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Observed and modeled sea ice variability in the Arctic

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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, which is the predominant feature of its physical environment. 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 ocean–climate system. However, the past and present spatial-temporal variability of this key parameter is not completely known or understood.

The most consistent, quantitative means to monitor the Arctic sea-ice cover is from satellite-borne passive microwave sensors. In the presented study merged "inter-calibrated" SMMR-SSM/I time series have been produced and analysed, establishing the trend of the Arctic sea ice cover of about 3% per decade. The reductions have been mostly pronounced in the European sector in winter and the Siberian-Alaskan sector in the summer, with the record of low arctic ice minima in the 1990s and 2002. The pronounced summer reductions imply changes in the character of the ice cover – i.e., reduced amount of perennial, multi-year (MY) ice. The negative trend in MY ice area analysis is often cited as evidence of a substantial change in the ice cover. However, the capabilities and limitations of passive microwave algorithms to estimate of the relative coverage of FY and MY ice have not been quantitatively established. In this study the validation of the NORSEX algorithm is presented based on the comparison with SAR image expert interpreted sea ice data. For this purpose RADARSAT ScanSAR images covering the whole Arctic in November 1997 and March 1998 have been used. Besides, a new approach, based on the neural networks, is suggested for

MY ice concentration retrievals.

A set of model predictions is used to quantify changes in the ice cover through the twenty-first century, with greater reductions expected in summer than winter. In summer, a predominantly sea-ice-free Arctic is predicted for the end of this century.