General Comments

This is a very interesting paper presenting a new innovative method for the growth and displacement of landfast ice from SAR. The information was well presented and addressed an important issue of landfast ice growth in the Mackenzie Estuary. Field observations would increase the value of this paper but their absence in this case is quite understandable given the extreme remoteness and accessibility of the site. As mentioned in the manuscript, I believe this information could have further practical applications to be used with the oil and gas industry and increase our knowledge of ice interactions in a changing climate. A better understanding of ice conditions is critical for future development and safety concerns. I also wonder if this method could be adopted for rivers (like the Mackenzie), as ice thickness can increase the chances of mechanical break-up leading to ice jamming and community flooding.

Specific Comments

The author mentions drift, wind and ocean currents as a possible reasoning for landfast ice displacement, but very little evidence is presented to back up this claim other than reference to ice sheet break-up shown in Figure 3. Perhaps a wind rose, or a paragraph of winds statistics for the study time period may help to highlight this point.

Air temperature is an important component of the methodology towards the sea thickness model but the author failed to mention what the trend was during the study period. It would be good to know how this compares with the information presented in the discussion. Is there a threshold of growth once a maximum temperature is reached? Is that why maximum growth takes place between November to January and not after.

Did the authors look at the growth and displacement of bottomfast ice during the study period; does it show comparable growth patterns between the years?

<u>Technical Corrections</u>

The figures were well done and helped to explain the results. A few edits below:

Figure 1 A – elevation model on land appears to be discontinuous with the abrupt break in the elevation at the latitude line. I am also confused on the colour, do they represent a range? (ie. 0-10, 10-50, 50-100). I think the map would look more realistic if you tighten the range of elevations at the lower levels (ie. 0-2, 2-5, 5-10, 10-50, etc) Bathymetry estimates seem believable.

Figure 1: (caption): missing bracket after b, adjust other brackets in caption to equal out.

Figure 5b: Please explain the large offset arrow coming from the Yukon coast in the Shingle Point area.

Figure 5d: The red circles are hard to see

Figure 6: Perhaps the land value can be black which is instantly distinguishable and matches the circle in Figure 5.

Line 35: Does bathymetry play a role in the distribution of landfast ice – perhaps it should be mentioned here. The shallow water depth of the Mackenzie Estuary definitely plays a role in the distribution of bottomfast ice and subsequent water discharge through these regions defined by the bottomfast ice barrier.

Line 129: Please explain what an orbital phase ramp is?

Line 158: Please add reference

160 – I think it would be good to insert some stats on prevenient wind direction from the Pelly station.

168, Yes agree, tidal fluctuations are nil but wind driven storm surge (even in the winter) have been known to cause over ice flooding. It would be good to know what the wind pattern was during the study period.

171 – Chris Stevens (University of Calgary 2006-2011) conducted a MSc and PHd looking at the this area through GPR, perhaps his subsequent publication would provide some validation. May I also suggest the GSC online expedition database ED at Sea for further validation? https://ed.gdr.nrcan.gc.ca/index_e.php search cruise 2007301, Solomon describes a series of ice measurements with thickness and bottomfast ice.