

Interactive comment on “Sea ice detection with space-based LIDAR” by S. Rodier et al.

Anonymous Referee #2

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This paper describes a new technique to discern the presence of sea ice on the Earth’s surface using the satellite-borne LIDAR instrument on the CALIPSO mission. The LIDAR footprint is 90m, with 335m spacing between shots, so the spatial resolution is comparable to that of the visible bands of MODIS, and significantly better than passive microwave. (Of course the LIDAR data lie along a 1D track, not in a swath or 2D image). The LIDAR can operate through thin clouds and darkness, so it is not restricted to clear-sky conditions. Temporal coverage is 2006–2011.

This is an interesting new data set for sea-ice research. The authors compare the data with sea-ice concentration from AMSR-E (passive microwave), which has 12.5 km grid cell size, and find that the classification accuracy is very good. They also determine that clouds are likely not a factor in errors of mis-classification.

I recommend publication after the authors address the minor comments below, which

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are in page order. Comments of substance are marked with ###; other comments are merely typographical.

Page 4682 - Introduction. Somewhere in the Introduction the authors should say that the satellite cannot see poleward of about 81 degrees latitude. This is illustrated in Fig 5, where the large pole hole is evident. The data may still be useful for the Arctic, but that's a very big hole. In the Antarctic it's not a problem – all the sea ice is north of 81S.

Page 4682 line 24. Change "being" to "is". Change "recent" to "2012".

Page 4683 line 10. Change "Artic" to "Arctic".

Page 4683 lines 23-24. "are the are the" (it is repeated twice)

Page 4684 line 4. Very funny – the "Imagining" Spectroradiometer! Maybe it is just imagining things, but we should still call it the "Imaging" Spectroradiometer anyway.

Page 4684 line 8. "during the during the" (it is repeated twice)

Page 4685 line 1. "backscatter from 2 km below the surface" – really?? I don't understand how there can be backscatter from 2 km below the surface.

Page 4685 line 6. "Fig 1 d, e, and f" should be "Fig 1 f, g, and h".

Page 4685 line 7. Latitudes are given as -49S and -24S, but there is no need for the minus signs. The "S" tells us it's the Southern Hemisphere.

Page 4685 lines 8-21. These sentences refer to features in Figure 1, but the panels of Figure 1 are so small that it's impossible to see what the authors are talking about.

Page 4686 and following. The authors confuse two similar words, "colocate" and "collocate" (e.g. see lines 22 and 23). These are not alternative spellings of the same word; they have different meanings. Decide which meaning is intended and then spell the word consistently throughout.

Page 4687 lines 2-3. "longitude offset less than 0.11 degrees (approximately 12 km)". This is not correct. At latitude L , a degree of longitude is about $110 * \cos(L)$ km. At the equator the authors' statement is correct, but since they're talking about the Arctic, with latitudes of 70 degrees or more, 0.11 degrees of longitude is 4 km or less. Does this mean that the authors have made an error in their sampling strategy?

Page 4687 line 9. What is meant by the number "29,7 679 034"??

Page 4688 line 17 "335 m surface depolarization samples"; Page 4688 line 27 "335 m CALIPSO samples"; Page 4689 line 14 "335 m CALIPSO sample"; Page 4691 line 16 "335 m footprint". All of these phrases imply that the footprint or SIZE of a sample is 335 meters, but the Abstract states that the footprint is 90 meters, with sample SPACING 335 meters. Please either use the correct number for footprint (90 m ?) or clarify the usage (footprint vs. sample spacing) in the text.

Page 4688 line 18. Change "AMRS" to "AMSR".

Page 4688 line 21. Change "mix-phase" to "mixed-phase".

Page 4689 line 5. According to Table 1 it should be "39% of these matching scenes..." (not 40%). Similarly, "whereas 60%" should be "whereas 61%".

Page 4689 line 7. Change 68% to 69%.

Page 4689 line 17. Change the first instance of "classifies" to "classified".

Page 4689 line 18. Change "Artic" to "Arctic".

Page 4689 lines 20-23. Change "AMSRE" to "AMSR-E".

Page 4689 line 22-23. Change "between 120W to 120E" to either "between 120W and 120E" or "from 120W to 120E".

Page 4689 line 24. Change "CALOIP" to "CALIOP".

Page 4689 lines 19-24. This paragraph talks about Figs 5a and 5b. The authors

point out the discrepancy between AMSR-E and CALLIOP between 120W and 120E, but they don't draw any conclusions from it. Having pointed out the differences, the authors need to say why the differences exist, or at least what are the implications of the differences for interpreting the presence of sea ice (or open water) in AMSR-E or CALLIOP data. This need not be more than a sentence or two, but the paragraph is begging for a conclusion, aside from the very general final sentence.

Page 4690 line 8. Start a new sentence after "Fig 7".

Page 4690 line 21. It looks like 0.16% should be 0.17%. Also, change "expect" to "expected".

Page 4691 line 14. Capitalize Arctic.

Page 4691 Summary. Where is the new sea-ice data set archived and documented? Is it available to researchers? I don't mean CALIPSO data, I mean the sea-ice data derived by the authors from the depolarization ratio.

Page 4691. Any acknowledgements, such as funding agency?

Page 4692 (last reference) and 4693 (first reference). These two Perovich references are identical. Please double-check all references.

Page 4694 Table 1. In the first line of data (Month 01), in the "Matching" section, the cloudy and clear percentages add to 101% (26.02 + 74.98).

Page 4695 Figure 1. This figure is of major importance in illustrating the depolarization ratio, which is central to this paper. The SIZE of the figure MUST be increased to make the labels and the scales legible. The panels are currently impossible to read and interpret. Also, panels a and e should be described in the caption.

Page 4696 Figure 2. The X and Y axes should be labeled (e.g. "Depolarization Ratio" and "Number of Samples").

Page 4697 Figure 3. In the Y axis label, change "Agreement" to "Agreement". Re-write

the caption to make it grammatically correct.

Page 4698 Figure 4. In the Y axis label, change "Agrement" to "Agreement". Re-write the caption to make it grammatically correct. At the very end of the caption, the number "0.02" should probably be "0.2".

Page 4700 Figure 6. Same comments as for Figure 3.

Page 4701 Figure 7. Same comments as for Figure 4.

Interactive comment on The Cryosphere Discuss., 7, 4681, 2013.

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7, C1886–C1890, 2013

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