



## **Investigating the spread of surface albedo in snow covered forests in CMIP5 models**

Libo Wang (1), Jason Cole (2), Paul Bartlett (1), Diana Verseghy (1), Chris Derksen (1), Ross Brown (3), and Knut von Salzen (2)

(1) Climate Processes Section, Environment and Climate Change Canada, Toronto, Ontario, Canada , (2) Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, British Columbia, Canada, (3) Climate Processes Section, Ouranos, Environment and Climate Change Canada, Montreal, Québec, Canada

This study investigates the role of leaf/plant area index (LAI/PAI) specification on the large spread of winter albedo simulated by climate models. To examine the sensitivity of winter albedo to LAI, we perform a sensitivity analysis using two methods commonly used to compute albedo in snow-covered forests as well as diagnostic calculations within version 4.2 of the Canadian Atmospheric Model for which PAI is systematically varied. The results show that the simulated albedo is very sensitive to negative PAI biases, especially for smaller PAI values. The LAI and surface albedo of boreal forests in the presence of snow simulated by the Coupled Model Intercomparison Project Phase 5 (CMIP5) models are evaluated using satellite observations. The evaluation of CMIP5 models suggest that inaccurate tree cover fraction due to improper plant functional type specification or erroneous LAI parameterization in some models explains, in part, an observed positive bias in winter albedo over boreal forest regions of the Northern Hemisphere. This contributes to a large intermodel spread in simulated surface albedo in the presence of snow over these regions and is largely responsible for uncertainties in simulated snow-albedo feedback strength. Errors are largest (+20-40 %) in models with large underestimation of LAI but are typically within  $\pm 15\%$  when simulated LAI is within the observed range. This study underscores the importance of accurate representation of vegetation distribution and parameters in realistic simulation of surface albedo.