Application of SRB data to evaluation of snow/ice albedo parameterization in models

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The Arctic sea ice has been decreasing in both extent and thickness and shifting towards first-year ice (FYI) dominated. This has resulted in lower albedo, allowing more solar energy deposited in the Arctic Ocean. In 2012 and 2013, an Ice Mass Balance buoy (IMB) and a Spectral Radiation Buoy (SRB) were deployed on the first-year ice (FYI) in the central Arctic in springtime. The IMB monitored the thermodynamic changes at the ice surface and bottom, and the SRB measured the spectral solar radiation above and below FYI from spring to autumn in the two years. The albedo in the two years shows a high value during pre-melt season. It started to decrease in June when snow began to melt, reaching minimum in July. Then after a rapid increase, the albedo gradually returned to pre-melt value. These albedo observations are used to evaluate 6 existing albedo parameterizations, which are mostly based on observations on MYI. The evaluation results indicate the albedo parameterization either overestimate or underestimate the albedo evolution during the melting season. The albedo parameterizations are also assessed by incorporating into two sea ice models, the one dimensional high resolution thermodynamic snow and ice model HIGHTSI, and the Las Alamos Sea Ice Model CICE to simulate the seasonal evolution of the ice mass balance