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Interactive comment on "Open-source sea ice drift algorithm for Sentinel-1 SAR imagery using a combination of feature-tracking and pattern-matching" *by* Stefan Muckenhuber and Stein Sandven

Anonymous Referee #2

Received and published: 30 December 2016

Dear members of the TC editorial board and authors of the manuscript tc-2016-261,

The topic manuscript in interesting and useful for the sea ice community. Pattern matching (normalized cc or phase correlation have been standard methods for operational ice drift monitoring for a few decades already) and feature-based approaches seem to be promising approach for fast ice drift monitoring.

Before publishing the manuscript needs to be updated and clarified at some points. Here are my comments:

Major comments:

Introduction, P2: The manuscript should include some additional background information on the sea ice drift in the study area (with possible references): what are the magnitudes of typical ice drift in the study area and whole Arctic (e.g. cm/s and daily) and in which areas they are located and which are their causes?

Method/Feature tracking, P5: It is mentioned that "The best match is accepted if the ratio of the two shortest Hammin Distances is below 0.75.". Explain why this is done and how the threshold was selected. Probably to reduce possibilty of similarization errors? What is magnitude of typical Hamming distances? If they are small, then 0.75 has quite different meaning than for larger values. I assume that the ratio is the ratio of the shortest and second shortest Hamming distance (also write this in the text).

Method/Combination, P6: To filter outliers each vector is simulated using two functions which are LS solutions... This need more explanation. Why third degree polynomial has been used and which data are used in the LS fit? Also in the extrapolation is also performed using a LS solutions. Also describe this in more detail. How is the traingulation constructed (Delauney?) in interpolation?

Parameter Tuning/Validation, P10: It is not exlpicitly mentioned which data were used for the parameter tuning. Were all the vlaidation data used for this? Then the validation with this data set is not fair as the algorithm has been tuned for this data. Then only the buoy data can be used for independent validation. Or if separate sets are used for parameter tuning and validation, indicate this in the manuscript.

Detailed comments:

P1L2: "computanional" -> "computationally"

P2L33: "90s" -> "90's"

P2L38: In the case of ENVISAT, rather give the name of the instrument i.e. ENVISAT ASAR, could also mention that RADARSAT was an instrument of CSA and ENVISAT ASAR of ESA.

P3L88: "((" -> "("

P3L88: "...dual polarization support..." "..also in wide swath mode". Also earlier instruments had a possibility to measure multiple polarizations but the covered area was small. This has been changed by RADARSAT-2 and SENTINEL-1.

P3L90: Give also the acronyms for the mode i.e. EW GRDM (thes are generally used by ESA in documentation and file names).

P4L125: You can remove "of 93m range x 87m azimuth", this information has already been given earlier.

P6 eq. 3: Here You give the formula for NCC. Also give the drift (dx,dy) detection as a formula, something like: (dx,dy)=argmax_(k,l)in W NCC(x+k,y+l) Is NCC computed according to this equation or by applying FFT and IFFT (which has been applied in many algorithms to fasten the computation)?

P6 Eq. 4: Define "side" in the text.

P7 Fig 1 and Fig 2. Use a, b, and c for the subfigures and to refer to them.

P7 L195: Explain here what is denoted by "beta". Itis is also in Fig. 2 caption.

P7 Fig.2 (and text): Why rectangular/square templates has been used? A circular template would be much easier (symmetric) to rotate. Consider using a circular templates instead.

Logarithmic scaling P8-9: I think logarithmic scale is the typical presentation of SAR sigma0 and often a fixed scaling to gray tone imagery is used for SAR imagery, e.g. scaling between -30dB -> 0 dB. You could mention this fact on the manuscript. This also leads to the question if any other "scaling" would produce even better results, e.g. applying some king of histogram derived image mapping (e.g. simple histogram equlization etc.). This could be one topic for further development.

P10/Computaional efficency: You give a time of less than 3.5 minutes here. Is this a

typical execution time or just execution time for a randomly selected example. Could you give average execution times and deviations or maybe estimate for the worst case? Does the execution time increase linearly as a function of the number of vectors or is there some other kibd of relationship?

P12 L270-271: also give the average D. "peak" is not a correct word here, the histogram/distribution has many peaks, possibly You could use "mode" here and also in the caption of Fig. 7.

P12 L276-277: The DTU method has not been documented very well in any publications I think. Also the reference given does not say much. I suppose there is not better reference for this?

P12 L279: "...used the nearest neighbors..." -> "...used the nearest neighbors (NN's)..." then NN can be used in Table 4.

P13 Fig. 6: Would it be possible to indicate the location of the detail in the coarse-scale image (without causing too much damage for the image)?

P14 Table 4: "Average distance" -> "Average NN distance" or something like that. Are the values after +- sign standard deviations or some multiples of tandard deviation or something else? Include this infomration in the table or caption.

Discussion: What is the possible error magnitude of the manually estimated drift (is it assumed to be sub-pixel, one pixel or more and what kind of possible error sources these vectors include?)?

P15 L319-320: Also ESA is going to improve their thermal noise removal by including more measurements along the azimuth direction. Rpbably this also could be mentioned. If necessary You can get more information on this from Nuno Miranda at ESA (nuno.miranda@esa.int).

Sincerely,