

## **Answer to Anonymous Referee #1**

*We thank the anonymous referee for the additional comments on the second version of our paper. Please find the point-by-point answers to the comments below.*

### **Technical corrections**

Throughout the manuscript esa -> ESA *Changed*.

Some of the figures are using a) and b) and some Left: Right:. Please update this for consistency. *Changed*.

P1 R3-4. Unclear sentence after the comma please revise. *Revised*.

Fig. 1. Satellite Radar -> satellite radar *Changed*.

P4. R3. What is suitable? Please define. *Suitable is replaced with "Large enough"*.

Section 2. The order in which the information is presented is a bit back and forth, the 20 images are selected (P3 R17) before the description on the criteria for the selection, e.g., cloud free and time of year, is presented on P4 R1-7. Please go through this section to ensure a logical continuation of the text. How many images were excluded as they didn't fulfil the set criteria? *Mainly deleted the first sentence of the paragraph. Sadly, we did not keep record of the total number of excluded images, which is why we did not include the number.*

P5. R8. First two should be to. *Thanks!*

The first two paragraphs on Page 3 section 3.2 could ideally be integrated as it is now there is a lot of backtracking. *We assume you mean page 6 and removed the first introductory sentence/paragraph. From our point of view, the paragraph about the "apparent lead width" should stay there.*

P5 R14. Image -> images? *"On every band 4 image" is supposed to be singular.*

Figure 4 is referenced to before Figure 3 in the manuscript. Please correct. Many figures appear in the text before the actual figure is shown, sometimes this is a full page apart. Please correct. *Changed the order of Figure 3 and 4. The final placement of the Figures within the text is up to the typesetting.*

P5 R18-19. The terminology used in part of the methods section doesn't live up to the standard one would expect from TC. Based on section 3.1 I would say that you use a supervised Bayesian classifier with a non-parametric PDF and estimate the PDF with kernel density estimation with Gaussian kernel (also known as Parzen windows). A suggestion is to use these terms when describing the method as it'll be easier to understand for researchers used to working with pixel-wise classification. *We did not use the method described by the reviewer, which is why we described it in the method section as we did.*

P6 R7-9. Open water may refreeze quickly, but this depends on the surrounding temperatures. Please update the sentence. *The sentence already mentions the surrounding temperatures.*

Fig. 4. The error areas indicated in this figure are not correct. What is indicated is the pixels that are nilas but are classified as open water, but not the ones that are open water that gets classified as nilas. Similarly for the nilas vs gray sea ice, and gray sea ice vs. gray-white sea ice, and gray-white sea ice vs sea ice covered with snow. Please update the figure with a complete set of errors. Moreover, there should also be a lower threshold for the OW class, as the values below approx. 0.05 are only nilas and not OW. *The error shows the overlap of two TOA-reflectance distributions, which occurs below the set threshold. Thus, it shows where we manually classified pixels with the same TOA-reflectance in different sea-ice surface categories. We then only account for the overlap error below the set threshold, which is why it looks like "half of the error".*

How were the error estimates presented in Table 2 derived, do they include the total error or only half of the errors as indicated in Figure 4? *They include the overlap error shown in Figure 4. To clarify that we renamed "error" to "overlap error" in Figure 4 (now Figure 3).*

P9 R 14. Comparably -> comparatively *Changed.*

P9R14. What is this sentence referring too? The separation between open water and nilas? *No. The differentiation between open water and nilas was more easy than between the other sea-ice surface types.*

P9R16. ...thresholds (0.10 for OW and 0.16 for OWN) were used for the lead detection and agree with values from previous... *Changed.*

P10 R6-8. Do you mean that you measured leads with a width from 10m and upwards? *Yes.*

P10 R9. What do you mean with feature? Please clarify. *The feature is that there are less measurements as possibly expected.*

P11 R2-3. Why would leads with OWN be wider? *OWN also includes wider leads, since the edge of the lead starts to freeze and contains nilas, while the middle part is only covered with open water.*

P13 R12. Which Landsat? *Landsat 8*