The snow grain size and soot concentration remote sensing: sensitivity studies using SCIATRAN

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The radiance over a snow field as detected on a satellite depends on the snow properties and also on atmospheric parameters in the propagation channel. The snow parameter of interest in this work is the average snow grain size (SGS). The retrievals of this parameter can be influenced (depending on the channel used and the type of pollutants) by the concentration of pollutants (CP). Therefore, it is of importance to derive both parameters from reflected light simultaneously. We study the sensitivity of the reflection function to both SGS and CP. The derivatives of the reflectance (and corresponding weighting functions) with respect to these parameters are calculated using the radiative transfer code SCIATRAN. The model of a semi-infinite ice cloud with fractal snow grains was used in simulations. It was shown that measurements around 1.06 and 1.2 micrometers are most suitable for the grain size determination. The near - infrared radiation penetrates to very small depths in the snow (depending on the grain size and actual wavelength). Therefore, only subsurface grain size can be measured and not corresponding vertical profiles. The influence of viewing and illumination geometry on retrievals is also studied in this work.