Geophysical Research Abstracts
Vol. 12, EGU2010-6211, 2010
EGU General Assembly 2010

Potential effects of albedo feedbacks due to land cover change in Siberia under current IPCC climate change scenarios

Nadezda M. Tchebakova, Elena I. Parfenova, and Amber J. Soja
Institute of Forest, Russian Academy of Sciences, GIS, Krasnoyarsk, Russian Federation (ncheby@forest.akadem.ru)

Our goal is to evaluate the potential effects of feedbacks from vegetation-induced albedo change and its potential to accelerate or mitigate vegetation shifts. First, we simulated vegetation cover change in Siberia by 2080 to investigate vegetation change feedbacks on the alteration of surface albedo and energy. We applied our Siberian BioClimatic Model (SiBCliM) to the HadCM3 A2 (largest temperature increase) and B1 (smallest temperature increase) scenarios of the Hadley Centre (IPCC, 2007) to highlight potential shifts in large-scale vegetation cover. Large changes in land cover are predicted from the A2 scenario: coverage by northern vegetation types (tundra, forest-tundra, and taiga) would decrease; and southern habitats (forest-steppe, steppe and semidesert) would expand. Altered land cover would feedback to surface reflectivity (albedo) resulting in net radiation alterations. We calculate annual albedo as the mean summer albedo during months with no snow cover, winter albedo during months with snow cover and transition months with partial snow cover. In a warmer climate, by 2080, albedo would increase in the southern and middle latitudes in Siberia due to the forest retreat. In the northern latitudes and highlands, tundra would be replaced by the forest and albedo would decrease. Albedo-induced solar radiation change suggest that the annual shortwave and consequently net radiation would decrease in 2/3 of the area in the south and would increase in 1/3 of the area in the north, resulting in an even greater warming than currently predicted in the high latitudes. These climate change corrections are applied to IPCC A2 and B1 climate change scenarios, and then, SiBCliM is used to simulate vegetation shifts, with consideration of the predicted feedbacks. The comparison of vegetation distributions in Siberia predicted without/with albedo feedback corrections suggests that the forest advance into tundra may accelerate warming in the north and steppe advance into forest may mitigate warming in mid-latitudes.