



## **The contribution of sub-grid snow distributions to climate change and polar amplification in a quadrupled CO<sub>2</sub> world using a coupled GCM.**

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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 CO<sub>2</sub> experiment with a pre-industrial control experiment. We also compared a quadrupled CO<sub>2</sub> 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 CO<sub>2</sub> world.