Geophysical Research Abstracts
Vol. 21, EGU2019-553, 2019
EGU General Assembly 2019

The use of magnetic susceptibility for the identification of the swash zone run-up limit

Kristina Viršilaitė, Donatas Pupienis, and Dovilė Karlonienė

Vilnius University, Institute of Geosciences, Department of Hydrology and Climatology, Lithuania
(kristina.virsilaite@chgf.stud.vu.lt)

The swash zone is the most dynamic component of the littoral environment as it is subjected to turbulent and rapidly varying swash motion. It is also a place where the alongshore and cross-shore sediment transportation occur, altering the beach face morphology, associated with coastal erosion and recovery after high energy events. The wave run-up is a significant factor of the swash flow as it is directly controlled by the intensity of hydrodynamic conditions. The landward upper-most limit ranges from the shoreline or berm crest during relatively calm conditions, up to the middle part of the beach or foredune foot and cliff base during severe storms.
Sandy beaches fronting the Lithuanian coast of the Baltic Sea are composed mainly of quartz sands, with a locally important increase in accessory minerals – heavy mineral concentrations (HMCs). The HMC distribution on the beach helps to reconstruct paleo-hydrometeorological conditions. The aim of this study is to identify the swash zone run-up limit on the sandy beaches after the storms.
To identify the upper run-up limit, a low-field magnetic susceptibility (MS) were measured on 11 cross-shore profiles at every 1 m with 0.565 kHz Bartington MS3 field scanning system with MS2K sensor. The beach topographic data was collected using a Topcon's HiPer SR receiver at 1 m interval. A measuring tape was used to measure the distance between topographic points along the cross-shore profile. The measurements were made three days after each of two subsequent storms. To detect run-up upper limit the Sequential Regime Shift Detection Software was used. The calculation was carried out using the regime shift index, where the cut-off length is 3 and the significance level p = 0.1.
Analysis revealed that the recent storm caused a peak in MS values which was slightly shifted towards the shoreline, suggesting that the run-up force did not reach such extent as the earlier storm has demonstrated. However, the peaks of MS values would imply that its impact force was greater. Some profiles revealed a different behaviour, perhaps as a result of a different storm impact on the swash zone related to geological framework variations along the coast.
The studies have shown that higher HMC's are a proxy to determine the extent of hydrodynamic energy, as the largest deposits are found at the upper boundary of storm surge. Magnetic properties of heavy minerals concentrations can be easily and effectively measured by applying inductive field. The combination of two methods 1) measuring of MS and 2) using Sequential Regime Shift Detection Software would suggest a simplified approach of run-up limit detection.
This study was supported by the Lithuanian Science Council (Grant No. 09.3.3-LMT-K-712-10-0072).