

Response to Reviewers' comments to manuscript tc-2021-314 – 2nd revision

“Potential of X-band polarimetric SAR co-polar phase difference for Arctic snow depth estimation”

Dear Editor and Reviewer,

Thank you for your careful review.

The point-by-point response to the second iteration of revision is attached to this response.

Reviewer's comments

Answers to reviewer

Modification in the text

Line 23: “DHF” is not defined in the abstract

We included “Depth hoar fraction (DHF) in the abstract.

line 26: remove “n.”

Line 68-69: change “2019 and (2)” to “2019, (2)”. Lower case “d” after (3)

Line 100: The two parts of this sentence are disconnected. Should there be an “and” or “or” after the comma?

Line 155: “transect(s)”, plural

Thank you. All the corrections were made.

Line 161: I don't think “depth hoar” needs to be capitalized. Are “melt-freeze crust” and “ice layer” considered two separate layer classifications, or the same?

That was a typo. Following changes were made:

“From the above observations, each layer was classified according to their density and snow grain type across 6 classes following Fierz et al. (2009): 1) depth hoar, 2) windslab, 3) surface hoar, 4) fresh snow, 5) melt-freeze crust and 6) ice layer”

Line 164: remove comma after “classified”

Thank you. We corrected it.

Line 227: Depth Hoar Fraction (DHF) is never really described. Suggest adding the equation or a description here

Following sentence was added in the paragraph:

“We focused on the SD variability between vegetation classes. We also evaluated depth hoar fraction (DHF) given that King et al. (2018) found that X-band backscattering is highly sensitive to depth hoar grains. *DHF is the depth hoar ratio within the total depth of a snowpit.*”

Section starting at line 235, “Topographic Wetness Index as a proxy”: You don’t say what TWI is a proxy for. It’s a little confusing since this section talks about snow surface properties and also water content at the soil surface, as well as vegetation classes.

We agree with the reviewer. Subtitle was change to *Topographic wetness index* and following modification were made in line 241-242:

The Topographic Wetness Index (TWI) was chosen to analyze the variance between vegetation groups *as a potential indicator of variability*.

Line 259: “371 pixels were used”, instead of “was”

Thank you. We corrected it.

Figure 5 caption: “Windows pixels size is 1x1 pixel (5x5m).” This wording is still confusing – it’s not clear what you mean by “windows”. Could this be something like, “The window over which vegetation class information was extracted is the same size as a TSX pixel (5x5m)”?

Thank you. The sentence was deleted and changed to:

“The window over which vegetation class information was extracted is the same size as a TSX pixel (5x5m).”

Line 437: missing a word between “allows” and “to”

Sentence in lines 441-443 was changed to:

“With a high incidence angle (> 30°) and a high TWI (> 7.0), significant correlation between SD and CPD can be found with a R-squared of 0.72. “