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The impact of a port on the surrounding seashores based on the 13-year monitoring results

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The study was carried out in the vicinity of Sillamäe town and industrial port, located on the north-eastern coast of Estonia in the south-eastern part of the Gulf of Finland (The Baltic Sea). Sillamäe was potentially one of the most serious threats for the whole Baltic Sea environment. The town was founded together with the construction of a highly specialized chemical and metallurgy plant in 1946, where fuel rods and nuclear materials for the Soviet nuclear power plants and weapons were produced. The current study is focusing on the shore processes and the coastal sea fronting Sillamäe. The town is located east of the port. It is the region with the highest potential impact of the port. Until the town was founded and the factory with its nuclear waste depository was constructed, the shores near the town were described as one litho-dynamic system with a good natural balance. Major human influence (construction of the port, waste depository, etc.) and additionally climate warming has taken place since then. The shores in front of the nuclear waste depository are well protected today. However, the rapidly expanding port is the major obstacle of the longshore sediment transport since 2001.

The aim of the study is to analyze the impact of the port to the changes in coastal evolution and sediment budget in the vicinity of the port based on the regular monitoring results.
The dynamics of the seashores was assessed using remote methods and in situ measurements. Remote methods included the analyses of shoreline changes and changes in scarp positions in space and time using orthophotos. The study is also based on the measurements of scarp edges, shorelines and shore profiles conducted in 2004–2016. The measurements were carried out using Leica GS09 RTK-GPS and Leica level. The volume of sediments in the active zone of each profile was calculated. The active zone was defined as the zone from the mean shoreline to the elevation where storm waves were still able to influence the shore processes.

The results suggest that either a stable geomorphic state or a slow accumulation has prevailed along major part of the studied coast. After stronger storms, occasional erosion events were registered in several sections of the study site. However, these changes were mostly temporary and a stable state was usually restored soon after the erosion event. There are two exceptions on profiles 1 and 9. The first of them has experienced a gradual increase in the volume of sediments (the most distant from the port) while the second one has gradually lost the sediments (the closest to the port). The reason of the loss is directly attributable to the unsuitable hard defence measures established during the Soviet period but still influencing the shore processes. The effect of the new port has been of minor importance but might increase in the future. Therefore, the need for monitoring coastal processes is still recommended.

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