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The Cryosphere Discussions

Interactive comment on "Monitoring spatial and temporal variations of surface albedo on Saint Sorlin Glacier (French Alps) using terrestrial photography" *by* M. Dumont et al.

Anonymous Referee #1

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This paper presents a new method to retrieve glacier surface albedo from terrestrial digital photographs, taking into account the anisotropic reflectance of snow and ice and using radiative transfer modelling for the narrow-to-broadband conversion. The method is an advance on previous work as no measured value of albedo is required in the field of view of the camera. Validation measurements are only available for two points on the glacier, but the dataset is of a large enough temporal extent to assess performance over a wide range of glacier surface conditions. The results are generally good, the methods are explained very thoroughly, and the technique could be useful in a range of glacial and cold region hydrological applications. I think the paper is highly relevant and worthy of publication in The Cryosphere, but a few minor issues should

be addressed first, as detailed below.

Discussion points a) p. 291, lines 14 onwards. Satellite albedo retrieval algorithms are already available and a range of albedo 'products' are available for, e.g. MODIS. Surely, the advantage of your technique is that is overcomes some of the limitations of satellite measurements: e.g. photographic spatial resolutions more suited to small glaciers and provide much better temporal resolution (especially at locations which are frequently obscured by cloud). b) In the conclusion you should point out that albedo cannot be retrieved from your method under cloudy conditions, but albedo is known to vary significantly with varying cloud cover and these effects would need to be parameterised in a model. c) Presumably, the range of zenith angles under which albedo was measured is quite small (summer season on a temperate glacier, within a few hours of solar noon). How might the results vary at larger zenith angles and how applicable could the method be to polar glaciers where solar zenith angles are greater?

Clarifications Order of figures: Fig. 4 is introduced in the text before Fig. 3 (p. 284) so the order of these two figures should be reversed. p. 278, Measurements of reference albedo section. Under what conditions were suitable photographs retrieved? Are these limited to clear sky conditions, or is a partly cloudy sky acceptable. Also, what is the range of solar zenith angles for the albedo reference data? p. 288, first paragraph, if the AWS was located at the equilibrium line then surely the transient snowline (boundary between ice and snow) would have been located well downglacier from this location at this relatively early stage of the ablation season. Or do you mean that the AWS corresponded with the position of the transient snowline on 3rd July?

Typographical and grammatical errors p. 272 Line 3, glaciers. Line 5, replace 'leading variable' with 'most important variables'. Lines 20-21, final sentence overcomplicates things, you simply mean that the melt rate is sensitive to meteorological conditions – but this is obvious.

p.273 Line 1, replace 'becomes' with 'is'. Line 12, 'frozen surfaces' but temperate

glaciers often have liquid water present at the surface. Line 18, replace ‘proved’ with ‘has proven’. Line 26, replace ‘showed’ with ‘shown’.

Interactive comment on The Cryosphere Discuss., 5, 271, 2011.