

Response to Anonymous Reviewer #1:

The reviewer suggested two general changes and several small editorial modifications.

1) How does the albedo of snow over sea ice evolve over time and how does it differ from the albedo for sea ice in the CCSM?

I believe some clarification of the albedo treatment was warranted, and the edited manuscript contains additional text elaborating on the Delta Eddington parameterization and citing work by D. Perovich on the albedo evolution of snow. To quickly summarize, the DE parameterization considers several variables but temperature and snow age are not among them. D. Perovich found upwards of .2 drop in albedo as snow ages (Perovich 1998). While important, this study focuses on the impacts of snow thickness.

"2) Have the authors considered examining the long term trends in snow over sea ice and how this may be related to changes in snowfall in the Arctic?"

Adding a small discussion of the future projections of snow depth and the implications for the Arctic climate also increases the impact of the work. The authors and other parties have examined these changes. I have added a small discussion in the introduction and conclusion with citations: Hezel et al 2012, Vavrus et al 2012, Blazey et al 2012. The first two included projected decreases in snow depth throughout the 21st century, while the latter includes an investigation of the thermodynamic impact of the projected decline. By way of summary, the snow cover decreases throughout the 21st century. The impact on the energy budget is large in terms of both albedo and conductivity, but the net effect is a slight increase in flux to the ice.

The authors have made corrections as outlined by the specific editorial comments, and appreciate the additional proofreading.

Blazey, B A, 2012: Snow Cover on the Arctic Sea Ice: Model Validation, Sensitivity, and 21st Century Projections, Ph.D. Dissertation, University of Colorado, USA

Hezel, P. J., X. Zhang, C. M. Bitz, B. P. Kelly, and F. Massonnet (2012), Projected decline in spring snow depth on Arctic sea ice caused by progressively later autumn open ocean freeze-up this century, *Geophys. Res. Lett.*, 39, L17505, doi:10.1029/2012GL052794.

Perovich, D.K., C.S. Roesler, and W.S. Pegau, 1998, Variability in sea ice optical properties, *J. Geophys. Res.*, 103, 1193-1209.

Vavrus, S., and D. Waliser, 2008: An improved parameterization for simulating Arctic cloud amount in the CCSM3 climate model, *J. Climate*, 21, 5673-5687