General comments

This manuscript introduces estimating deformed sea ice thickness with in-situ data using simple statistical methods and deep learning technique. Although I believe Convolutional Neural Network (CNN) can be an alternative way to retrieve sea ice thickness without snow depth and densities, the readability of this manuscript is low. I think major revisions are needed before publishing.

Specific comments

Introduction: the long introduction distracts the objective of this manuscript. The authors should concise previous literatures in the introduction. The authors should focus on more the objective of this study in the introduction.

P2 L27: surface elevation normally means surface height with respect to Earth ellipsoid in the altimetric study. Surface elevation and freeboard are used the same meaning in this manuscript, which can confuse the reader. I would suggest change surface elevation to freeboard throughout the manuscript.

P2 L29: since the hydrostatic equilibrium equation depends on altimeter type (i.e., laser/radar) it would be good to mention which one.

P7: This manuscript majorly covers the methodology for estimating sea ice thickness. I believe this manuscript should include method section in the main body for better understanding to readers. This manuscript needs a method encompasses the entire manuscript. Particularly, as CNN is rather highlighting in this manuscript CNN details should be in the body manuscript.

Table 1: Please briefly explain in terms of sail angle.

P9 L7: There is no validation for the model in 3.1.1 and 3.1.2, which is not consistent throughout the manuscript. Do authors have a specific meaning without the validation?

P12 L15: Please briefly explain in terms of drill lines.

P13 L17: Why this particular range? (2.9-6.1)

P13 L23: What is the basis for setting 5.9?

P14 Figure 7: While freeboard (F) is mentioned in figure 7, surface elevation (F) is mentioned in the caption, which is not consistent.

P14 L8-17: this paragraph should be in the discussion.

P16 Table 2: Please briefly explain in terms of Akaike Information Criterion (AIC).

P17 Table 3: Why the authors separate linear model (i.e., without constant vs. with constant).

P17 L10-L18 - P18 L1-12: this part should be in the discussion.

P18 L13: It would be better the authors include the spatial distribution of sea ice thickness derived by CNN with discussion.

P18: the first paragraph of 3.3 should be in the methods.

P19 L12: Normally this parameter setting is determined by trial and error.

P20 Figure 9: Some part of the caption of figure 9 should be in the main body. (from we also to the end).

P18-21: 3.3 predicting SIT with deep learning is quite mixed with methods, results, and discussion. please reorganize 3.3.

P25 L15: what is meant by Figure #0?

P26 L31: as the validation of this method is spatially limited, this sentence should be corrected.

Technical corrections

P2 L9: wieth -> with

P7 L6: With -> with

P7 L7: need references.

P9 L11: I don't see ratio of keel depth and snow-sail height in the Table 1.

P17 Table: replace "no constant" with "without constant".

P19 L16: replace "CNN" with ConvNet.

P22 Figure 10: Figure 10 never mentioned before.