



Multi year sea ice concentration mapping using passive and active microwave sensors

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The sea ice cover, which presently is perennial in the Arctic Ocean and at least seasonal in its marginal seas, is an important component of the global climate system. A consensus in the climate modelling community is that global warming should be amplified in the Arctic due to feedback processes within the atmosphere-ocean-ice climate system. The amplified warming suggests a drastic reduction of the sea ice cover. The most consistent, quantitative means to monitor the Arctic sea ice cover is from satellite-borne passive microwave sensors. At present, changes of the spatial coverage or extent of sea ice cover for the passive microwave data era is well described. However, changes of composition of sea ice cover, in terms of ice types, are not adequately understood. This study is an extension of the Johannessen et al, 1999 research that reported the 14% reduction of the multi year ice cover for 1978 - 1998 on the one hand and demonstrated problems of retrieving multi year ice concentrations from passive microwave data (growth of calculated by NORSEX algorithm multiyear ice coverage) on the other hand. In the study the QuikSCAT scatterometer data was used as a complimentary source of information that assisted in separating first year and multi year ice, improving algorithm of multi year ice retrieval and describing multi year ice movement in the periods when passive microwave retrievals cannot provide a stable picture. NORSEX calculations and QuikSCAT-based retrievals were validated using available SAR images, ice charts and in situ ice type observations. Finally, the improved NORSEX algorithm is introduced, and a new multi year ice concentration dataset for 1978-2005 is presented. Capabilities and limitations of passive microwave algorithms in estimating the relative coverage of first year and multi year ice are discussed and quantitatively established.