A satellite-based climatology of wind-induced surface temperature anomalies for the Antarctic

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It is well-known that katabatic winds can be detected as warm signatures in the surface temperature over the slopes of the Antarctic ice sheets. For appropriate synoptic forcing and/or topographic channeling katabatic surges occur, which result in warm signatures also over adjacent ice shelves. Over more or less homogeneous parts of the ice sheet slopes so-called katabatic streaks are found as well. At the Antarctic Peninsula foehn warming effects can also cause a warm signal in the surface temperatures. MODIS ice surface temperatures (IST) with a spatial resolution of 1km are evaluated for the whole Antarctic for the winter periods 2002-2017. Firstly we aggregate all cloud-free pixels as monthly means. The wind-induced warming over the slopes can clearly be seen, and signatures of persistent surge areas are found in particular for the Ross Ice Shelf (RIS). In order to filter the seasonal temperature variation, we derive a climatology of wind-induced IST anomalies focusing on the RIS, the eastern Weddell Sea (Halley area) and the Larsen ice shelf at the Antarctic Peninsula. The anomaly is computed with respect to the monthly mean IST of an area on the ice shelves, which is not affected by the katabatic winds and surges. The anomaly distributions show maxima around 10-15K for the slopes, but values of more than 25K are also found. These results suggest that wind-induced warming is also relevant for the surface energy balance, the snow structure and surface melting.