Geophysical Research Abstracts,
Vol. 11, EGU2009-1410, 2009
EGU General Assembly 2009

Vegetation modeling in Yakutia, northeastern Siberia: connecting to palaeovegetation simulation and model-data comparison

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Vegetation model is a useful tool to understand the impacts of climate change on ecosystems in the present, past and future. Simulation of the palaeovegetation can link the geographical pattern of vegetation in the past to pollen proxy and then test the palaeoclimate modeling. In this study we used an equilibrium vegetation model (BIOME4) and a dynamic vegetation model (LPJ) to predict the present-day vegetation pattern and their dynamic changes from 1901-2002 in Yakutia, an Arctic and sub-Arctic region in eastern Siberia, where is sensitive to climate change. Both the models characterized the basic features of regional vegetation pattern, function and their changes through time. The BIOME4 simulated a reasonable pattern of present biome distribution compared to the regional vegetation maps, the deciduous taiga-montane forests in the southern and central Yakutia, evergreen taiga-montane forests in the southwestern mountainous region and in the eastern coast, shrub tundra and dwarf shrub tundra in the northwest and northeast mixed with temperate xerophytic shrubland. In the NW Yakutia the LPJ demonstrated a dynamic change of local vegetation during the past 102 years responding to the changed climates. Forest and shrub covered the large area from the beginning to the 1950s of the 20th Century. Tundra extended from the west to the east during 1960s to 1970s. The woody plants extended in 1980s and in late 1990s to early 21st Century and grasses extended in 1990s. The performance of global vegetation models in regional study is well, but problems still existed. More plant functional types especially the shrubs and grasses and climatic constraints to them should be taken into account when improving the models. Soil water-related parameters should be redefined. The modules of permafrost, snow, and fire should be added or modified. Regional input data of climates, vegetation and soils at finer resolutions will be obtained from the regional and local studies.