The contribution of sub-grid snow distributions to climate change and polar amplification in a quadrupled CO2 world using a coupled GCM.

Ryouta O'ishi[1,2], Tomoko Nitta[1,2], Kumiko Takata[1,3], Tetsuo Sueyoshi[3], Glen E. Liston[4], Ayako Abe-Ouchi[2,3]
[1] *National Institute of Polar Research*
[2]*Atmosphere and Ocean Research Institute, the University of Tokyo*
[3] *JAMSTEC*
[4]*Cooperative Institute for Research in the Atmosphere, Colorado State University*

Snow cover evolution is an important factor in snow albedo feedback processes and thus "Polar amplification" within future climate projections simulated using general circulation models (GCMs). In the present study, we introduce a sub-grid snow distribution submodel (SSNOWD; Liston 2004) into the Minimal Advanced Treatments of Surface Interaction and RunOff (MATSIRO; Takata et al. 2003, Nitta et al. in preparation) land surface scheme, which is coupled interactively with a GCM known as the Model for Interdisciplinary Research on Climate (MIROC; Watanabe et al. 2010).

By using this new version of MIROC GCM with SSNOWD, we compare and evaluate the warming in a quadrupled CO2 experiment with a pre-industrial control experiment. We also compared a quadrupled CO2 experiment with a control using the original version of MIROC which assumes a simple empirical relation between snow amount and snow cover in a grid-cell. We finally estimate how the introduction of the sub-grid snow distribution representation contributes to the large-scale climate change and the polar amplification in the quadrupled CO2 world. We also quantified the impact of SSNOWD on the climate sensitivity by so called Gregory plot.