

## ***Interactive comment on “Photopolarimetric retrievals of snow properties” by M. Ottaviani et al.***

**M. Ottaviani et al.**

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Dear Editor,

We thank you and the reviewers for your keen eye that allows us to improve this manuscript. The comments received by the two anonymous referees have been addressed and posted as individual replies. Moreover, we would like to include other minor corrections inspired by our desire of making the manuscript more readable. These latter adjustments DO NOT insert sentences, paragraphs or modify concepts, but only concern occasional choices of a better word or shifted the position of a paragraph to give a better flow. In a couple of instances, we removed a redundant sentence. All proposed changes are highlighted in red in the attached pdf. Line and page numbers below refer to the manuscript published on the Discussions.

Faithfully, M. Ottaviani, B. van Dierenhoven, B. Cairns

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Proposed changes:

Page 3059, line 2: “from” substituted with “as reported by”

Page 3059, line 8: “reports” substituted with “recorded”

Page 3060, line 12: “Shifting the attention to” substituted with “For”

Page 3060, line 14: Sentence “In these retrievals, the fit is sought to the RSP measurements by using a database of ice crystal properties to implement the radiative transfer within the snow layer.” deleted because redundant.

Page 3061, line 5: Corrected “with simulated values” with “a look-up table of values simulated”

Page 3061, line 7: Eliminated because incorrect “within the top of the snowpack”

Page 3061, line 8: Paragraph “Our database, initially created to be of use for the retrieval of ice clouds properties, contains 765 different combinations of aspect ratios and roughness parameters and was computationally assembled by running Monte Carlo simulations based on geometric optics [Macke96a].” was moved to Page 3060, line 22. (Immediately after, we added the content specified in the reply to reviewer #2, point 6)).

Page 3061, line 13: Eliminated “instead”

Page 3061, line 16: Substitute “The single scattering albedo at a given wavelength” with “,which”

Page 3061, line 25: Substituted “their volume over the crystal surface area” with “the crystal volume over its surface area,”

Page 3061, line 26: Modified paragraph: “Here, we estimate the effective diameter of snow for a given scene by matching the measured reflectance with a simulated value assuming an ice crystal model with an asymmetry parameter consistent with the asymmetry parameter retrieved for that scene using the method described above.” With

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paragraph: “The effective diameter of snow for a given scene is estimated by matching the measured reflectance with an ice crystal model whose asymmetry parameter is consistent with that retrieved for that scene using the method described above.”

Page 3062, line 17: This paragraph moved close to the end of the Introduction after line 18 at Page 3057: “There certainly is debate on the applicability of the radiative transfer theory to a densely packed medium as snow. In any case, the formalism is recognized to model the total reflectance with sufficient accuracy for reasons likely associated with the large number of scattering events taking place within the snowpack. Based on this assumption, the method is expected to perform even better for the polarization component because the polarimetric signatures of a medium are known to originate from its top layer [vanDiedenhoven13]: deeper into the medium (i.e., past the first units of optical depth) multiple scattering randomizes polarization.”

Page 3062, line 2: Eliminated “doubling adding”

Page 3062, line 6: Substituted sentence: “In the analysis, it should be remembered” with “Another important aspect to consider is”

Page 3062, line 12: Substituted “scenes” with “regions”

Page 3062, line 27: Substituted commas with parentheses around sentence “corresponding to a spatial resolution of about 225 m”

Page 3062, line 26: Paragraph: “The analysis for each scene (different columns in the figure) was performed over a single RSP pixel, corresponding to a spatial resolution of about 225 m, since averaging over a few adjacent aggregated scans did not show appreciable scan-to-scan variability, revealing more or less uniform snow conditions within the instrument instantaneous field of view. The upper panels [.]” Adjusted to: “For each of the three scenes (different columns in the figure) the analysis was performed over a single RSP pixel, corresponding to a spatial resolution of about 225 m. Indeed, averaging over a few adjacent aggregated scans did not show appreciable

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scan-to-scan variability, revealing more or less uniform snow conditions on a scale larger than the instrument instantaneous field of view. Real-time imagery from the high-resolution camera onboard the ER-2, overlaid to Google Earth, is included for context. The second and third rows of panels [.]”

Page 3063, line 14: Modified paragraph: “Nevertheless, it should be remembered that a layer of a few millimeters is sufficient to fulfill the semi-infinite approximation at the long wavelengths used for the retrieval of grain size. Conversely, the SWIR channels at 1594 and 2264 nm are very dark as expected by the strong absorption of ice at these wavelengths.” With: “Nevertheless, a layer of a few millimeters is sufficient to fulfill the semi-infinite approximation at the longer wavelengths used for the retrieval of grain size: the RSP SWIR channels at 1594 and 2264 nm are very dark because of the strong absorption of ice at these wavelengths.”

Page 3064, line 24: Eliminated: “conveniently”

Page 3065, line 9: Substituted “selected” with “different”

Page 3066, line 4: Inserted reference: “[Macke et al., 1996]”

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Interactive comment on The Cryosphere Discuss., 9, 3055, 2015.

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