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Cloud optical properties from surface radiation measurements over snow and ice

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We present a simple method to extract year-round records of cloud optical thickness from radiation measurements made over snow and ice surfaces. A 'longwave-equivalent cloudiness', N_ε, obtained from longwave radiation measurements, is combined with the effective cloud optical thickness, τ, from shortwave data, to obtain consistent, year-round information on cloud properties. For a wide variety of Automatic Weather Stations (AWS) locations (Norwegian glaciers, Greenland ablation area, Antarctic coast and plateau), the good correlation between daily-mean N_ε and τ implies that shortwave radiative properties of clouds can be inferred using longwave radiation even in the absence of solar radiation itself. An error analysis shows that retrievals of τ are accurate to about 21% for hourly values, 11% for daily means, and about 6% for monthly means. As some applications, we will present clear- and cloudy-sky radiation budgets at several locations, and demonstrate that it is possible to compute trends of cloud optical thickness in longer radiation data series. This method can prove useful both for those that wish to gain more information on cloud climate from their radiation data sets on snow and ice surfaces (e.g. AWSs), and for those that are looking for validation data of satellite products of cloud optical thickness in remote polar areas over snow and ice surfaces.