Using a regional climate model to derive melt extent and volume at the surface of Antarctic ice shelves

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Meltwater that is produced at the surface of an ice shelf can fill up crevasses and deepen them, eventually leading to the complete disintegration of the ice shelf. Assessing the volume of meltwater produced around the Antarctic continent is challenging and requires a regional climate model equipped with good snow physics for estimating various parts of the surface mass balance. RACMO2.1/ANT is such a model, and has been run over the continent at $27x27$ km^2 resolution from 1989–2009 using ERA Interim fields as lateral domain boundaries. The model features a sophisticated multi-layer snow scheme allowing for melt, percolation, refreezing and runoff. A new snow albedo scheme based on snow grain size evolution allows for simulating realistically the strongly positive feedback between melt and albedo. For the period 1989–2009, melt extent and duration from RACMO2.1/ANT are validated against microwave-derived melt extent and duration using the SSM/I satellite sensors. The agreement between RACMO2.1/ANT and the satellite-derived products is very good if care is taken to synchronize the model output with the timing of the satellite overpasses (early morning and late evening). RACMO2.1/ANT is subsequently used to assess how much melting is missed by the satellites due to the unfavourable overpass times, and to complement satellite melt extent and duration with a time series of melt water volume.