

## ***Interactive comment on “Spatio-temporal variability and decadal trends of snowmelt processes on Antarctic sea ice observed by satellite scatterometers” by Stefanie Arndt and Christian Haas***

**Anonymous Referee #2**

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### **General Comments:**

The authors examined the onset of snow melt over Antarctic sea ice using data sets from scatterometers (ERS-1/2, QSCAT and ASCAT) and passive microwave radiometers. Between 1992 and 2015, they found insignificant changes in onset dates which they claim be consistent with the small trends in Antarctic sea ice extent. Also, they used the differential lag in onset timing between the observing instrument to develop a conceptual model for inferring the evolution of the depth/temperature-dependent snow processes during the onset period, and conclude that multi-wavelength instruments

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may be able to provide information on the behavior of the snow column on Antarctic sea ice during early melt.

Throughout the paper, the authors contrasted the behavior of the Arctic and Antarctic – I find those discussions to be interesting and useful.

The only comment is that the authors inferred from only a few samples (12) the general behavior of the onset-dates of circumpolar ice cover and their relationship to the observed trend in ice extent. This is less credible without more justification as to why a non-uniform sampling of the ice cover (Fig. 1) is sufficient for this analysis.

I would like the comments below addressed prior to publication.

### **Detailed Comments:**

#### **Page:Line number**

1:28 While it is true that the circumpolar ice extent has changed insignificantly over the period of study, the trends are significant in the different sectors (e.g., Ross Sea sector). I think that fact should be noted and there are implications as far as the discussions in the remainder of the text regarding expected trends in the onset dates and ice extent.

3:20 This is in contrast to what is expected in the Arctic, where backscatter from perennial ice is expected to decrease during the summer. Perhaps another point to note.

6:19 Need clarification: Is it the daily product that was used or the twice daily product? On p.6, the text indicated only the daily product is used.

7:10 Please specify which ice concentration product is used here.

7:15 Perhaps it's good to point out how the samples were ‘carefully’ chosen to reflect/represent the large-scale behavior/trends of the Southern Ocean ice cover.

9:1 I don't think ‘extensive’ is appropriate here – let the reader decide.

Figures 3&4. Shouldn't the seasonal ice in sample D disappear during the summer?

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Figure 5. Are the backscatter for both C-band and Ku-band merged here? If so, please indicate so because one would expect differences between the two wavelengths.

18:8 Large oceanic heat flux (I imagine relative to the Arctic) – a reference is appropriate here.

18:13 meaningful for? For indicating the ice extent?

18:24 I think this is what you are referring to above, i.e., 18:13.

Section 4.2 the suggestion here that snow processes may be secondary in explaining the ice extent is important – perhaps worth noting in the abstract. Your work points to that and it is geophysically important, but saying that it is 'NOT' important may be a bit too strong without more discussion and supporting evidence.

20:14 This conceptual model depends on the initial changes to occur in the subsurface prior to that on the surface such that permittivity changes in the interior, while in the pendular regime, leads the change at the surface. I think this is perhaps too dependent on the temperature argument. Is the temperature profile entirely necessary?

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-27>, 2019.