

Earth Syst. Sci. Data Discuss., referee comment RC2  
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## Comment on **essd-2021-279**

Anonymous Referee #2

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Referee comment on "A temporally consistent 8-day 0.05° gap-free snow cover extent dataset over the Northern Hemisphere from 1981–2019" by Xiaona Chen et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-279-RC2>, 2022

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This paper describes a combined 8-day 5 km NH SCE product, GLASS SCE, derived primarily from AVHRR data. The authors use a decision-tree approach to identify daily SCE that they gap fill with existing SCE datasets and aggregate to an 8-day product. The authors assess the performance of GLASS with in situ GHCN data, MOD10C2 SCF and CLARA-A2-SAL surface albedo. The narrative is reasonably coherent but the text suffers from a large number of typos and language errors. The dataset could be very useful if properly presented and documented.

While I appreciate the substantial effort required to produce a dataset of this kind, I find the manuscript lacks sufficient detail (background, accuracy assessment) to guide a user on how to best use the dataset. The manuscript could be improved by providing more background on the datasets being merged, a more comprehensive accuracy assessment that includes binary metrics, and a discussion of the strengths and weaknesses of the merged 8-day dataset including considerations and recommendations for users.

### Major comments

**Dataset:** I would have liked to see a data layer that indicates the source of the SCE estimate for each pixel (i.e. AVHRR-SC CDR, JASMES, ESA CCI, IMS climatology). This type of information is critical for users who may want to filter out certain datasets for specific analyses.

**Accuracy assessment:** I am curious as to why the authors did not use traditional binary metrics [overall accuracy, user's accuracy, producer's accuracy, see Hori et al. 2017] for the comparison with in-situ data? I find the current evaluation strategy to be rather limited. I also urge the authors to present metrics in time-series form (annual, monthly or 8 day), in addition to the aggregate value.

## Text and study logic:

- It's not clear how much benefit is gained from gap-filling with JASMES and ESA CCI compared with the 8-day aggregation and IMS-derived climatology. Specifically, the authors fail to clearly outline how two existing AVHRR-derived SCE products (JASMES, ESA CCI) can reliably fill gaps where their AVHRR-derived product misses snow. From what I understand, JASMES uses AVHRR GAC and applied corrections for sensor degradation and ESA CCI also uses GAC (although this point was not clear from the text). The impact of improved AVHRR-SR CDR radiances, which are derived from AVHRR GAC, for identification of snow on ground is not clearly articulated. Differences in input data (AVHRR CDR version) aside, the fact that other existing AVHRR-derived products can be used to fill gaps in your product means that either:

- JASMES & ESA CCI are less conservative and either detect snow when your decision tree approach misses snow and/or they falsely identify snow. If it is the latter, are you not just adding error/uncertainty to your SC product? If it is the former, what are the benefits of your product compared to existing ones? i.e. why not simply take one of these existing products and product an 8-day composite gap-filled with IMS?

OR

- Your product is overly conservative and misses too much snow. If this is the case, have you considered improvements to your decision tree? The authors state that JASMES and CCI are used to reduce omission errors in NHSCE-D but never comment on the potential source of these omission errors. The authors should include specific details that might help explain possible omission/commission differences (i.e. cloud masking, algorithms applied, input data). As I was reading I kept wondering how the NHSCE-D product compared with JASMES and ESA CCI.

- IMS from 2005-2019 so used IMS-derived climatology (SC probability) to fill gaps after NHSC-D – JASMES – ESA CCI merging. This assumes 2005-2019 is applicable to 1978-2004 but there is no discussion of possible limitations or uncertainties with this approach.

- On the topic of IMS-derived climatology, if the aim of your product is climate analysis, what are the potential issues of filling gaps with climatology? i.e. a user should be made aware of where and when they are looking at observed SCE and where and when they are looking at climatology. Otherwise, any trends or anomalies will be falsely identified/misidentified. These types of issues should be clearly articulated so users properly use the dataset. Again, a layer identifying the source of each SCE estimate and discussion of limitation of the dataset would help avoid possible misuse.

## Minor comments

Zenodo link – should be 10.5281/zenodo.5775410 (L27 & 386; 10.5281/zenodo.5775410 refers to the .dat format and not the geotiff)

8-day averaging and gap-filling with climatology is expected to result in less spatial and temporal variability. Please comment on this and its implication for the aim of your product (could be included in expanded discussion).

L119-121: This is important information but the way it is written is a bit unclear. Relates to major comment about benefit of your new SCE vs JASMES/ESA CCI.

L122-124: Did the studies you present specifically evaluate snow? Please clarify.

L136: Where and how were the elevation data used? Not stated anywhere in the text.

L149: Please provide link to JASMES dataset and date accessed either here or in reference list.

L151: Hori et al. 2017 states that AVHRR GAC is used for 1978-2005. Has this been updated since the 2017 publication? Unable to confirm because dataset information not provided.

L155-161: CCI SCFG dataset also includes per-pixel unbiased RMSE. Was this information considered during the merging process?

L161: What happened here? Where did the rest of the sentence go?

L207-210: Average of all pixels in the domain implies average of all NH pixels. Is this what you intended or was it the average of the pixels intersecting or within the 0.5° pixel? Similar lack of detail presented for upsampling.

L248: 'published' not 'polished'

L252: What is the priority order of JASMES and ESA CCI? Order of priority not indicated on Fig 2 or in text.

L259: What is a 'rest gap'?

L260: What do you mean by an 8-day minimum gap?

L294-299: Fig 5 looks to have continental differences rather than clear latitudinal differences.

L304-306: It would be interesting to see whether there are differences according to snow depth. i.e. is shallow snow being missed more often than deep snow? Partitioning the analysis by GHCN SD might help understand this.

L307-308: 'shows' instead of 'explored'; 'evaluated' instead of 'employed'

L 323-325: Is the exclusion of snow in Africa and South America a good thing? i.e. is the IMS-derived climatology beneficial in these regions?

L323: 'retrieved' not 'retriebed'

Discussion: Do you mean you considered using fractional snow cover and spectral unmixing but decided not to adopt that approach or do you mean you did both? Not clear.

## **Figures**

Figure 1: Please use color other than green for stations and smaller dots.

Figure 2: Suggest 'IMS climatology' instead of 'IMS'

Fig 2 caption: suggest 'using AVHRR-SR CDR, JASMES SCE, ESA CCI and IMS-derived SE climatology'

Fig1 – Fig 4&5 discrepancy. Both captions state 562 GHCN stations but fewer stations shown on Fig 3 than Fig 1. L378-379 states 'Moreover, as shown in Figure 1, to meet the needs of long temporal coverage in the validation process, only 562 stations were selected in the analysis.' But Fig 1 and Figs4&5 have different numbers of stations and any filtering of the stations was not explained in the text.