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An enhanced resolution QuikSCAT derived Antarctic melt record (1999-2009): development and evaluation of wavelet-based methods

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We present a record of spatial and temporal melt distribution over Antarctica estimated from a spatially enhanced QuikSCAT dataset distributed by the NASA Scatterometer Climate Record Pathfinder (SCP), at Bingham Young University (Utah, USA). The effective spatial resolution of this dataset is $\sim$5 km. We report melting trends at both regional and continental scale as well as detailed maps of melting over specific regions of Antarctica. Estimates date of melt onset (MO) and extent (ME) are produced from both spatio-temporal dynamic and fixed-threshold based methods. The fixed-thresholding case assumes that melting occurs at times where the recorded normalized radar cross section (σ^0) decreases below the average wintertime value minus a fixed set threshold. Two distinct thresholds values are considered, first based on previous studies and the second derived from electromagnetic modeling (e.g., strong fluctuation theory). Alternately, melting is estimated dynamically, by applying a discrete, dyadic scale, wavelet transform to seasonal σ^0 time series at each pixel. Melt events are chosen from the wavelet coefficients by tracing significant wavelet maximum peaks from a coarse to a finer temporal scale. Only maxima that are significant over multiple temporal scales, which imply a sustained change in σ^0, are retained. Differently from other studies reported in the literature making use of wavelet-based thresholds, no a-priori information is used in our approach. We compare the output of the above-mentioned algorithms with melting estimated from the analysis of surface temperature (10m) provided by automated weather stations (AWS). We also compare melting derived from QuikSCAT with that obtained from passive microwave observations (SSM/I) using approaches proposed in the literature. Besides providing a tool for assessing the different approaches using QuikSCAT data, the comparison between active and passive sensors also allows to study the spatial distribution of melting within each passive cell grid, in view of the enhanced resolution of the active product.