



## **Reconstruction of storminess over the last 8000 years in northeastern Baltic Sea coastal region**

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Shifts in storm regime have significant impacts on natural, social and cultural systems in coastal regions. Aeolian sand influx (ASI) to peat bogs has been applied for reconstruction of the past storminess in northern Europe and elsewhere. However, verification of the method has been limited. This study first evaluates the ASI records from four sites along the Estonian coast against instrumentally-measured meteorological and historical records of storm activities in the region over the last two centuries. Although minor variations exist among the sites, our high-resolution ASI records mostly depict the characteristic patterns of measured storm occurrences expressed by significant positive cross-correlation values.

We then reconstructed the past storminess over the last 8000 years using ASI records from the same four sites. The chronologies of the peat cores were established with 36 AMS  $^{14}\text{C}$  dates in total; the number and grain size of all mineral particles  $>65\ \mu\text{m}$  were counted and measured from each sample (5 ml in volume) using a digital microscope camera and an image analysis system. The ASI record was compared with the patterns of coastal sand ridge formations, an independent information of the past storminess; the ridge sequence was dated by 50 OSL ages and their internal structure was imaged with ground-penetrating radar (GPR). Fossil pollen from the studied peat cores was also analyzed for vegetation reconstructions in relation to storminess.

The ASI records among four sites are consistent, in general. The frequency and/or magnitude of storminess appear high around 7500, 6400, 6000, 3500, 3000, 2000, and 1500 cal yr BP. The ASI values during the last 1200 years are higher than those in the previous millennia, indicating the stormiest period over the last 8000 years in the region. The sand ridge sequences reveal two clear events in ridge-formation around 3500 and 800 cal yr BP; the latter event created high (up to 10 m) dunes in two study areas. Overall, the sand ridges formed during the periods of decreased ASI are lower. Pollen-based reconstructions of the regional vegetation suggest a weak positive correlation between pine abundance and storminess.

We can conclude that the storminess has increased since 3500 cal yr BP and especially during the last 1200 years in the northeastern Baltic Sea region, in general. The shift in storminess around 3500 years ago is also supported by the previous palaeoclimatic studies suggesting changes towards cooler, more humid and stormier conditions.