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Stability and biodegradability of organic matter from Arctic soils of Western Siberia: Insights from ^{13}C-NMR spectroscopy and elemental analysis

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Arctic soils contain large amounts of organic matter which, globally, exceed the amount of carbon stored in vegetation biomass and in the atmosphere. Recent studies emphasize the potential sensitivity for this soil organic matter (SOM) to be mineralised when faced with increasing ambient temperatures. In order to better refine the predictions about the response of SOM to climate warming, there is a need to increase the spatial coverage of empirical data on SOM quantity and quality in the Arctic area. This study provides, for the first time, a characterisation of SOM from the Gydan Peninsula in the Yamal Region, Western Siberia, Russia. On the one hand, soil humic acids and their humification state were characterised by measuring the elemental composition and diversity of functional groups using solid-state ^{13}C-NMR spectroscopy. Also, the total mineralisable carbon was measured. Our results show that there is a predominance of aliphatic carbon structures, with a distribution of functional groups that has a minimal variation both regionally and within soil depth. Such vertical homogeneity and low level of aromaticity reflects the accumulation in soil of lowly decomposed organic matter due to cold temperatures. Mineralisation rates were found to be independent of SOM quality, and to be mainly explained solely by the total carbon content. Overall, our results provide further evidence on the sensitivity that the soils of Western Siberia may have to increasing ambient temperatures and highlight the important role that this region can play in the global carbon balance under the effects of climate warming.