



Satellite microwave observations of the interannual variability of snowmelt on sea ice in the Southern Ocean

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Snowmelt processes on Antarctic sea ice are examined. We present a simple snowmelt indicator based on diurnal brightness temperature variations from microwave satellite data. The method is validated through extensive field data from the western Weddell Sea and lends itself to the investigation of interannual and spatial variations of the typical snowmelt on Antarctic sea ice. We use in situ measurements of physical snow properties to show that despite the absence of strong melting, the summer period is distinct from all other seasons with enhanced diurnal variations of snow wetness. A microwave emission model reveals that repeated thawing and refreezing causes the typical microwave emissivity signatures that are found on perennial Antarctic sea ice during summer. The proposed melt indicator accounts for the characteristic phenomenological stages of snowmelt in the Southern Ocean and detects the onset of diurnal snow wetting. An algorithm is presented to map large-scale snowmelt onset, based on satellite data from the period between 1988 and 2006. The results indicate strong meridional gradients of snowmelt onset with the Weddell, Amundsen and Ross Seas showing earliest (beginning of October) and most frequent snowmelt. Moreover, a distinct interannual variability of melt onset dates and large areas of first-year ice where no diurnal freeze-thawing occurs at the surface are determined.