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Climatic differences between Estonia and Svalbard during the second half of the Holocene

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This overview compares various environmental publications to find out the contrasts and similarities in climatic conditions in the last 6000 years in Estonia and Svalbard.

Both regions with their geographical differences are sensitive to climate change, Estonia on the meeting borderline with maritime and continental air masses and Svalbard at the end of the North Atlantic Cyclone track with very changeable climatic conditions. The study aims to find out how the colder and warmer periods differ in the larger time scale such as the Middle and Late Holocene.

The Holocene in Estonia and Svalbard experienced dramatic climate changes including several cold and warm episodes. A variation of paleoclimatic records was compared with other geological proxies (lake sediments, glaciers, pollen, coastal and dune belt formation data presented in scientific publications) and a good correspondence between cold and warm climate periods was found in both areas.

The climate conditions were warm and dry during the Middle Holocene with step wise cooling, no glacigenic input in Svalbard, water level in Estonian lakes extremely low; abrupt decrease in temperature appeared around 4000 BP and 2500 BP in both areas. Approximately 4500 years BP, North Atlantic Oscillation (NAO) changed its phase from primarily positive NAO conditions to weakly positive NAO roughly for the next 2500 years. Around 4000 BP dry conditions changed to humid in Estonia and remained so for a thousand years (broad-leaved trees declined and pine forests became dominant approximately 3000 BP; stormy period 3300 - 3000 BP recorded in ancient beach formations), the climate likely shifted towards maritime; in Svalbard more intense precipitation stages were recorded in lakes runoff 3150 - 3000 BP. The next 2000 years the temperature appeared stabilised, Estonia mostly dry (more continental climate again) with a strong storm period characterised by large beach ridges in the NW of the country formed 2300 - 2000 BP, Svalbard cool and moist with possible glacier advance around 2000 BP and a 400-year humid phase in 1600 - 1350 BP. The Little Ice Age (LIA) occurred around 600 - 100 BP in Svalbard and 500 - 200 BP in Estonia. During the LIA, precipitation and storminess increased in Svalbard whereas the Estonian climate turned more continental (dry and cool) with prevailing northern storms, clearly reflecting in the morphology and shape of dunes formed during this period.

Despite the distinct climatic conditions between Estonia and Svalbard there's no major differences in climate in the last 6000 years, still some noticeable shifts occur. Several detectable changes

taking place in both areas were noticed around 3300 - 3000 BP: weaker NAO+ phase, humid conditions in Svalbard, exceptionally stormy period in Estonia followed by explicit changes in dominant tree species. During LIA more continental climate was dominating in Estonia while maritime influence was increasing in Svalbard. Similar opposite shifts in the past cannot be ruled out and need further investigations and more precise dating information.