	66.7
AE (Land)	OLCI (611)	0.526	0.531	-0.35	-	-
	TROPOMI (**991**)	**0.725**	**0.418**	**0.18**	**51.6**	**76.0**
	POSP (719)	0.270	0.472	-	49.4	73.3
AE (Ocean)	OLCI (46)	**0.751**	0.386	0.18	-	-
	TROPOMI (**1417**)	0.474	0.474	**0.16**	**52.1**	**71.3**
	POSP (158)	0.409	0.667	-	29.7	49.4
SSA 550 nm (Land + Ocean)	OLCI (115)	0.471	**0.026**	-0.01	-	-
	TROPOMI (358)	**0.522**	**0.026**	**0.00**	**82.1**	**94.4**
	POSP (**570**)	0.305	0.040	-0.007	63.0	81.2

4. In Figure 6, while it is true that the ocean validation results appear better than those for land and that most data points are well distributed around the 1:1 line, there seem to be several significant outliers. In other studies, ocean validation results have generally been more stable. Of course, as the number of validation points increases,

some outliers are inevitable, but considering that Figure 6 shows only 219 ocean data points, the distribution appears somewhat scattered. Since the paper already mentions that the glint mask was applied too strictly and should be improved, this is likely not a glint-related issue. Instead, it would be helpful to provide additional explanations on whether the issue is due to bad pixel screening, a limitation in GRASP's ocean retrieval algorithm, or some other factor.

Response:

Thanks for the suggestion! I fully agree that the ocean validation in Figure 6(b) shows that there seem some outliers in the POSP ocean products, for example the RMSE is 0.091 in contrast with typical values obtained from our previous processing of TROPOMI and OLCI are around 0.04-0.05. Meanwhile, the intercomparison between POSP and VIIRS AOD (550 nm) over ocean also show larger RMSE 0.074 (Figure 12) than 0.055 between OLCI and MODIS, and 0.033 between TROPOMI and VIIRS, indicating less stable in POSP AOD over ocean. There are three potential reasons: (i) the cloud mask doesn't functional well and lead to cloud contamination in some pixels (Figure 11), this can be an intrinsic reason due to its relative coarse spatial resolution (6.4 – 20 km) from POSP; (ii) the radiometric calibration issue in POSP SWIR channels; (iii) the wind speed is not used to constrain angular properties of ocean surface BRDF in POSP processing, which is proved to be able to stabilize the ocean AOD retrievals in previous OLCI and TROPOMI processing. We have added these to the discussions in the main text.