POLAR SEA ICE IDENTIFICATION USING NSCAT DUAL-POLARIZED BACKSCATTER MEASUREMENTS

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The applications of NASA Scatterometer (NSCAT) data to the mapping and monitoring of sea ice edges are described in this paper. The trends of sea ice extents of the polar sea ice covers have been suggested as useful indicators of climate changes. Additionally, the location and change of ice edge in the Arctic are useful for the ship navigation in coastal waters. Earlier studies of ice extent have relied principally on weekly maps of sea ice produced by the National Ice Center (NIC). These maps are the result of a subjective analysis of a combination of visible, infrared and passive microwave data from various spaceborne sensors as well as observations of opportunity from aircraft and ships. More recent investigations on polar sea ice have been based on the data collected by multi-frequency radiometers, including the Scanning Multichannel Microwave Radiometer (SMMR) instrument and Special Sensor Microwave Image (SSM/I). The SMMR and SSM/I data have been used to produce routine sea ice concentration maps. However, the most widely used algorithm developed by Nimbus-7 SMMR team for SMMR and SSM/I radiometers remains affected by the spatial and temporal variations in the microwave signature of sea ice and local meteorological conditions.

Our recent investigation has shown that a dual-polarized Ku-band scatterometer could be used to discriminate sea ice from open water and that a routine ice edge product derived from active microwave data could provide an important complement to the SSM/I estimates. This algorithm, utilizing a combination of backscatter intensity and polarization behavior to separate the open water pixels from the sea ice pixels, has been demonstrated with the Ku-band dual-polarized backscatter data acquired by the SeaSat scatterometer (SASS) in July 1978 for Arctic and Antarctic sea ice. This paper investigates the applications of this algorithm to the data from NSCAT, which was launched on the Japanese ADEOS-1 spacecraft in August 1996 and started to operate in September. The results show that the copolarized scattering ratio of sea ice after summer remains to be quite distinct from that of open water. The sea ice edge derived from NSCAT data is in reasonable agreement with that from NIC, although NIC ice edge appears to slightly overestimate the extent of sea ice cover. Hence, the algorithm developed for SASS was shown to be applicable to NSCAT data. Furthermore, it is shown that NSCAT data can be used to produce a sea ice map for every three to four days, enabling a frequent monitoring and change detection of sea ice edge.