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Evaluating the impact of disturbances on the carbon balance of forest ecosystems in Hokkaido by using data and model: fr

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Changes in carbon flux and storage in forest ecosystems are influenced by climate at various temporal and spatial scales, whereas carbon flux and storage are affected instantaneously and heterogeneously by artificial and natural disturbances at the local scale. Disturbance events such as forest fire, damage by insects, and forest harvest drastically change NEP and carbon storage. In this study, we address the effect of disturbance on carbon balance based on two scale; one is site scale and another is local scale.

First, we performed a baseline simulation of carbon dynamics and compared these values with those observed across a wide range of stand ages (old mixed forest and young and middle-aged larch forests). By taking into account seasonal variation in the understory leaf area index, simulated net ecosystem production (NEP), gross primary production, ecosystem respiration, and biomass for the three types of forests were consistent with observed values.

We compared two cases of simulations concerning the carbon balance: one taking account of spatial distribution of disturbance-induced forest age derived from forest inventory data (disturbance case) and another ignoring the disturbance impact (non-disturbance case). NEP was gradually and spatially changed ranging from 0 to 1 t C/ha/y depending on meteorological conditions such as temperature or solar radiation. On the other hand, in the case of disturbance, large NEP ranging from 3 to 5 t C/ha/y were distributed patchwise like hotspots, because forest age of these spots ranging from 20 to 100 years old and then younger than those of the non-disturbance case. In the 1970s, wood harvest and tree planting were intensively conducted in Hokkaido. In the disturbance case during this period, there were many hotspots which show negative NEP.

Keywords: process-based ecosystem model, eddy covariance method