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MeDAntS – a longterm dataset on the onset of snowmelt on Antarctic sea ice

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The polar cryoshere and sea ice in particular represents a key factor for a monitoring of climate change. The complex feeback mechanisms through which sea ice interacts with the global circulation of the atmosphere and the ocean are considerably amplified by an additional snow cover. Thereby, seasonal variations of the physical snow properties, and the onset of snowmelt in particular, make a significant contribution to the local and regional energy budget as well as the to the sea-ice mass balance. This study provides the first long-term investigations of the trait of snowmelt on Antarctic sea ice based on satellite microwave imagery in combination with in-situ measurements from the Weddell Sea during the summer of 2004/2005. As revealed by the field data, the snow is not melting completely during summer. Instead, pronounced diurnal freeze-thaw-cycles are prevailing, causing a growth and rounding of snow grains as well as the formation of internal ice layers. Through a careful examination of in-situ measurements together with coincident satellite observations, as well as through modelling the microwave emissivity of the snow cover, a new indicator to identify summer melt on Antarctic sea ice could be derived. The indicator describes diurnal variations of the microwave emissivity of snow and clearly highlights the summer period within the seasonal cycle of snow on sea ice. The indicator was used in a new threshold algorithm to derive snowmelt-onset maps for the entire sea-ice area in the Antarctic. By applying the new method to long time series of satellite data, a comprehensive data set could be prepared, resuming the spatial and temporal varaibility of snowmelt onset

on Antarctic sea ice from 1988 to 2006. Results show, that no significant trends in the onset of melt can be observed in the observational period and that snowmelt is considerably weaker as compared to the Arctic. An investigation of atmospheric forcing through the examination of meteorological reanalysis data reveals the general impact of circumpolar atmospheric patterns on the interannual variations of the onset and the strength of snowmelt during summer.