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A new albedo parameterization for the use in climate models over ice sheets

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A physically based parameterization for the broadband albedo of snow is included in a regional climate model (RACMO2.1/ANT) for Antarctica, and validated against field observations for the period 1995–2004. The parameterization is based on snow grain size evolution, cloud optical thickness, and solar zenith angle. Over the Antarctic continent, modeled snow grain size exhibits expected behaviour. The agreement between modeled and observed albedo is very good when compared to measurements taken at Neumayer, Dronning Maud Land. The new parameterization does a good job at simulating subtle changes in the observed albedo. December–February mean differences in modeled and observed net shortwave radiation range from –3.8 to +8.7 W m^{-2} between 1995 and 2004, with a mean bias of +2.7 W m^{-2}. This is a considerable improvement over the previous RACMO2.1/ANT albedo parameterization, that overestimated the net shortwave fluxes by +15.0 to +22.7 W m^{-2}, or 40–55% of the observed net shortwave flux over the same period. The improved simulation of ice sheet albedo opens up possibilities to use melt extent, duration and volume as indicators for climate change.