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Postglacial sea-level rise and its impact on the circum-arctic Holocene climate evolution

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The global sea-level rise after the last glaciation not only affected the surface properties (circulation, T-S, sea ice seasonality) of the Arctic Ocean and nearby seas it also had a strong impact on the Holocene development of the shallow North Siberian shelf systems and the environmental evolution of the adjacent hinterland areas. In this region sea level reconstructions indicate the postglacial highstand occurred some time in the middle Holocene, between 6 to 5 ka (Klemann et al., 2015). After that time the sedimentary regime of the shelf seas stabilized as noted in a drastic decrease in sedimentation rates observed in all sediment cores taken from middle to outer shelf water depths of the Laptev Sea (Bauch et al. 2001). But, at water depths lower than 30 meters – i.e. in the inner shelf and nearer to the coasts – sedimentation continued at relatively higher rates, presumably due to input of terrigenous material from river runoff as well as coastal erosion. In relation to the latter process, the huge Lena Delta should comprise a region of sediment catchment where aggradation wins over erosion. However, little is known about the detailed history of this delta during the second half of the Holocene. We therefore have investigated three islands within the Lena Delta. All of these are comprised of massive peat of several meters in thickness. Picking discrete specimens of water mosses (Sphagnum) only, we have carefully dated these peat sections. The depth/age relation of the sampled profiles reflect the growth rate of peat, and thus, the islands. It shows that the islands' history above the present-day delta sea level is about 4000 yrs. old. Moreover, a significant change in peat growth is noted after 2500 yrs BP in both, accumulation and composition, and allows the conclusion of a major shift in Arctic environmental conditions since then. Thus, our results add further information also for other coastal studies, as the ongoing degradation of the rather vulnerable permafrost coast in the Laptev Sea and elsewhere along the North Siberian margin is central within the context of recent Arctic climate change due to global warming.
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