



Testing Yasso07 and CENTURY soil C models with boreal forest soil C stocks and CO₂ efflux measurements

Boris Tupek (1), Mikko Peltoniemi (1), Samuli Launiainen (1), Liisa Kulmala (2), Timo Penttilä (1), and Aleksi Lehtonen (1)

(1) Natural Resources Institute Finland, Vantaa, Finland (boris.tupek@luke.fi), (2) Dept. Forest Sciences, University of Helsinki, Finland

Soil C models need further development, especially in terms of factors influencing spatial variability of soil C stocks and soil C stock changes. In this study we tested the estimates of soil C stocks and C stock changes of two widely used soil C models (Yasso07 and CENTURY) against measurements of the boreal forest soil C stock and CO₂ efflux at four forest sites in Finland. In addition we evaluated the effects of using coarse versus detailed meteorological, soil, and plant litter input data on modeled monthly CO₂ estimates. We found out that CO₂ estimates of both models showed similar seasonal CO₂ efflux pattern as the upscaled monthly measurements regardless of the fact whether the models used soil properties as input data. Winter and early summer CO₂ fluxes agreed somewhat better between estimates and measurements than summer CO₂ peaks and autumn CO₂ levels, which were underestimated by models. Both models also underestimated equilibrium soil carbon (SOC) stocks, although SOC of CENTURY were larger than SOCs of Yasso07. CENTURY was more sensitive to variation in meteorological input data than Yasso07 and also to functional form of temperature response to decomposition. In conclusion, for modeling boreal forest soil C Yasso07 would benefit from including soil properties in the model structure, while Century would benefit from reformulation of temperature and moisture functions.