Interactive comment on "Sea ice drift from Sentinel-1 SAR imagery using open source feature tracking" *by* S. Muckenhuber et al.
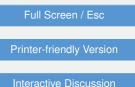
Anonymous Referee #3

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Journal: TC Title: Sea ice drift from Sentinel-1 SAR imagery using open source feature tracking Author(s): S. Muckenhuber et al. MS No.: tc-2015-215

The paper describes the application of a new technique (ORB) to the problem of detecting ice drift from sequential Synthetic Aperture Radar images from the Sentinel-1 satellite. The paper is well written and merits publications. However, some significant issues should be addressed before publication:

1) The method should be described in some more detail, preferably with a figure explaining the feature identification procedure.

2) The results from (only) 4 example images are presented very summarically. It should be shown how the results vary between the 4 examples (preferably by showing results

from all 4).

3) The discussion section should include a further discussion (based on the differences between the 4 examples) on the applicability of the algorithm in other regions and seasons that the examples (which are all from March-April). In particular it should be discussed in mode detail how different ice type regimes would impact the results.

More specific comments:

P6939-L20-21: Even though a sea ice drift algorithm specifically for S1 may not have been published, the S1 data are very similar to Radarsat data and to some extent also Envisat ASAR data, and the Copernicus Marine Service operationally produce daily ice drift data from Sentinel-1 data, so in that respect the results should have been compared to the CMEMS ice drift data available from the CMEMS data portal. The CMEMS ice drift data are from day to day so the first two example datasets should have CMEMS correspondence.

P6940-L7: The Sentinel-1 satellite belongs to the Copernicus programme of the European Union and should be referred to as such, NOT as an ESA satellite. ESA operates the satellite but Copernicus is an initiative of the European Union.

P6940-L18: The resolution of the EWS GRDM S1 data is 93x87 meters with an ENL of 12.7 according to https://sentinel.esa.int/web/sentinel/user-guides/sentinel-1-sar/resolutions/level-1-ground-range-detected The pixel spacing is 40x40 meters but that is not the same as resolution.

P6941-L19: Same issue as above. The resolution is not 40x40m in the S1 EWS data. Please rephrase.

P6942-L20-25. Please clarify if this transformation is universal or performed patch by patch, image by image or what? Sigma-max and sigma-min are user defined as far as I understand, but that should be stated clearly in order to avoid the misunderstanding that they depend on image or patch properties (and thereby speckle noise).

P6943-L8: addressed -> ascribed

P6945-L15-16: changed to "computationally more efficient enabling testing the remaining parameters"

P6945-L24: what is a grid cell?

P6945-L20-25: It should be discussed if individual features tracked can be considered independent.

P6947-L23: The figure only shows 1.2 (not 1.1, 1.3 and 1.4)

P6947-L20-24: The ORB algorithm was optimized before this inter-comparison. It should be more clearly stated whether the SIFT and SURF algorithms were also optimized (or if they were not, some considerations on their potential optimization would be useful).

P6948-L1-5: It should be discussed whether the vectors found with the ORB algorithm can be considered independent. This is a very important prerequisite of the conclusion here, and it is not clear whether the many vectors are not partly dependent. SIFT and SURF algorithms can also provide many more vectors if they are applied with many more partly overlapping windows.

P6948-L7: are sufficient computational efficient (not good english)

P6948-L15-21: The validation illustrated in figure 4a show results for all 3 algorithms. Numbers should be provided for RMSD between the 3 algorithms and between the 3 algorithms and CMEMS operational ice drift data. 7.5 pixels (610 meters) seems like quite a large difference, so some additional information about whether the difference is randomly distributed of mainly present in areas of ice rotation or other characteristics would also be relevant.

P6949-L4: proof -> prove

P6949-L6: proofing – proving

P6949-L8-11: This is speculation and should be demonstrated with data. It has not been proven that feature tracking vectors are necessarily independent, and it has not been shown that pattern recognition is more prone to errors in areas of high velocity gradients. Evidence should be provided.

P6950-L6: Synthetical – Synthetic

Figure 1, 2 and 3: Please show results for each of the 4 test cases and in the text discuss what may cause different results in the 4 cases.

Interactive comment on The Cryosphere Discuss., 9, 6937, 2015.