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Historical trends of black carbon deposition in wetlands in Northeastern China

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Black carbon (BC) is produced by incomplete combustion of fossil fuels and biomass, and it is strongly influenced by human activities in recent hundreds years. Due to its refractory nature, BC is stored in sedimentary archives (e.g. wetland, lake sediments) and provides an ideal proxy to show historical fire frequency and regional BC emission. Increased slash-and-burn of pastures and forests during reclamation increases fire frequency, and thus influences regional BC emission and storage. However, few study investigated the influence of land use and land use change on regional BC deposition. To address this gap, we investigated BC deposition, and regional land use and settlement history in four wetland regions in Northeast of China: Sanjiang Plain, Changbai Mountain, Songnen Plain and Great Hinggan Mountain. People were encouraged by the government to settle in these regions and exploit natural resources after 1895. Our results showed that BC deposition fluxes in the different wetlands regions were around 10 (from 1 to 15) mg cm-2 yr-1 during the last 150 years, and were thus similar with results of studies on forest soils and higher than fluxes derived from other sedimentary archives. Wetland degradation caused by human reclamation and desertification in the surrounding landscape due to improper land use change BC storage and may also lead to BC losses in wetland soils. On the other hand, higher frequency of fire events caused by exploitation of resources lead to several peaks in BC deposition in the surrounding wetlands before the 1980s. After the 1980s, wild fires were controlled and forest protection policies were implemented by the government. This decreased regional fire frequency and thus BC deposition in the western region of Northeast of China. However, in the eastern regions, increasing anthropogenic impacts (e.g. industry sources) became the dominant factors on BC deposition and kept BC deposition fluxes increasing here.