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Impacts of peatland forestation on regional climate conditions in Finland

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Climate response to anthropogenic land cover change happens more locally and occurs on a shorter time scale than the global warming due to increased GHGs. Over the second half of last Century, peatlands were vastly drained in Finland to stimulate forest growth for timber production. In this study, we investigate the biophysical effects of peatland forestation on near-surface climate conditions in Finland. For this, the regional climate model REMO, developed in Max Plank Institute (currently in Climate Service Center, Germany), provides an effective way. Two sets of 15-year climate simulations were done by REMO, using the historic (1920s; The 1st Finnish National Forest Inventory) and present-day (2000s; the 10th Finnish National Forest Inventory) land cover maps, respectively. The simulated surface air temperature and precipitation were then analyzed. In the most intensive peatland forestation area in Finland, the differences in monthly averaged daily mean surface air temperature show a warming effect around 0.2 to 0.3 K in February and March and reach to 0.5 K in April, whereas a slight cooling effect, less than 0.2 K, is found from May till October. Consequently, the selected snow clearance dates in model gridboxes over that area are advanced 0.5 to 4 days in the mean of 15 years. The monthly averaged precipitation only shows small differences, less than 10 mm/month, in a varied pattern in Finland from April to September. Furthermore, a more detailed analysis was conducted on the peatland forestation area with a 23% decrease in peatland and a 15% increase in forest types. 11 day running means of simulated temperature and energy balance terms, as well as snow depth were averaged over 15 years. Results show a positive feedback induced by peatland forestation between the surface air temperature and snow depth in snow melting period. This is because the warmer temperature caused by lower surface albedo due to more forest in snow cover period leads to a quicker and earlier snow melting. Meanwhile, surface albedo is reduced and consequently surface air temperature is increased. Additionally, the maximum difference from individual gridboxes in this area over 15 years of 11 day running means of daily mean surface air temperature reaches 2 K, which is four times as much as the maximum difference of 15-year regional average of that. This illustrates that the spring warming effect from peatland forestation in Finland is highly heterogeneous spatially and temporally.