The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-346

Anonymous Referee #1

Referee comment on "Ice ridge density signatures in high-resolution SAR images" by Mikko Lensu and Markku Similä, The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-346-RC1, 2022

TC-2021-346

Ice ridge density signature in high-resolution SAR images by Mikko Lensu and Markku Simila

Overview

This manuscript presented an approach to studying sea ice ridges from medium- and high-resolution SAR imagery from TerraSAR-X validated against Helicopter-born EM (HEM) datasets acquired over the Baltic sea. This study proposed a method to delineate linear ridge features from SAR images regarding the local density of bright SAR pixels over a certain percentage. This study found a linear relationship between SAR bright pixel percentage (BPP) and HEM ridge coverage. Although acknowledged, this study does not contribute towards quantifying sea ice roughness/ridges corresponding to SAR backscatter, which is a major gap in the sea ice literature. However, this study argues that the proposed method can aid safe navigation through ice-infested water.

Major comments:

The paper provides important details on the subject matter, works of literature, and proposed methodology, supported by necessary figures. My major comments are as follows:

I have a concern regarding the structure of the paper. The paper is comprehensive; however, sections 1-3 can be synthesized well to shorten the length. There are a few very short sentences in the manuscript, which can be added to the previous sentence. Similarly, a few very short paragraphs can be merged with the previous section to keep the flow consistent in the manuscript. Please check and correct this issue throughout the manuscript. At least, section 2 needs to be synthesized to have a better flow of the content, which I find scattered in the current version.

The methods and results are mixed in sections 4-7, making it difficult to follow. I think the authors should separate results and discussion.

When TSX was acquired, the paper motioned the air temperature as -2.3 degrees C. Since the ice was first-year sea ice and the snow had brine, I wondered whether the snow was brine-wetted at the bottom had an impact on X-band backscatter. A sea ice study on C-band SAR imagery reported moist snow at -3.1 +/- 1.5 degrees to have a melt onset signature. Since air temperature was warmer in Baltic during TSX acquisition, how could this affect the SAR statistics presented here?

Minor comments:

Since the manuscript focuses on TSX images, the title should reflect the frequency used in this study. Please include 'X-band' in the title.

If section 7.1 can be considered validation, the title should show that information so that the reader can refer to the section title to find necessary information without going into the details of the text.

Was both the imagery acquired in ascending or descending mode? Please confirm. A mixture of modes can seriously impact SAR backscatter from ridge sail direction.

In-text references are not included correctly. For example, page line 17 should be 'As verified by Dierking (1999)…". Please correct similar issues throughout the manuscript.

Page 17, line 16

?? should be replaced with an equation number.

Page 25 line 9

What does ‘?’ denote?

Page 26 line 1

Check and correct the section title

Page 23

Section number needs to be updated after 7.1. Currently, the result section shows 7.1.1. One section in between does not have a section number.