EGU2020-10779
https://doi.org/10.5194/egusphere-egu2020-10779
EGU General Assembly 2020

Revisiting Carbon Storage in Northern Peatlands: Ground-Based Estimates and Top-Down Constraints from Holocene Global Carbon Budget Reconstructions

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Northern peatlands store large amounts of carbon (C) and have played an important role in the global carbon cycle since the Last Glacial Maximum. Most northern peatlands have established since the end of the deglaciation and accumulated C over the Holocene, leading to a total present-day stock of 500 ± 100 GtC. This is a consolidated estimate, emerging from a diversity of methods using observational data. Recently, Nichols and Peteet (2019 *Nature Geoscience* **12**: 917-921) presented an estimate of the northern peat C stock of 1055 GtC—exceeding previous estimates by a factor of two. Here, we will review various approaches and estimates of northern peatlands C storage in the literature and consider peat C storage in the context of the Holocene global C budget. We argue that the estimate by Nichols and Peteet is an overestimate, caused by systematic bias introduced by their inclusion of data that are representative for the major peatland regions and of records that lack direct measurements of C density. In particular, some "peatland" sites and data that were included in their synthesis were likely from lacustrine sediments prior to the onset of peat deposits. Furthermore, we argue that their estimate cannot be reconciled within the constraints offered by ice-core and marine records of stable C isotopes and estimated contributions from other processes that affected the terrestrial C storage during the Holocene.