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Soil record of the Holocene paleofires at the north of European Russia

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Soils and sediments serve as complementary sources of detailed information on paleofires in various ecosystems. Despite the abundance of charcoal material entrapped in soils they remain relatively less studied pyrogenic archives in comparison to the sedimentary paleofire records (e.g. lacustrine and peat deposits), and that is especially the case for the most territory of Russia. We report here on the numerous soil archives of the Holocene forest fires at the Kola Peninsula (66.347°N, 37.948°E) and the north of Arkhangelsk region (64.747°N, 43.387°E) in Russia. Series of buried Podzols (up to ten successive profiles) separated by the distinct charcoal layers were revealed in specific geomorphological traps like the thermokarst depressions inherited from the early stages of moraine sediments formation (Kola Peninsula), as well as in active and paleokarst sinkholes in carbonate and sulfate rocks (Arkhangelsk region). The maximum temporal depth of archives was estimated as 10261±40 cal yr BP for the key site in Arkhangelsk region, with up to 12 major pyrogenic events recorded at the local scale. Soil formation at the inter-pyrogenic stages maintained a uniform direction for at least 10 thousand years and profiles of Podzols were regularly replicated at all the key sites. We employ here a combination of soil morphological hierarchical analysis, study of geomorphological processes leading to the burial of pyrogenic carbon, 14C dating of charcoal and TOC derived from the soil organic matter, carbon and nitrogen isotope ratio mass spectrometry and anthracomass concentrations analysis to extract a set of paleoenvironmental information from these soil archives. The study of complementary pyrogenic archives in the three-component system of the karst landscape (including bottom and slopes of the funnels, as well as the flat elevated areas between them) helped to mitigate overestimation or underestimation of the anthracomass concentration and allowed to acquire a detailed dataset on paleopyrogenic events at the local scale. This study is supported by the Russian Foundation for Basic Research, Project No. 19-29-05238.