

Comparison of SSM/I- and SAR-derived estimates of old ice area in the Arctic

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The Arctic sea ice cover is considered to be a potential early indicator of global warming, which is expected to be enhanced in the Polar Regions. Satellite microwave data has been the main tool for examining the general characteristics of the sea ice cover, such as ice extent, ice concentration and old (multiyear) ice area. Analysis of SMMR- and SSM/I-derived sea ice characteristics has revealed a significant decrease of the sea ice cover in the Arctic since 1978. The greatest decreases were observed in the summer and in the old ice area. According to the definition, old ice is sea ice that has survived the summer melting. The area of old ice after the beginning of freeze-up should then be approximately equal to the minimum total ice area observed in late summer. During the winter the old ice area decreases due to the ice export, mainly through the Fram Strait, and also due to deformation. The mean monthly ice areas, calculated from SSM/I data using the NORSEX-algorithm, were compared with mean monthly ice areas in Zakharov data set for the period 1978-1999. The average decrease amounted to 34225 km²/year and 26150 km²/year, respectively. The monthly mean old ice areas for November revealed a decrease of 35300 km²/year for the same period. Due to a significant difference in the backscatter coefficient, the old ice can be distinguished from new or first-year ice in radar images. In our studies we used X-band RAR images from OKEAN satellite, and C-band SAR images from RADARSAT and ENVISAT satellites. SSM/I-derived estimates of multiyear ice area in selected days for November 1997 and March 1998 were compared with estimates derived from RADARSAT images for the same days, covering almost the whole Arctic. Similar comparison has been made for the old ice area produced from recent (2004) ENVISAT wide swath and global mode data. Comparison of OKEAN- and SSM/I- derived old ice areas were made for several areas in the Eurasian Arctic. Based on the comparison analysis, discussion on the accuracy of old ice area from SSM/I and radar data are presented.