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Interactive comment on "Lead detection in Arctic sea ice from CryoSat-2: quality assessment, lead area fraction and width distribution" *by* A. Wernecke and L. Kaleschke

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Dear Referees, we strongly acknowledge your comments and honestly feel that they will help to improve the manuscript. We understand that your main concern is the resolution of MODIS which limits the derivable information about narrow leads and we do agree that this reduces the value of the later analysis. This limitation has not been discussed in a sufficient way. The higher sensitivity of CS-2 measurements to leads can result in correct lead detections even if MODIS dose not indicate a lead. This is true despite the fact that the footprint of CS-2 (300 X 1500m) is about 7 times larger in area than a MODIS pixel (250 X 250m). We do further agree that an analysis of the

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variability of the Sea Surface Height (SSH) can be used to verify the stated results.

We would here like to present the used method and first results of SSH estimates in order to promote a discussion about it. The other specific comments will be answered soon.

Taken steps:

1. Implementation of a re-tracker We decided to use the threshold first maximum re-tracker (TFMRA) (Helm et al. 2014) which has also been used by Ricker et al. (2014). We use a threshold level (TL) of 0.4

2. Surface elevation The Surface elevation is obtained from the Satellite altitude (above ellipsoid), the window delay time and the re-tracker output. Influences of the following processes have been corrected (as provided in CS-2 L1B data): Dry troposphere, wet troposphere, inverse barometric effect, dynamic atmosphere, ocean tide, long period tide height, ocean loading tide, solid earth tide, geocentric polar tide, ionosphere (modelled).

3. Mean SSH and variance We calculate the mean SSH and its variance from all detected leads between January and March from 2011 to 2014 on a 10 X 10km north polar stereographic grid. The mean field represents the stable SSH signal and the variance is connected to fluctuations around it which can be caused e.g. by wrong classifications. This calculation (mean and variance) is repeated for each classifier, as the lead detections differ.

4 Variability distribution Figure A1 shows the variance distribution from all grid cells derived by different classifiers (comparable to Fig. 3 in Kwok et al. (2007)). Only grid cells with at least three lead measurements are considered. This spatial approach is attributed to sea ice thickness estimates as SSH estimates are used Arctic-wide. Here each grid cell is considered equally while ungridded approaches would always focus on high latitudes (due to the orbit) and regions with many leads.

TCD
9, C787–C790, 2015

In Fig. 1A all histograms show a (at least local) maximum at the first Bin (0 to 0.0026 mˆ2) and a second mode at higher variances. The MAX_1 classifier shows the highest amount of variances close to zero and consistently smaller values for variances between 0.01mˆ2 and 0.055 mˆ2. It is clearly showing the smallest fluctuations for the SSH estimate.

This result supports the assumption that the MAX parameter is suited to reduces the amount of leads detections over ice and/or off-nadir leads.

Another suggestion was to 'calculate the along track variance of the SSH at 20Hz, 40H, 100H'. We understand this as a recommendation to divide the track into periods of 1/20, 1/50 and 1/100 s and calculate the variance for each of this periods. This is not possible as the used measurements are recorded with approximately 25Hz (the average velocity of CS-2 (7389 m*sˆ-1) divided by the along track repetition interval (300m)) and most measurements are not detected as lead. If we misunderstood the comment please let us know.

Please feel free to comment on the presented analysis.

Helm, V. , Humbert, A. and Miller, H. (2014): Elevation and elevation change of Greenland and Antarctica derived from CryoSat-2 , The Cryosphere, 8 (4), pp. 1539-1559 . doi: 10.5194/tc-8-1539-2014

Kwok, R., Cunningham, G. F., Zwally, H. J., & Yi, D. (2007). Ice, Cloud, and land Elevation Satellite (ICESat) over Arctic sea ice: Retrieval of freeboard. Journal of Geophysical Research: Oceans (1978–2012), 112(C12).

Interactive comment on The Cryosphere Discuss., 9, 2167, 2015.

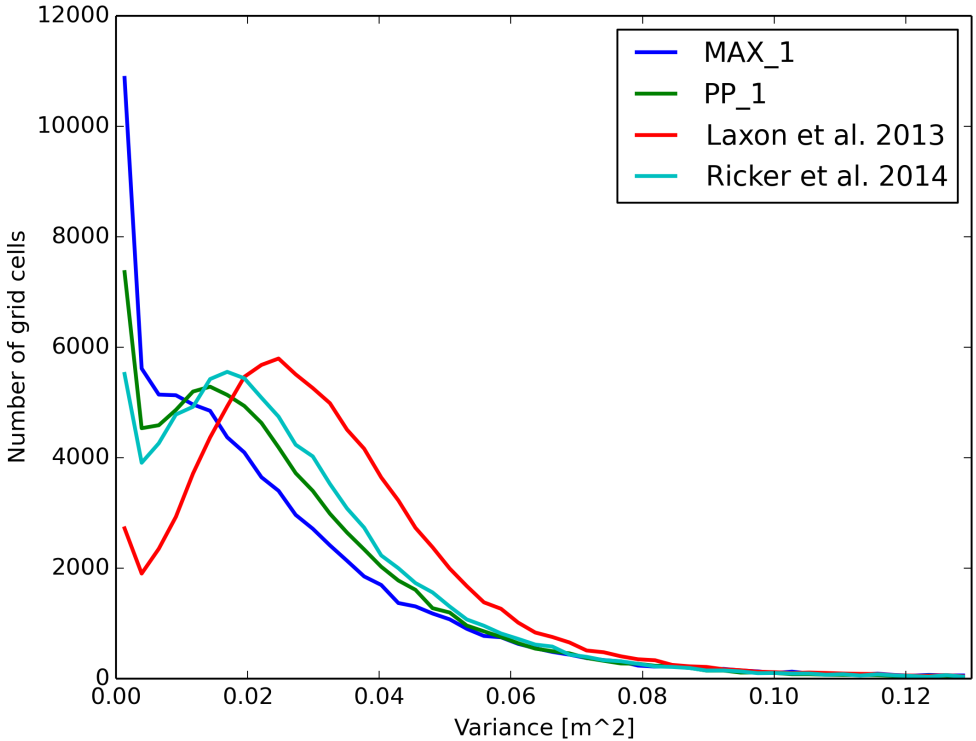

Fig. 1. Variance distribution

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