Quantifying of feedback between atmosphere-vegetation-hydrology in the permafrost zone of Scandinavia and Northern Russia

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Assessment of the potential impacts of climatic and associated ecosystem changes in Northern Europe is in focus of this project. Dynamic global vegetation models (DGVMs) combining mechanistic representations of plant physiology, canopy biophysics, soil processes and population dynamics will be used for these purposes.
Process-based model SEVER-DGVM (Venevsky, Maksiutov, 2007) will be applied to describe current and future tree-line location and it'structure in relation to climatic and terrain properties. As part of the modelling exercises, the ecosystem model will be extended and tested using a permafrost module (Venevsky, 2006), which will be significantly modified for conditions of European Northern permafrost zone. In its recent state the permafrost module describes thermal and hydrological dynamics as a function of integrated positive and negative ground temperatures in the previous year, actual ground moisture, ground texture, and heat capacity and conductivity of the ground. Simulated distributions of continuous and discontinuous permafrost correspond well to observations, and permafrost effects on soil water availability and runoff improve modelled patterns of terrestrial ecosystem water balance and net primary productivity (NPP) (Venevsky, 2006).
Field measurements from Abisko Research Station, Sweden and Syktyvkar Institute of Biology, Russia and remote sensing data will be used to modify the large scale SEVER model to a landscape spatial resolution. Absent data will be additionally collected in the field.
A modified model will be used to study effect of climate change upon hydrological status of soil, vegetation composition and carbon exchange in Northern Europe, including Fennoscandia and the permafrost zone of European Russia.

References

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