Research on Arctic Sea-ice Type and Freeboard Detection Based on the Surface Waves Investigation and Monitoring Instrument of the China-French Ocean Satellite

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Résumé

The sea-ice type and thickness are the key parameters for Arctic sea-ice monitoring. Traditionally, Arctic sea-ice types are mainly identified based on the scatterometer and Synthetic Aperture Radar (SAR) with the medium-incidence angles; Arctic sea-ice thickness is primarily retrieved from the sea-ice freeboard extracted using the satellite altimeter data with the normal incidence. The Surface Wave Investigation and Monitoring instrument (SWIM) on the China-France Oceanography Satellite (CFOSAT) is a new type sensor with the low-incidence-angle (0○, 2○, 4○, 8○ and 10○) detection mode which is different from traditional remote sensors. SWIM can obtain the backscattering information and sea-ice echo signals, and has the sea-ice detection capability of the altimeter and the scatterometer. SWIM has the potential to detect the sea-ice type and freeboard. The sea-ice detection method based on SWIM is also under development. In this research, the sea-ice classification and the sea-ice freeboard retrieval methods using the SWIM's low-incidence-angle observations are proposed. Firstly, there are eleven echo waveform features extracted from the SWIM with the six low-incidence angles, including the backscattering power, the leading-edge width, the leading-edge slope, the stack standard deviation, the skewness and so on. Secondly, the sea-ice is classified using the echo waveform features are studied based on the SWIM data from November 2019 to April 2020, then the classification results are compared with the ice charts of the State Scientific Center of the Russian Federation the Arctic and Antarctic Research Institute (AARI) to obtain the classification accuracies, and the optimal feature sets for the sea-ice classification of SWIM are chosen. Thirdly, the ability of the echo waveform features responding to the sea-ice freeboard is studied based on the SWIM data from December 2019 to March 2020, then the retrieval results are compared with the sea-ice products of the Cryosat-2 to obtain the retrieval accuracies, and the sensitive feature sets are selected. This research will expand new horizons for the SWIM ocean detection application.

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