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Improved retrieval of multiyear ice concentration from satellite passive and active microwave observations

E.Shalina (1), S.Sandven (2)

(1) Nansen International Environmental and Remote Sensing Centre, (2) Nansen Environmental and Remote Sensing Centre (elena.shalina@niersc.spb.ru)

The most consistent and the longest available quantitative means to monitor the arctic sea ice cover is from satellite-borne passive microwave sensors. However, the present algorithms for observing the arctic ice are not quite accurate in multiyear fraction calculations, which is a significant disadvantage of the present system of global ice monitoring considering the fact that multiyear ice is one of the key indicators of changes in the Arctic climate. A number of studies demonstrated problems of retrieving multi year ice concentrations from passive microwave data. Those problems are manifested mainly by growth of calculated with passive microwave algorithms multiyear ice coverage during winter. The improvement of multiyear fraction calculations based on NORSEX algorithm is achieved through adding in a calculation procedure active microwave satellite data. QuikSCAT scatterometer data is used as a complimentary source of information that assists in separating firstyear and multiyear ice. Sea ice backscatter maps help to correct the cases where passive microwave algorithm incorrectly classify firstyear ice as multiyear, they also allow to describe multi year ice extent changes in the periods when passive microwave retrievals cannot provide a stable result. Capabilities and limitations of using passive and active microwave data for estimating the relative coverage of first year and multi year ice in the Arctic are discussed and quantitatively established. Improved NORSEX retrievals are validated using available ASAR images and ice charts produced at NIC and AARI. Comparison of calculated multiyear ice maps with NASA Team and EUMETSAT Ocean & Sea Ice Satellite Application Facility (OSI SAF) multiyear ice maps is demonstrated. It is shown that improved NORSEX algorithm provides better results than two men-

tioned sources. The attempt to reconstruct multiyear ice changes from the beginning of passive microwave observations is described and the comparison with September minimum ice changes is shown.