The paper entitled 'Combined SMAP/SMOS thin sea ice thickness retrieval' by Patilea et al. proposes a combined sea ice thickness (SIT) retrieval using SMOS and SMAP brightness temperature. First, authors present an algorithm to retrieve SIT from improved version of SMOS TB. Secondly, a SMAP calibration at 40 deg with SMOS is proposed. Finally, a combined SMOS+SMAP SIT retrieval is attempted. Although, the combined use of SMOS and SMAP circumvents several issues and has a lot of potential, more work needs to be done before the manuscript can be recommended for publication.

General comments:

Full validation, as mentioned by the authors on the last line of the paper, needs to be considered in this paper itself. Without validation, it is difficult to assess the performance of the proposed algorithm (s) – one from new version of SMOS TB, second from combined SMOS+SMAP.

The other major issue is the differentiation between contribution of TB from sea ice concentration (SIC) and thin sea ice. It is not clear from the paper, whether the authors assumed 100% SIC or above 80% or all 0-100%? If SIC less than about 80% is used, then thin ice retrieval is incorrect. A SIC map would be very useful. These point should be discussed in the paper.

Unfortunately, the paper does not show the validation part of this work, so it makes it very difficult to assess the retrieved SIT in the areas where SIC is below 80%. It is likely that the thin ice area shown in Figure 5 may be, in fact, marginal ice zone with SIC less than 80%.

I miss an error analysis, maybe you could cite the error budget from Huntemann.2014.

In Figure1, it would be easier to read if you show sit of the same date as shown in Figure 5 SIT retrieval, i.e. 29 Oct. 2010 OR 11 Oct. 2015.

There are spelling errors throughout the paper.

Specific comments:

P1.L5: 'SMOS data covers a large incidence angle range whereas SMAP observes at a fixed 40∘ incidence angle which makes thin sea ice thickness retrieval more stable as incidence angle effects do not have to be taken into account'. I do not agree that the incidence angle variation of SMOS brings instability on the measurements. Explain it better to convince the reader or remove the sentence. SMAP is more stable because it is a real aperture antenna, better RFI control system, narrower swath, etc...

P1.L20: The radar system of SMAP failed few months after launched. You should specify this, is you talk about the radar system.

P2.L12: 'Within a snapshot just one or two of the Stokes parameters are measured at the same time'. Please explain this properly, this sentence has no sense. Explain when one or two are measured?

P2. L23: 'SMAP started providing data starting in April 2015.' Re-phrase.

P.2.L8. It is not clear to me which is the RFI filtering method used in this paper, the one in Huntemann et al 2014, or 2015?

p3.L25: You should explain that a resolution of 12.5km is a subsampling grid, this is not the real SMOS resolution. In fact, in my opinion, it has not sense to go to 12.5Km, only with SMOS data, you should use the grid of 25km. In case you use other data with thinner resolution combined with SMOS then you could go to 12.5km, if not this resolution is completely false. You should explain this clearly in the paper.

Eq. 2: It is very dangerous to use in the equation of Q the exponential of a number which is raised to d ($Q=(a-b).exp(-x/c)^d+d$), it makes the model inestable. But I imagine this comes from Huntemman 2014 method...

P3.L28. Please explain – spillover effects. Or Re-word.

P4.L9-10. 'Also…version.' Please re-write the sentence. It's unclear.

P4.L22: 'Moreover,…' , here you are talking about your method to remove RFI and averaging the TB, not on the SMOS acquisition method. This should be specified, if not, it seems this is a problem of SMOS, since the previous sentence you talk about the SMOS acquisition method. This sentence starting with 'Moreover,' I understand is the basis to explore the new method of fitting a curve, so please explain this clearly.

P5.Eq 3: Are the values of a, b, c, d the ones in table 1? This is not cited here. And are bh and bv from the equation different? I don't see the values of H and V pol in table 1. Moreover, bh and bv, they should be equal, to permit to have Tbh=TBV at Theta=0 (nadir).

P5.L23. Figure 4 is mentioned in the text before Figure 3. Please correct it.

P6. L1: You talk about 'estimated retrieval error of 30% of SIT'. This is not commented before, from where do you have this value? Please add reference. Which method has this retrieval error? The daily of the 45º? Please discus better the error budgets as well.

Figures:

Figure 1 and 4: Increase font size.

Figure 5: Please also show the SIT map derived using SMAP only, and SMOS only for the same date alongside SMOS+SMAP SIT map. This will make it easier for visual comparison.

References:

- Please add webpage from where to find the documents used in the references (Indra Systems and SMOS Calibration…). I am sure they are public.

- I think the references should order it for name of first author and year. So reference 3 and 4 should be switch.