We would like to thank the reviewer for the careful assessment. Please find our replies below in red. Underlining highlights proposed additions, removals or revisions in manuscript.

The CLARA climate data record is the longest remote sensing based record for global surface variables, and has unique significance to environmental and climate studies. This manuscript presents an overview to the latest version of CLARA-A3 albedo product, including its algorithm update and features of dataset. The content is relevant to the scope of ESSD, and will be helpful to data users. The aim of this manuscript is to clearly describe the strength and limitations of the dataset. In this consideration, some questions and revision suggestions are raised as follows:

1. Firstly, I would complain that data is not directly accessable at the provided DOI: 5676/EUM_SAF_CM/CLARA_AVHRR/V003.

The data are orderable free of charge after registration in the CM SAF data portal. We (the CM SAF project) are required to keep registry and track usage of our data records, therefore direct downloads are not possible. The reviewer's listed DOI above seems to miss the "10." needed in the beginning, we checked that the DOI listed in the abstract and data availability section is complete and points to the correct web site of CM SAF.

2. In table 1, I just ask a question: is there any change in the algorithm of albedo retrieval over ocean surface?

The algorithm itself remains unchanged, but we have removed the normalization to 60 degrees SZA to maintain internal consistency in treatment of CLARA albedo estimates over all surfaces on Earth. Also, now the WAL and BAL estimates are also available over ocean surfaces, as noted in the table 1.

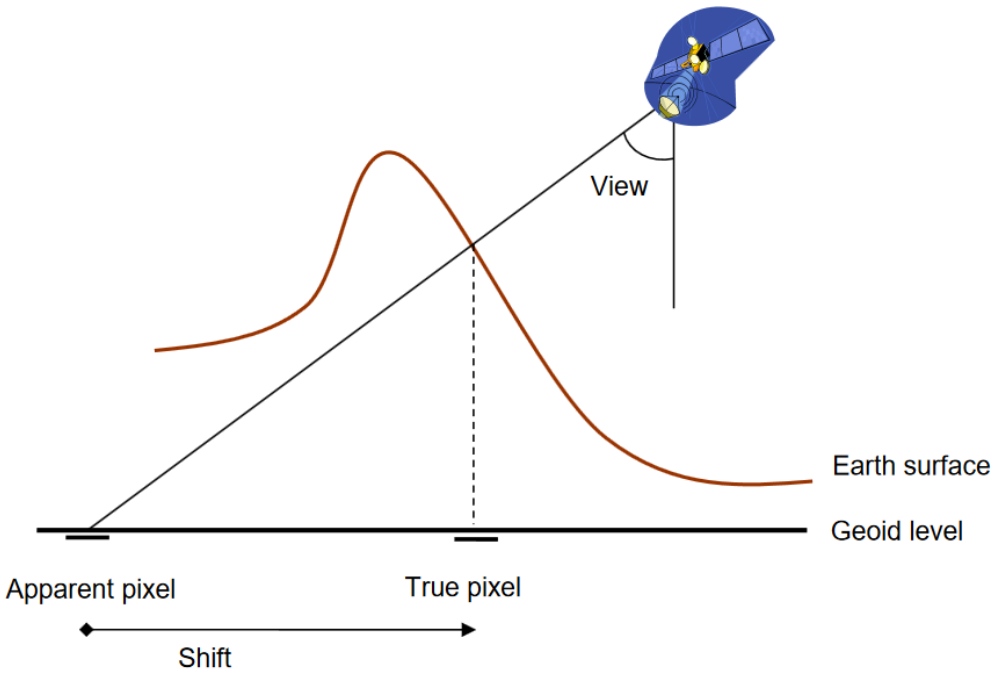
3. In Line 98, page 5, "As AVHRR geolocation is calculated on a geodesic reference ellipsoid, a combination of sufficiently large elevation and viewing angle requires across-track shifting of pixels to obtain true geolocation", I cannot easily understand the phase "requires across-track shifting of pixels to obtain true geolocation". And I think maybe the geometric processing of AVHRR data is not in the scope of this manuscript, otherwise, it would be too much to discuss in a single article.

The text refers to the need to alter the location of some pixels within the AVHRR swath if their true location (in mountainous terrain) differs too much from the original estimate, which is computed for flat terrain. For the reviewer's information, we repeat here Figure 3-5 from the data record ATBD, which illustrates the process; the geolocation estimate may differ markedly from true position in the across-track direction if the imaginary line from satellite to ground intersects true terrain position much 'earlier' than expected due to elevated terrain. This correction is applied only if the shift is larger than 0.5 times AVHRR resolution and is thus restricted to high mountains. We propose to add some clarifying text here, i.e. "As AVHRR geolocation is calculated on a geodesic reference ellipsoid (flat terrain), a combination of sufficiently…"

We nonetheless propose to keep the current brief description of topography correction, as it is one component of the CLARA SAL retrieval process. Detailed descriptions remain available in the ATBD. A similar procedure is described in Dech et al. (2020) for their AVHRR

processing, we will also refer to that paper for readers who desire additional references on the topic.

Dech S, Holzwarth S, Asam S, Andresen T, Bachmann M, Boettcher M, Dietz A, Eisfelder C, Frey C, Gesell G, et al. Potential and Challenges of Harmonizing 40 Years of AVHRR Data: The TIMELINE Experience. *Remote Sensing*. 2021; 13(18):3618. https://doi.org/10.3390/rs13183618



4. In Line 100, page 5, it is not clear whether the mean slope refers to slope of 30m pixel or 0.05DEG pixel. And whether the mean refers to the mean of 0.05DEG pixel or 0.25DEG pixel. If possible, please indicate the percentage of pixels which need topology correction.

Thank you, this was indeed not clearly presented and suffered from a typo. Specifically, the requirement is that the **maximum** slope between the 1/120 deg. GTOPO30 pixels contained in the GAC pixel under treatment must exceed 5 degrees in order for radiometric correction computations. The limit is exceeded only for mountainous areas (e.g. Rocky Mountains, Andes, Himalayas), but we do not have global statistics on the amount of retrievals being treated, as the condition is calculated for each AVHRR overpass separately. We propose revising the text here to “Over sufficiently rugged terrain (max GTOPO30 slope larger than 5 degrees in the GAC pixel, i.e. mountainous areas)”.

5. In Line 103, page 5, it is not clear whether the "each AVHRR pixel to be corrected" refers to 05DEG pixel or 0.25DEG pixel.

The text refers to each GAC-resolution pixel, revised accordingly.

6. In line 123, page 6, it is not clear whether the same narrow-to-broadband conversion (NTBC) algorithm in Liang et al. (2000) is applied both for snow-ice surface and snow-free surface.

Line 120 attempted to make clear that the text refers to the snow-free terrain path. Revised the text for further clarity to "The narrow-to-broadband conversion (NTBC) algorithm for snow-free land also follows Liang..."

7. In line 231, page 9, "available sampling may change by a factor of 50", what is the meaning of "by a factor of 50"?

As seen in Figure 4b, by a factor of 50 means y = 50 * x; the available sampling for e.g. spring months in light color may be 50-100 GAC-resolution pixels, whereas in midsummer that number may reach 6000, thus 50-60 times larger.

8. In line 236, page 9, the "climatological albedo" is used in this manuscript as a reference data. But the source and accuracy of climatological albedo cannot be found throughout the manuscript.

We do not quite understand the comment. The climatological albedos listed here, with references to their original publications, are solely used in visualizing BAL variability about the expected value for (relatively) homogeneous terrain. The accuracy of these climatological estimates is of course no better than for climatologies in general, as both snow and vegetation are not static surface types. The intent here is simply to visualize the scatter and variability of CLARA BAL estimates against literature-based expectations for what the surface albedo would likely be for these types of terrain, assuming homogeneity.

9. Figure 4b, pages 10. I found it difficult to understand this subfigure. Are the scattered points in Figure 4b a single time sequence? If so, why are they not continuous as in Figure 4a?

Each marker indicates a single monthly mean over the limited region over central Greenland, whereas Fig 4a illustrates the global mean of available sampling per month. Due to this vast difference in sampled area, Fig 4b will naturally vary so much that a line plot would be quite hard to follow. It was also desired to encode the information on mean Solar Zenith Angle over the area into Fig 4b in order to prove that the variability is primarily related to lack of illumination in spring and fall, when the mean SZA approaches the cut-off limit of 70 degrees. If the reviewer deems it important, we can of course alter Fig 4a to also show a scatter plot-type of presentation, but using a continuous line plot for both subplots is not optimal in our view due to the reasons stated.

10. In line 284, page 12, "the decadal stability of bias, i.e. the temporal trend in bias as per cent per decade". The use of temporal trend as stability indicator is not questionable to me. It is possible the long-term trend is very small while the sequence

of albedo looks very noisy and unstable. I would suggest using variance of the bias as stability indicator.

The indicators chosen serve different purposes. The reviewer desires information about the variability of bias, which we present as the "Precision" indicator, with the bias-corrected rms error against reference as the metric. Being a rms metric, this indicator grows large in cases of noisy albedo retrievals as shown for some sites in e.g. Figures 7 and 8. The purpose of the "Stability" indicator is to provide information about the stability of the time series on annual and decadal scale to detect e.g. uncorrected radiometric calibration drifts of the AVHRR sensor constellation. These are important aspects to cover for considering the application of this time series to albedo trend detection. We thus argue that the provided indicators do provide information about the overall bias versus reference (bias), the noisiness of the retrievals (precision), as well as the long-term stability of the retrievals (stability).

11. Figure 6c, page 16, "Sizes of rectangular markers indicate the amount of valid clear-sky AVHRR data of each month." But I cannot find the rectangular markers in the figure.

Thank you, here perhaps the information was lost in the size of the multi-panel visualization. Each of the colored markers in Figure 6c is in fact a rectangle, whose size corresponds to the amount of data it is based on. The goal here is to not give excessive visual weight to large or small biases if they are based only on a very limited set of comparable data. To make this clearer to the reader, we propose revising the caption text to "The heights of the colored markers indicate…"