Geophysical Research Abstracts
Vol. 21, EGU2019-15306, 2019
EGU General Assembly 2019

Sensitivity of snow cover dynamics and associated surface energy fluxes to boreal forest management

Stephanie Eisner (1), Jan Magnusson (2), Richard Essery (3), and Rasmus Astrup (1)

(1) Norwegian Institute of Bioeconomy Research (NIBIO), Ås, Norway (stephanie.eisner@nibio.no), (2) The Norwegian Water Resources and Energy Directorate (NVE), Oslo, Norway, (3) University of Edinburgh, School of GeoSciences, Edinburgh, United Kingdom

In Fennoscandia, forestry is one of the main drivers of land cover/management change and the region is characterized by large-scale transitions in forest structure over the past century. The long-lasting snow cover is a major determinant of land-atmosphere exchange of energy and water in the boreal zone and structural forest characteristics such as stand density or species composition are known to govern snow accumulation and ablation processes. In order to balance carbon sequestration targets and biogeophysical climate effects of medium to long-term forest management strategies in the region, increased knowledge on the interactions between forest structure (as shaped by forest management) and snow cover dynamics is required.
This study aims to quantify the sensitivity of snowpack dynamics and associated surface energy fluxes and states to forest management interventions for the spatial domain of mainland Norway. Forest structural information was derived from the high-resolution, remote sensing-based forest map SAT-SKOG, which was classified into 12 structural forest types using a matrix scheme specifically developed for Fennoscandian forests (Majasalmi et al. 2018, Biogeosciences). The scheme differentiates between three species groups (spruce, pine, and deciduous dominated), and each group is further divided into four subgroups reflecting differences in structural stand characteristics. Based on the current species distribution and the forest structure matrix, we develop four synthetic forest management scenarios spanning a maximum range of land perturbation through tree species selection and density management/harvest.
For each management scenario, snow simulations are carried out using an updated version of the Flexible Snow Model (FSM). FSM2 is a multi-model framework of energy-balance snow models with intermediate complexity, and includes a one-layer representation of forest canopies. Canopy parameters for each forest type (leaf area index and vegetation height) are derived from a look-up table accompanying the classification scheme. All simulations are carried out at 3hr time steps and 1 km spatial resolution, and are analyzed for differences in latent and sensible heat fluxes, ground snowpack, net radiation, and albedo.