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Uncertainties in the retrieval of Arctic broadband albedo using satellite, airborne and ground-based optical instruments

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The Arctic surface shortwave broadband albedo, hereafter called albedo, is a key quantity which determines the radiation budget of the Arctic and is closely related to the Arctic climate. Consequently, climate models require albedo data within an accuracy of +/- 0.02 - 0.05 to simulate the Arctic climate correctly.
The albedo data is derived from reflectance measurements by various satellite (e.g. MERIS, MODIS, AVHRR), airborne (e.g. SMART-Albedometer), or ground-based optical instruments (eg. FIGIFIGO, ASD-spectroradiometer). However, several specifications of the different instruments, namely the spectral and angular resolution, the spectral bandwidth, and the field of view (FOV), can introduce uncertainties in the derived albedo product.
We quantify these uncertainties for typical Arctic surface types with a main focus on snow types. Bidirectional reflectance factors (BRFs) and albedo values are simulated under variable solar zenith angles (55° - 80°) by the radiative transfer model SCIATRAN. The influences of the instrument specifications on the BRF and albedo are shown. Spectrally and angularly sparse resolved satellite observations introduces the highest uncertainties in the albedo retrieval, which tend to increase with the solar zenith angle. Uncertainties due to different spectral bandwidths and FOVs can be neglected.