Review of *Biases, Uncertainties, and Trends in Arctic Sea-Ice Thickness*...

Ludwig et al

General Comments

The introduction has a number of repetitive statements. For example: measurements need to be aggregated for full Arctic wide coverage, passive microwave radiometers are limited to below 1 m thickness, etc.

The introduction and title should mention this is just winter sea ice thickness studies

There are a lot of acronyms used to describe datasets in Section 2 that should be defined.

The reference data is referred to as the ULS and the BGEP data interchangeably. Choose one and stick to it. Typically it is ULS in text, but in figures and captions it is BGEP

The pairwise comparison (Section 3.2) lacks motivation and could include more discussion. Why was this conducted? Can you elaborate on what this says about the regional variability and previous section about comparison with the reference data. For example if two products are biased high versus the reference data how do they compare Arctic wide with each other? And why?

In the comparison of the large scale datasets, you state that the largest disagreements between products is in the Beaufort Sea. What does this mean for your comparison with the ULS data? When you compare products to each other across that region, how can you relate this to the comparison with the reference data?

Check misuse of the word "would"

Specific Comments

Line 10-11: Confusing wording. Consider "deviation from" instead of "difference towards"

Line 31: what is "good" accuracy

Line 35: you have already said "south of 81.5 N" no need to repeat with until 81.5 N

Line 35: "**until** x N" is a strange phrase. "up to" or "south of" would be better. (maybe a personal preference)

Line 56: "discrepancies between single products" is a strange statement. What do you mean between single products? The word between suggests multiple products.

Line 104: What do you mean "more model output would be available from the community"

Line 105: spell out CFS acronym

Line 142: "such as those from young sea ice"- consider including "and leads"

Line 187: This is the first time you have defined the EASE2 acronym but it has been used throughout the description of the datasets before.

Figure 1 caption. Instead of left to right note (a),(b), and (c).

Line 215: Discussion of the lack of multi-product data in Figure 1b. This is confusing can you elaborate on the "design" of the ESA SMOS product that would show thinner ice. Also can you discuss more about the bias correction in the TOPAZ model that would bias these data.

Figure 1a. In the altimetry section you mentioned altimeter accuracy is greater for thicker sea ice. Here it shows greater biases for thicker ice. Can you discuss this here?

Line 222: instead of saying "most products" and "some models" name specific products that have the highest and lowest bias and suggest why this may be the case. Can you indicate in Figure 2 which products use the same assumptions for freeboard to thickness estimates as the reference data and discuss this in the text to determine if this actually the reason that some product perform better than other against the reference data.

Line 260: Why do you compare products to each other? Is this just so that you can look at a larger region? Please describe motivation?

Lines 275 to 281: this discussion seems out of place and maybe belongs in the outlook section.

Line 283: RMSD units of meters (?)

Line 313: What does that mean "snow thickness increases over multi-year ice and decreases elsewhere" from the Lee et al. study. That statement does not make sense.

Line 318: trends in what months Do you look at the monthly data for each month from November through March?

Line 351: Explain how less export of sea ice through the Fram Strait affects the average sea ice thickness

Line 354: I don't think this is consistent with the IPCC statement. The IPCC statement and consideration of "ice-free" is based on extent not thickness and is thus not a relevant statement in this section or paper. Unless you can describe it differently?

Line 363: "end of freezing season" – just say March? Or define the freezing season

Line 380: this sentence does not make sense: what do you mean "most of the sea ice thickness products also include the snow thickness used."

Technical Corrections

Line 21: Inconsistency with hyphenation of sea ice throughout introduction

Line 36: ICESat-2 is Ice ,Cloud, **and land** Elevation Satellite

Line 194: include the data availability statement in the backmatter data availability section instead of in the main manuscript

Line 220: the sentence ends in a colon.

Line 223: model → models

Line 293: two periods at the end of the sentence