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Determination of cloud optical thickness over snow using satellite measurements in the oxygen A-band

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Clouds are the subject of interest for numerical weather prediction models, global circulation models, and climate studies. Due to the fact that clouds vary considerably in their horizontal and vertical extent, which is crucial to studies of global climate change, it is of great importance to have a good knowledge on cloud properties and their variation in space and time. One of the most relevant parameters for such studies is the cloud optical thickness (COT) because shortwave cloud radiative properties depend almost exclusively on this parameter (and the cloud effective radius).

Currently, there is no retrieval algorithm, which is capable to determine COT over snow surfaces since such targets appear as bright as clouds in the visible wavelength region. Therefore, we present our newly developed cloud optical thickness retrieval over snow (CROS) algorithm, which is using the sensitivity of top of atmosphere reflectance in the oxygen A-band to the cloud optical thickness. The CROS algorithm applies forward simulations for clouds over snow using the radiative transfer model SCIATRAN in order to find the COT value representing the measured top-of-atmosphere reflectance for the given cloud top height, cloud bottom height and solar zenith angle. We present results for synthetic retrievals as well as an error analysis with respect to errors in cloud position.