TIMING OF ARCTIC SEA ICE ALBEDO TRANSITIONS

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The ice-albedo feedback mechanism plays a key role in the heat and mass balance of the ice and upper ocean in the Arctic that affects the global climate system. We derive the timing of Arctic sea ice albedo transitions using RADARSAT-1 data from the Arctic Snapshot program and sea ice products from the RADARSAT Geophysical Processor System (RGPS). This is done in conjunction with field measurements from SHEBA (Surface Heat Budget of the Arctic Ocean) and C-ICE (Collaborative Interdisciplinary Cryospheric Experiments). Results from SHEBA used in Climate System Model GCM (General Circulation Model) calculations show that the exact timing of the albedo transitions is important for an accurate estimation of the total solar heat input into the sea ice cover.

Albedo of snow-covered sea ice has significant changes between phases of freezing and melting during seasonal transition periods. C-band backscatter has a large change between these different phases (5 to 10 dB) and the backscatter change is considered as a switch corresponding to the significant albedo change. However, the challenge is to determine the backscatter change caused by albedo transition and separate backscatter change caused by ice motion and deformation. Our approach is to use time-series RADARSAT backscatter tracked over Lagrangian cells around SHEBA site. Timing of the backscatter switches is determined from the RADARSAT time-series, and the correlation between backscatter switches and albedo changes together with heat flux balance and other parameters obtained from SHEBA are studied.

With RGPS tracking of backscatter, we can determine the response from the same piece of sea ice. We exclude locations with large ice convergence and divergence (by RGPS) to ensure that observed backscatter changes are not caused by ice ridging or lead formation. The use of RGPS products together with available extensive observations from the SHEBA program allow an unprecedented capability for this study. We obtained the time-series results including backscatter, divergence, shear, and vorticity from RGPS tracked over the SHEBA site during the 1998 Spring-Summer transition period. RGPS/SHEBA results show that the time at the start of albedo change can be determined accurately to within the temporal resolution of RARDASAT coverage, the snow melt period can be identified, and the time of initial pond formation corresponds to a backscatter peak. Furthermore, the Canadian C-ICE field program with concurrent RADARSAT-1 and QuikSCAT data collected over this site can provide more data sets to extent this study over fast ice in the Canadian Arctic archipelago region. We plan carry out the analysis over local, aggregation, and regional scales.

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