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Atmospheric Chemistry and Physics Discussions

Interactive comment on "CLARA-SAL: a global 28-yr timeseries of Earth's black-sky surface albedo" *by* A. Riihelä et al.

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We thank the reviewer for the constructive comments. The replies to the comments raised are as follows:

1. Sections 3.1: Please clarify how you reprojected 4.4 km GAC data to 25 km EASE grid in detail, along with the treatment of underlying surface type. Did you resample(pick third pixel from every 5 pixels in a line or a 5x5 box) or average original GAC data?

Each GAC resolution pixel is first projected to an EASE grid at 5 km resolution. This resolution was chosen, because it is close to the nominal GAC resolution (at nadir) and therefore the majority of the original observations are still represented in the re-

*projected grid. In this step, each observation is mapped to only one pixel (i.e. no averaging, interpolation or nearest-neighbour filling is applied), so that the weighting of observations does not changed. These reprojected grids are then used to calculate the temporal and spatial mean (i.e. at 25 km resolution, and pentads or monthly means) by averaging all the (projected) observations that lie within the 25km*25km square and the time interval. All surface type considerations take place at satellite projection level where the instantaneous SAL computation takes place. Surface type is retrieved from a 1-km USGS land cover dataset using nearest-neighbor sampling.*

2. Section 3.2: Keeping AOD and Ozone constant over time and space can be very problematic for the albedo retrieval. If it is hard to get real-time data, at least some climatological data for AOD and ozone should be considered in terms of season and different latitude bands. And I don't also understand why the water surface albedo is a constant value of 0.0676 since AVHRR visible channels provide some information about the water surface and quality. And authors didn't mention how to retrieve ice surface albedo, please add it in, since it deems to be a global dataset including polar regions.

We agree that retrievals over high-aerosol regions are problematic, but the use of an aerosol climatology provides at best a partial solution since the regions with high aerosol loading tend to also have a large variability in AOD. Our use of a constant AOD provides users with an opportunity to apply their own preferred AOD data to perform a post-processing correction, if required. As stated in the manuscript, over many areas of the Earth the average aerosol loading is not so large as to invalidate the product. These findings are being checked with RTM calculations, but we already note that they are in line with previous studies like Li and Garand (1994). A more dynamic AOD correction is planned for the next CLARA-SAL releases. The ozone effect on the broadband albedo retrieval is much smaller than the AOD effect over typical atmospheric conditions. Regarding the ocean albedo, the use of a LUT-based approach circumvents issues such as an accurate AOD correction over oceans (challenging as AVHRR retrievals of AOD

are very difficult), partial cloud contamination in AVHRR data and anisotropic effects of water reflectance over areas experiencing high surface winds. Surface conditions such as chlorophyll concentrations affect broadband ocean albedo only slightly (Jin et al., 2004). We agree that the constant ocean albedo in CLARA-A1-SAL represents only some average surface conditions; in release 2 we plan to include wind speed data from an independent source to enhance the accuracy (and robustness) of the ocean albedo in CLARA-SAL.

Regarding the ice/snow albedo retrieval, we will revise the annex to include additional details on the retrieval but note that since the retrieval has already been discussed and reviewed in depth in Riihelä et al. (2010), we propose to conserve space by not repeating that discussion fully.

References: Li, Z. and L. Garand (1994), Estimation of surface albedo from space: A parameterization for global application, J. Geophys. Res., 99(D4), 8335–8350, doi:10.1029/94JD00225.

Jin, Z., T. P. Charlock, W. L. Smith Jr., and K. Rutledge (2004), A parameterization of ocean surface albedo, Geophys. Res. Lett., 31, L22301, doi:10.1029/2004GL021180.

Riihelä, A., Laine, V., Manninen, T., Palo, T., and Vihma, T., Validation of the Climate-SAF surface broadband albedo product: Comparisons with in situ observations over Greenland and the ice-covered Arctic Ocean, Remote Sensing of Environment, 114 (11), 2779-2790, ISSN 0034-4257, doi:10.1016/j.rse.2010.06.014.

3. Section 4: In any long-term dataset generation from space-borne different satellites, the inter-calibration between different satellites are important to guarantee the dataset consistent without systematic biases due the switch of the satellites overtime, because the sensors onboard satellites degrade over time after launch, and different satellites may experience different after-launch calibrations, though in general it is small for AVHRR visible channels. I suggest authors discuss this issue in the paper, at least summarize other researchers' results.

The CLARA-A1-SAL dataset is based on an intercalibrated AVHRR radiance data record, as stated in the manuscript (pg. 3, lines 166-174). We can provide more details on this topic in the revised manuscript, but we propose to include it in section 6, 'Product stability and retrieval uncertainty considerations', as that is in our opinion the most appropriate place.

4. Section 4: The validation results within-situ observations are hard to say good, for monthly average, the relative errors areway too large over 10

Retrieval accuracies of 10-15% are comparable to previous AVHRR albedo datasets and algorithms (Csiszar and Gutman, 1999). Over snow and ice, our results are similar to the ones previously found for APP-X (Stroeve et al., 2001). Our dataset provides added value through its longer coverage compared to previous datasets, its basis in an intercalibrated AVHRR radiance record, the inclusion of a topography correction, in the potential to combine the use of CLARA-A1-SAL with the host of other CLARA-A1 family products (Karlsson et al., 2012), and in the simple virtue of providing an independent estimate on global black-sky surface albedo through algorithms that are different from previous studies. We agree that the dataset is not perfect; efforts are underway to improve its capabilities still further in the release 2.

References: Stroeve, Julienne C., J. E. Box, Chuck Fowler, Terry Haran, and Jeffrey Key. March 2001. Intercomparison Between in Situ and AVHRR Polar Pathfinder-derived Surface Albedo Over Greenland. Remote Sensing of the Environment 75(3):360-374

Csiszar, I. and G. Gutman. 1999. Mapping Global Land Surface Albedo from NOAA AVHRR. Journal of Geophysical Research 104(D6):6215-6228

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 25573, 2012.