

Interactive comment on “Comparing C- and L-band SAR images for sea ice motion estimation” by J. Lehtiranta et al.

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In the reviewed manuscript, the authors make the use of multiple satellites data to compare C- and L- band SAR images for sea ice motion estimation. Based on the motion results performed from L-L band, C-C band and mixed-band image pairs, they concluded that L-band images are preferable for motion estimation. It is interesting to compare data from three satellites, and these conclusions are valuable for the sea ice motion detection. I also agree with the authors that comparing C- and L-band data for motion estimation are not covered in the literature, and this work is thus needed. However, there are a number of things that remain unclear and the authors should address them before being recommended for publication in TC.

General comments:

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1. Readers may have difficulties to understand the structure of the paper in general and sections specifically. And an English edition (both structure and grammar) is required to make the paper more fluent.
2. It is not convictive to make the conclusion that L-band images are preferable for motion estimation with only two L-band images available. If possible, I recommend considering more data for analysis.
3. The sequence of figures is so disordered that must be adjusted. For example, “Figure 3” in Line 13 (page 4) is the first figure shown in the text, it should be numbered as “Figure 1”.
4. Both “Abstract” and “Conclusion” require a deeper discussion.

Specific comments:

Page 3 Line 17-25: Table 1 should be introduced and described in this paragraph.

Section “1 Introduction” in general: - If multiple satellites data are available, why not calculating sea ice motion using images from different satellites of the same band or the same polarization only? Considering the images with low resolution, image pairs mere hours apart are always useless for sea ice motion estimation. Therefore, it needs more discussion in this section.

Page 4 Line 4: “For baltic sea ice” -> “For the Baltic Sea”. Line 5-6: “and late autumn temperatures staying higher than normal” -> remove. Line 13: The air temperature in Figure 3 may lead to ice growth or melting, does it effects the motion results? Need more discussion. Line 25-9(page 5): Both GPU and OpenCL are tools for research. Even though they are important in your study, I don’t think it’s appropriate to mention them detailed in the paper. I suggest summarizing it with one or two sentences. - In the section of “The motion estimation approach”, a brief description of MCC is necessary, which is the main approach used in this paper.

Page 5 Line 15: “initial guesses” -> “initial input”? Please explain it. Line 19: Why and

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how do you choose the image windows with 16x16 pixels?

Page 6 Line 17-23: Hard to understand, please rephrase it.

Page 7 Line 10-13: More introductions about “margin”, “peak margin” and “regularity”. What are they mean? How were they calculated? Why 15% is chosen? Line 14: Does the data used in this study with high resolution are ScanSAR images? If this is the case, has the incidence angle correction performed? Explain how did the authors deal with the speckle noise.

Page 8 Line 4-13: Again, a detailed description of topographical data is not appropriate in the paper, I suggest removing it or summarizing it with a briefer introduction.

Section “2 Data and methods” in general: - The structure in this section is disordered and difficult for understanding, I would strongly recommend giving it a reorganization. For example, words from Line 17 (Page 3) to Line 23 (Page 4) could be organized into a new section, which is mainly describing the SAR data and ice conditions of the Baltic Sea. Both section 2.4 and 2.5 in the reviewed manuscript are discussing the preprocessing of satellite image, which could be combined into one section. It would be better if the new section is moved to the location following section 2.1. - Is there any deformation in the sea ice? Because the MCC is not available to detect the deformed ice and retational ice, how did you deal with these two types of ice?

Section “3 Visual comparison between L- and C-band images” in general: - I don’t think such a detailed analysis is necessary. Some redundant sentences should be removed.

Page 12 Line 13: “that neither image pair produces motion for the southern tip of the drift ice area.” - Why? Line 14: “Table 2” – As Table 2 has been mentioned here and further in the text, and it is also the result of the proposed performance metrics, a detailed discussion in this paragraph is required.

Page 13 Line 6-7: “a large peak margin in cross-correlation is not sufficient as an indicator of correctness” – Is this conclusion based on Table 2? As can be seen in Table

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2, A1-A2 and A1-E2 image pairs come out the largest peak margin, have they produced the best motion field? Please give more explanation. Line 19: “new algorithm” – I don’t think the approach described in section 2.2 is a new algorithm you originally proposed. Line 22-23: Without an efficient comparison with in-situ data, this conclusion is not convictive. Need more analysis.

Page 14 Line 15: “in Fig. 14” – Is it a mistake? Line 18: “MCC” is the abbreviation of “maximal cross-correlation”? You should mention it at the first appearance in the text.

Section “4 Results and discussion” in general: - It’s not strict to make your decision with visual comparison, the authors should present the accuracy of motion estimation, and an analysis of error is also needed. - The cross-correlation coefficients are too small, which should be considered to be an unacceptable result. Need more explanation. - Based on the analysis of cross-correlation coefficient and histogram, authors concluded that both C- and L- band image pairs and mixed image pairs show similar statistical properties. However, a powerful discussion is missing. Does a larger cross-correlation coefficient resulting in a better motion field? What is the correlation between cross-correlation coefficient and motion error? Is there any suitable method to work out the different statistical properties between both band images? - Is there any historical in-situ data available? It would be better if the motion results are compared with any real ground truth or local buoy data.

Page 15 Line 4: “fast ice” -> “landfast ice”?

Tables and Figures: Table 2: - As abbreviations, “pm-good” and “reg-good” should be mentioned in the caption. Figure 3: - A indicator of direction is missing, reader will have no idea about the wind direction. Figure 4: - What’s the mean of “c-c”? - The red color is almost invisible. Figure 14: - Remove “of”. - “the algorithm developed for this work” – This is not a developed algorithm. Figure 15-16: - Captions of both figures are not comprehensive.