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Carbon-water dynamics in European High Arctic mires of Svalbard over the last few thousand years

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The Arctic region of Europe is expected to undergo further dramatic environmental change in the coming century that could destabilize large amounts of belowground carbon, which is concentrated in Arctic peatlands. To address the sensitivity of Arctic peatland carbon over the recent past we investigated several mire sites in the inner fjords of western Svalbard, Norway. Organic deposits were studied to assess the sensitivity of mire carbon-water linkages to past climate variation. Carbon-rich Svalbard mires store about 26 to 61 kg C m-2 in deposits as thick as 1.4 m. Our own AMS radiocarbon measurements together with a survey of the published literature show that sequestered carbon in Svalbard mires is typically of mid- to late-Holocene age. We use radiocarbon measurements of fossil bryophytes together with Bayesian calibration and Monte Carlo simulations to quantify uncertainties in carbon sequestration. A pattern of highly variable carbon accumulation was identified that ranged from multi-centennial periods of rapid accumulation, as high as about 35 g C m-2 yr-1, to very slow or hiatus conditions that persisted for hundreds to thousands of years followed by renewed sequestration. Hydrological variation appears to be one important control on High Arctic mire carbon dynamics, in addition to past summer temperature changes. Together with marine, glacial and lake records, peat archives of terrestrial change contribute to a clearer picture of Arctic carbon sensitivity in the context of ongoing high-latitude warming.