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Reflectance measurement and calculation for real snow structures

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Modeling snow reflectance is currently based on models using spherical or hexagonal particles. The effect of different snow particle shapes on reflectance is not well understood. In this study, a beam-tracing model was applied to vertical surface sections of four characteristic snow types (fresh snow, rounded snow, depth hoar, re-frozen wet snow) to investigate the effect of real (non-spherical and anisotropic) shapes on the reflectance of snow. This model calculates the bidirectional radiance derived from an arbitrary number of incident beams. The wavelength used in the simulation was 870 nm because at this wavelength the reflectance depends mainly on the grain size and not on impurities. The results show that measured reflectance and simulation agreed within a few percentages. Modeled snow reflectance and transmission was found to depend on the specific surface area, a parameter which corresponds to the effective optical diameter. With our method we make a step towards understanding changes in bidirectional reflectance distribution associated with changes in specific surface area. This progress is important within the topic of describing energy balances in snow packs.