In this manuscript, the authors use FengYun satellite series and derived sea ice concentration from 2010-19, which is interesting and valuable to the sea ice community and adds valuable information to the existing SIC climatology from other PMW satellite data. Therefore, I suggest potential publication to ESSD journal. However, I have few major comments that needs to be addressed before publication. Since I am a radar remote sensing scientist with expertise in sea ice (and snow) geophysics, for this round of review, I focus more on the geophysical uncertainty aspect that needs some attention. I am happy to review the revised manuscript and then would give a comprehensive review with more technical and specific comments. Below are my major comments.

a) My main concern with your paper is that you have not provided any information on how SNOW as a critical geophyical parameter affects brightness temperature and SIC estimates and its UNCERTAINTY from your datasets. In a warming Arctic and a fluctuating Antarctic, how does shift in sea ice types from MYI to FYI affect snow properties and that in turn affects your SIC estimates? Can you provide a uncertainty range in your derived SICs based on the snow cover and its spatiotemporal variability? For example, FYI cover is characterized by saline snow covers while thicker snow on thinner ice (especially in the Antarctic) is severely affected by flooding, slush and refrozen snow-ice formations. They severely affect the emitting layer correct? I think authors, since they are showing a brand new dataset, its worth and necessary to show the geophysical uncertainties as a quanity. I am a bit disappointed that snow is completely neglected (I should say) in your data product.

b) I am really surprised to see almost NO regional variabiity in Antarctic SIC (see Figure 3 (g) to (i)), from your products, when even recent studies (for example: https://essd.copernicus.org/articles/14/619/2022/essd-14-619-2022.html just to quote one) from the same time period as yours have shown large variability in snow depth (that heavily influences SIC) across multiple Antarctic sea ice sectors. This points to my previous comment about accounting for snow depth and its variability in your calculations. I think its a good idea to revisit PMW-derived snow depth data (not that its completely accurate) or any other snow models that can be used to quantify the SIC uncertainty, and combinely use them to figure out the regional SIC variaiblity atleast in the Antarctic. I am sure readers would appreciate that !

Reply:

Thanks for your questions and comments. We have used the PMW-derived snow depth data to estimate overall effects of snow depth on SIC uncertainties in the Arctic and Antarctic. Meanwhile, the effects of snow depth on TB differences were also analyzed. We added the example days in winter and summer for the Antarctic to quantity the SIC uncertainties in more details. In Fig. 3, the spatial distribution of SIC differences do not show the obvious variability with the snow depth, because the SIC differences were calculated from the SIC products all using the ASI algorithm, which have the consistent sensitivity to snow depth.

Page 5, Line 128-132, we wrote:

To quantify the effects of snow depth on SIC uncertainties, we obtained the snow depth on sea ice for the Arctic and Antarctic from the NSIDC (Table 1, AMSR-E version 3, Cavalieri et al., 2014; AMSR2 version 1, Meier et al., 2018). This data is derived from the AMSR TB using the AMSR-E snow-depth-on-sea-ice algorithms and projected on a 12.5-km polar stereographic grid. It is notes that this data is averaged by a five-day running window and only includes the depth of dry snow. Besides, this data provides snow depth for the entire Antarctic, but only for the first-year ice in the Arctic.

Page 12, Line 275-283, we wrote:

When the snow depth is lower than 10 cm, the SIC differences are largest with overall MADs of 6.3% between the MWRI-ASI and SSMI-ASI and of 8.4% between the MWRI-ASI and AMSR-ASI, which are about three times of those (2.2% and 3.2%) when the snow depth is higher than 40 cm. One of the reasons is that the TB differences are also largest when the snow depth is lower than 10 cm, about twice as much as when the snow depth is higher than 10 cm. The spatial distribution of SIC differences do not show the obvious variability with the snow depth (Fig. 3), because all the SIC products are retrieved by the

ASI algorithm, which have the consistent sensitivity to snow depth. In the Antarctic (Fig. 5), when the snow depth is lower than 10 cm, the MAD between MWRI-ASI SIC and SSMI-ASI SIC is 10% on the example day in summer, which are larger than those in winter by 3.5%. Overall, the snow over sea ice has an effect on the SIC uncertainties, which is greater at lower snow depth, especially in summer.

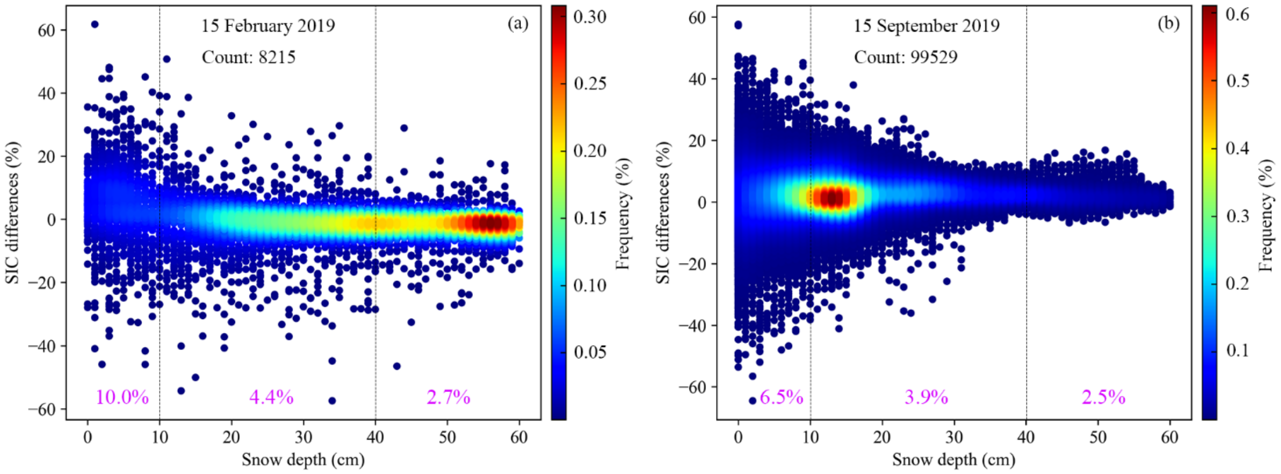

Figure 5: Frequency of SIC differences between the MWRI-ASI and SSMI-ASI with different snow depths in the Antarctic on 15 February (a) and 15 September (b) 2019. The purple numbers present the MADs in SIC between the MWRI-ASI and SSMI-ASI with the snow depth of 0-10 cm, 10-40 cm, and 40-60 cm.

Page 22, Line 469-470, we wrote:
Besides, shallower snow depth over sea ice could produce larger SIC uncertainties.

c) Like reviewer 1 mentioned, the introduction with your rationale is missing or maybe scattered/lost/cluttered within the intro material. I think refining the introduction will help the readability of the paper. Also, just a minor comment. I was curious to know the incidence angle used for the data acquisition. For now I refrain to providing these major comments above. In your revised version, I will provide comprehensive comments on the write up.

Reply:

Thanks for your advice. We have rewritten the introduction. The procedures of our MWRI-ASI SIC product can be seen in the supplement file, including the flow chart, steps, codes, and procedure outcomes. The incidence angle of MWRI sensors is 53, and theirs' characteristics are shown in the following table referring to our previous study: Zhao, X., Chen, Y., Kern, S., Qu, M., Ji, Q., Fan, P., and Liu, Y.: Sea Ice Concentration Derived from FY-3D MWRI and Its Accuracy Assessment, IEEE Trans. Geosci. Remote Sens., 60, https://doi.org/10.1109/TGRS.2021.3063272, 2022,

TABLE I

MAIN CHARACTERISTICS OF MWRI, AMSR2, AND SSMIS

Sensor	MWRI	AMSR2	SSMIS
Satellite	FY-3D	GCOM-W1	DMSP F-18
Altitude (km)	836	700	850
Incidence Angle (°)	53	55	53
Equator Crossing Time (Local Time Zone)	A: 14:00	A: 13:30	A: 18:03
	D: 02:00	D: 01:30	D: 07:08
Swath Width (km)	1400	1450	1707
Scan Period (s)	1.8	1.5	1.9
Number of Scans	266	243 / 486	256
Antenna Size (m)	0.977×0.897	2	0.61
Center Frequency (GHz) Polarization	10.65 V/H	10.65 V/H	- -
	18.7 V/H	18.7 V/H	19.35 V/H
	23.8 V/H	23.8 V/H	22.235 V
	36.5 V/H	36.5 V/H	37 V/H
	89 V/H	89 V/H	91.655 V/H
Footprint Size Along Scan × Across Scan (km^2) Sampling Interval Along Scan × Across Scan (km^2)	51×85 / 6×12	24×42 / 10×10	- -
	30×50 / 6×12	14×22 / 10×10	42×70 / 25×25
	27×45 / 6×12	11×10 / 10×10	42×70 / 25×25
	18×30 / 6×12	7×12 / 10×10	28×45 / 25×25
	9×15 / 6×12	3×5 / 5×5	13×15 / 12.5×12.5

“A” is ascending orbit and “D” is descending.