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The Cryosphere Discussions

Interactive comment on "Monitoring of glacier albedo from optical remote-sensing data: application to seasonal and annual surface mass balances quantification in the French Alps for the 2000–2015 period" *by* Lucas Davaze et al.

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First, I need to apologize for the delay in responding to the request for review. I can blame it on the NAS Decadal Survey for Earth Sciences and Applications programs, which has consumed me as I co-chair the Hydrology and Water Resources Panel.

A lot of work has gone into this paper, but the presentation of the results is not satisfactory. The measurement of albedo is rigorously and correctly done, following Dumont et al. (2012). However, the statistical correlation analysis of the minimum summer albedo

with the surface mass balance (SMB) sweeps a lot of interesting processes into it, and raises more questions. Specifically, how do the spatial and temporal variability of the albedo affect the SMB? And how does the uncertainty in the albedo estimate relate to the uncertain in the absorption, i.e. "1-α" , which is what we really want.

Therefore, a much stronger paper would result if instead you compute the absorbed solar radiation by date, and integrate it over periods of interest. This calculation, perhaps called the radiative forcing in W m–2, takes into account the variability on the glacier, along with the different glaciers' exposure to the incoming solar radiation. Painter has used this measure. Painter and his colleagues have used this measure effectively to characterize the effects of dust on snow. You've already had to do much of the work in order to compute the albedo values, so take the next step.

I agree with Anonymous Referee #1, who questions the reliability of the analysis for the accumulation phase of the annual glacier cycle, which is likely driven more by the winter snowfall. After all, there are three ways to make a glacier shrink: darken it, starve it, or warm it. The analysis presented concentrates on the darkening. Tying this into the radiation balance would strengthen the contribution.

A nit of a comment concerns the statement on Lines 74-77. David Shean's work using photogrammetry from fine-resolution commercial sensors from DigitalGlobe shows much promise for interpreting successive DEMs to understand glacier shrinking.

Miller, S. D., F. Wang, A. B. Burgess, S. M. Skiles, M. Rogers, and T. H. Painter (2016), Satellite-based estimation of temporally resolved dust radiative forcing in snow cover, Journal of Hydrometeorology, 17, 1999-2011, doi: 10.1175/JHM-D-15-0150.1.

Shean, D. E., et al. (2016), An automated, open-source pipeline for mass production of digital elevation models (DEMs) from very-high-resolution commercial stereo satellite imagery, ISPRS Journal of Photogrammetry and Remote Sensing, 116, 101-117, doi: 10.1016/j.isprsjprs.2016.03.012.