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Title: An Arctic sea ice concentration data record on a 6.25 km polar stereographic grid from three-years' Landsat-8 imagery
Author(s): Hee-Sung Jung et al.
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**General comments**

The article presents a data set of high resolution and high quality sea ice concentration maps derived from Landsat data that can be used to validate algorithms for ice concentration fields derived from other satellite data.  The authors note that the data should find utility as a benchmark data set by which to judge the accuracy of passive microwave-derived ice concentration data. While the spatial extent of each classified Landsat image is quite small relative to a passive microwave ice concentration field, the large number of classified Landsat images should somewhat make up for this limitation.

The data and methods are new, while having been built upon established methods for classifying visible and near-IR data.  Methods are described in detail with sufficient references.  Error estimates and sources of error are given and discussed in the article.   The data are accessible and can be downloaded from the linked Zenodo site. There is one NetCDF file for each of 12 regions.  I plotted SIC fields from the Beaufort region file using Panoply, and displayed a number of image days at random. These looked reasonable, but I did not assess the data quality beyond that. I'll note that the summary on the Zenado site needs significant copy editing.

I rate the data set as excellent in terms of its uniqueness, usefulness, and completeness.

The article is well-structured, and overall, the presentation quality is very good, but in some places it lacks clarity.   I have made comments under Technical Corrections that may help the authors improve clarity.

**Specific comments**

Section 3.1 says that an addition step in cloud mask quality assessment was to visually compare the cloud mask array from each image with the corresponding true-color image.  Please provide more information on this process, including who did the visual inspection and approximately how much time it took for each image. More that 15,000 images are a lot to visually screen, and this step should be described in more detail.

**Technical corrections or wording suggestions**

*Line      Comment or suggested rewording*

36      Remove "at least"

54      There have been developed various PMW SIC algorithms >> Various PMW SIC algorithms have been developed

72      However, there exist discrepancies >> However, discrepancies exist

78      What is meant by "ice/water mixtures"?  Note that the differences in algorithms isn't due to the presence of these things, but rather due to the differing sensitivity of the algorithms to these things, so it may be helpful to reword this sentence to reflect that.

88      It would be helpful add a sentence here that notes that you will use the Kern et al. data to validate your own data as described in Section 2.3.

107     The use of "sub-region" confused me. Here, and for most if not all other occurrences throughout the paper, "region" would serve equally well.  Consider changing "sub-region" to "region" throughout.

118     short-wave IR >> short-wave IR (SWIR)

122     Suggest you add "(used in the Normalized Difference Snow Index)" to tie this back to the abstract. So it would read "…SWRI band 6 (used in the Normalized Difference Snow Index)…"

167-170      This isn't clear. Does it mean that six of the scenes that Kern classified were used by the authors to validate their method? Or does it mean that six of the scenes that Kern classified are being offered to readers in the supplement, so that readers can evaluate the author's method?  I think it means the former.  A re-written sentence might read something like this: "In order to evaluate the classification method suggested by our study [to distinguish it from "this study" used earlier for Kern's study] we processed Landsat 8 reflectance from six clear-sky scenes that Kern (2021) had classified, and then compare results."  Then, point readers to where those comparisons can be found (Section 3.2?)

In the caption for Figure S1, it looks like "left of each panel" and "right of each panel" are reversed. Also, where it says "…and the reference classification map (left of each panel) are provided", consider changing to " …and the reference classification map **that our method produced** (**right** of each panel) are **shown**",

264     Classification of a Landsat-8 pixel into ice and open water >> Classification of a Landsat-8 pixel **as** ice **or** open water

276     Remove "in order"

282     Remove "steps"

301    are not consisted solely >> do not consist solely

321    are not fully concentrated by Landsat-8 pixels >> are not entirely filled by Landsat-8 pixels

331    each twelve >> all twelve

366-368         As mentioned in section 3.3, Landsat-8 SIC can be largely deviated from actual SIC if Landsat-8 measures partially-covered grid cell, in other words, SIC computed from partially-covered grid cells may not be representative of actual ice coverage over the entire grid cell  >> As mentioned in section 3.3, SIC computed from partially-covered grid cells may not be representative of actual ice coverage over the entire grid cell

391 consider adding "along with the mean and standard deviation of sea ice concentration" after "…shown in Fig. 6"

415    Should "..estimated over the pixels with such wrongly-masked pixel.." be "estimated **for grid cells** with such wrongly-masked pixel**s** …"  ?

424    are well corresponding >> correspond well

443    sub-range >> range for line 443 and also in the figure caption

445    The contribution of the two threshold variables to $\sigma_{SIC}$ was found that $\rho 5$ threshold explains most of … >> Still, the $\rho 5$ threshold explains most of …

446    In spite of the relatively high uncertainty in Landsat-8 SIC ranged from 20% to 80%, >> In spite of the relatively high uncertainty in Landsat-8 SIC between 20% and 80%,

460    …category, sub-section with 100% cloud cover based on visual inspection, but less than 100% cloud cover from CFMask was selected. From the collected sub-sections, the $\rho 5$ and NDSI values were collected …  >> …category, **those having** 100% cloud cover based on visual inspection, but less than 100% cloud cover from CFMask **were** selected. From **these images**, the $\rho 5$ and NDSI values were collected …

472    …and thus SICs produced …  >> …and thus **for** SICs produced …

482    "Chart" should be plural: "Charts"

495    The spreads >>The spread

498    "SIC from the ice chart was found to be positively biased to Landsat-8 SIC,"  Would it be more clear to say ""SIC from ice chart**s** tends to be higher than that found using Landsat-8 SIC, "

528    should be "Although **a** few…"

529    …because melt ponds are not easily discernible to open water, … >> …because melt ponds are not easily **distinguished from** open water, …

533    has robustness >> is robust

617    Comparison of Landsat-8 SIC against SIC retrievals from NASA Team (NT) and Bootstrap (BT) algorithms reveal >> Comparison of Landsat-8 SIC against SIC retrievals from NASA Team (NT) and Bootstrap (BT) algorithms **for two cases** reveal

619    related with >> related to