EGU21-1902, updated on 19 Oct 2021
https://doi.org/10.5194/egusphere-egu21-1902
EGU General Assembly 2021

Spatial heterogeneity of subsoil organic carbon turnover times in forest ecosystems across China

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Soil organic carbon turnover time (τ, year) is an important indicator of soil carbon stability and sequestration capacity. However, our understanding of the spatial heterogeneity of subsoil τ still was poorly qualified over a large scale, even though subsoil organic carbon below 0.2 m accounts for the majority of total soil organic carbon. We compiled a dataset that consisted of 630 observations in subsoil (0.2 - 1 m) from published literatures to investigate the spatial heterogeneity of subsoil τ (defined as the ratio of soil carbon stock and net primary production) and explore its main environmental drivers using structural equation modelling (SEM) in forest ecosystems across China. Results indicated that mean (± standard deviation) subsoil τ was 72.4 ± 68.6 years with a large variability ranging from 2.3 to 896.2 years. Subsoil τ varied significantly with forest types that mean subsoil τ was the longest in deciduous broadleaf forest (82.9 ± 68.7 years), followed by evergreen needleleaf forest (77.6 ± 60.8 years), deciduous needleleaf forest (75.3 ± 78.6 years) and needleleaf and broadleaf mixed forest (71.3 ± 80.9 years), while the shortest τ in evergreen broadleaf forest (59.9 ± 40.7 years). SEM suggested that soil environment was the most important factor in predicting subsoil τ. However, the dominant driver differed with forest types, i.e. soil environment for evergreen broadleaf forest and climate for evergreen needleleaf forest. This study highlights the different dominant controlling factors in subsoil τ and improve our understanding of biogeographic variations of subsoil τ. These findings are essential to better understand (and reduce uncertainty) in biogeochemical models of subsoil carbon dynamics at regional scales.