

Concentration and grain-size distribution of aeolian sands in peat bogs as an indicator of past storminess in coastal areas of Estonia

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Storminess in the Baltic Sea region has significantly increased over the last 50 years. As we do not have meteorological data beyond 20th century, therefore the long-term changes in storminess (e.g., frequency and magnitude of the storms) and its impact on the coastal evolution are mostly unknown. This study aims to reconstruct the extreme storm events along the coast of Estonia in late Holocene, inferred from changes in grain-size distribution and concentration of aeolian sands preserved in peat deposits.

Four cores in total were collected from bogs of coastal Estonia; three from west Estonian archipelago (Hiiumaa Island and Saaremaa Island); one from the northern coast of the mainland (Juminda Peninsula). Core from Saaremaa (166 cm) covers the last 2700 years, cores from Hiiumaa (171 cm and 330 cm) cover ca 4000 years, and core from Juminda (465 cm) covers ca 8500 years. All AMS dates (77) are converted to cal yrs BP. Analyses of LOI and grain size are carried out at every centimetre in order to obtain data for mineral matter content and concentration of sand particles.

The Juminda core shows a consistently low content of mineral matter ($LOI < 2\%$) without clear peaks over the last 8000 years. The LOI results at both Hiiumaa sites show that mineral matter content gradually decreases from 4000 to 1500 cal yrs BP and then becomes the lowest in the period of 1500-1000 cal yrs BP; since then, it becomes higher (up to 10%) with fluctuations and has a clear peak around 700 cal yrs BP. At Saaremaa, the overall trend of mineral matter content is similar to that at the Hiiumaa sites: gradual decline from 2700 to 1500 cal yrs BP, lowest in 1500-1000 cal yrs BP, and relatively high over the last millennium.

Concentration of mineral particles reveal clear peaks of aeolian sands at each site. At northern Hiiumaa, concentration has peaks around 3500, 3000 and 2500 cal yrs BP and is relatively high over the last 700 years. At Saaremaa, concentration has peaked at 2100, 1600 and 1000 cal yrs BP and has also been high over the last 600 years.

The preliminary results indicate: (1) a gradual decrease in mineral matter content starting from formation of bogs until 1500 cal yrs BP at Hiiumaa and Saaremaa can be related to the increasing distance from the shoreline due to the isostatic land uplift in late Holocene, (2) peaks of aeolian sand concentration show possible storm events, although the timing of storm events could be attributed to the openness of the sites to different wind directions, and (3) in west Estonian archipelago the most recent 500-700 years would have been stormier than the previous periods. With our on-going study a more detailed analysis of mineral particles at all sites will provide a more complete view on the Holocene dynamics of the coastal environment affected by the storminess changes in the region.