Decadal Scale Changes in Permafrost Carbon Accrual Measured By ^{210}Pb

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Predictions of the net change in carbon pools of Arctic tundra remain controversial as warming causes ancient permafrost to thaw by deepening of the active layer. Uncertainty is due in part to a lack of long-term experimental setups relevant to future winter climate projections in Arctic systems. To better understand the response of permafrost carbon pools to changes in winter precipitation amount, we investigated soil depth profiles of organic carbon concentrations and activities of ^{7}Be and ^{210}Pb from a 22-year winter snow depth manipulation experiment in moist acidic tussock tundra at Toolik Lake, AK. Correlations of cumulative carbon dry mass (g cm^{-2}) vs. unsupported ^{210}Pb activity (mBq g^{-1}) indicated that the accumulation rates of both soil organic carbon and unsupported ^{210}Pb were substantially greater with increased snow depth relative to ambient conditions. Moist acidic tussock tundra may have been acting as a net carbon sink on decadal time scales. However, over the longer term (~50-100 years), the gradual expansion of shrubs along with the effects of warmer winters on the duration and magnitude of winter snowpack may add to the complexity of carbon source-sink relations in this Arctic ecosystem.

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