The Cryosphere Discuss.,
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The Cryosphere Discussions

Interactive comment on "Effects of decimetre-scale surface roughness on L-band Brightness Temperature of Sea Ice" *by* Maciej Miernecki et al.

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This manuscript presents a method to model the effects of decimeter-scale surface roughness on the L-band signal of sea ice, and compares the results with airborne observation. While the model indicates a clear result of brightness temperature reduction of up to 8 K (v-pol) resp. 2.6 K (v-pol), the comparison with the experiments yields little correlation of roughness and brightness temperature. Although the results are not very indicative, the manuscript treats an important subject.

Main comments:

The discussion of Fig. 6 and its use for interpretation of the experiments is incomplete: One of the interesting results of Fig. 6 is that between 40° and 45° inc angle, the h-pol TBs are practically insensitive to the roughness parameter s. This is important for L band satellite sensors observing only at such incidence angles like SMAP (in orbit since 2015) and the upcoming CIMR, and for the airborne observations at 45° (Figs. 9 and 10, Table 1): In the case when no influence of the roughness on the TB signal is expected (h-pol), the found correlation between observation and model is clearly higher, the RMSE, bias and the ubRMSE all are higher than at v-pol, where the model predicts a sensitivity to roughness. In Figs. 9(c) and 10(c), the h-pol 45 ° inc angle cases, the modeled TBs show clearly less variability than the corresponding v-pol cases (Figs. 9(d) and 10(d)). Do you have an interpretation for this finding?

Fig. 6 and P12 L9-10 '..the horizontal and vertical polarization curves are brought together.' Correct only at incidence angles > 45°. At lower angles, the opposite is the case. Best, add to Fig. 6 the polarization difference curves near the bottom, potentially at an increased y scale.

Fig.6: Give x axis in degree, not in rd because in text you use deg.

The current version of eq. (3) contains a product instead of a sum ('+' missing), and eq. (5) is incorrectly copied from Ulaby and Long, (2014), p443: replace ˆr in nominator and in denominator by ˆn, and check order of factors. ˆr in this equation does not make sense at all: ˆy should be independent of ˆr !

Units should be given in a consistent way throughout the whole manuscript. Here, the units m, cm and mm all occur, which is confusing and makes reading cumbersome.

Have always a blank between number and units.

The references in the text are frequently odd: if part of a sentence, then it should read 'as found by Smith (1964)', and if not, it should read like '. . . was formerly shown (Smith, 1964)'. Might be incorrect use of LaTeX commands \cite{} and \citep{}.

References with two authors are cited like (Ulaby and Long 2014), not like (Ulaby et al. 2014).

Abstract and main text should be in present tense, not past tense.

Overall, I suggest accepting the paper after major revisions.

Other points:

Page 2 L(ines) 12-15:roughness explanation too short to be understandable without further reading. Some questions: 'high pass filtering (cut off at 0.25m)': high pass filtering occurs in frequency domain, but you give a length as cut off.

Give Fraunhofer criterion explicitly to make manuscript understandable without further reference.

P5L11 the current version of MILLAS takes into account multiple reflections: if this is new, then describe it in more detail.

Fig. 2: indicate which columns are used for the three curves in Fig 3, e.g. by using the same colors as in Fig. 3.

Fig. 3: give average values of slope, and give slope in deg instead of rad.

Fig 4: indicate the values used for the three curves in Fig 3, e.g. by corresponding colors.

P9L1: which is the direction of Phi_0: North? Flight direction?

P9L5: "local" coordinate system is an unhappy name, as all coordinate systems introduced are centered at the footprint center. Suggestion: we introduce a tilted coordinate system with the same origin, but the z-coordinate aligned .. with ˆn_i.

Eq. (9): define A, R.

Fig. 5: T_B H/V reads like a ratio, better call it e.g. T_B H,V. Explain ITS, CDF_alpha

If formula symbols are use in text, omit the article: Instead of '..the theta is the incidence angle and the phi is the azimuth..' say '..theta is the incidence angle and phi is the azimuth.. Occurs many time through whole text.

Minor points:

P(age) 1, L(ine) 11: take out incorrect blanks: 'on surface permittivity, second . . .'

P2L9: The incident wavelength reacts differently with individual components of the superimposed roughness: 1. Do you mean The incident radiation ? 2. Term superimposed roughness unclear. Do you mean roughness at different scales?

P3L30: 30% RFI contamination: in time or in signal energy?

P4L9: vertical, horizontal or both?

P4L16: define ALS

P5L23 boned -> beyond

P5L33 Reference: do not give first names, check bibtex file

P8L9 "global" coordinate system in Cartesian basis (..) → Cartesian coordinate system with the origin in the center of the sensor footprint

P12 end of L9: end → and

P13L3: height → high

P13L23: Figures 7,8, → Figures 7 and 8

P15L3: We want to determine the simulation setup that best reproduces . . ..

P16L8: I do not find 4.5 K in Table 1. Do you mean 4.6 K?

P17L9: decrees → decreases

P17L10: decreased → decreases, increased → increases

P17L13: ..strongest for the roughest surface

P18L5: had → has

P18L7: inclusion of a crude snow. . .; A possible explanation. . .

P18L11: the microphysical snow and sea ice properties

P18L13: on request

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