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A data-based statistical technique to process the time series on aeolian sand ripples obtained by the shadow cast technique

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The research considers a new data analysis technique to focus on morphometric parameters of aeolian sand ripples obtained by means of the shadow cast technique (SCT). The data from SCT are usually sparse. This constrains the application of asymptotical statistics, hence in the process of SCT data analysis one should consider small sample approximations. To do so, a large number of merged data sets corresponding to many dissimilar linkages between small time series obtained from single photographs is simulated. The value of the Ljung-Box statistics is derived for each merged sample. This approach aims to detect possible dependencies in the pattern of aeolian sand ripples. In order to quantify the results, we propose a formula to estimate the probability of misclassification in the process of testing using numerical simulations. This statistical technique is utilized to analyse field data. For the analysis the SCT is applied to a beach site at the Baltic coast of Poland. As a result, we gain a set of photographs, which are processed using GIS and computer-aided design tools. The obtained data correspond to heights and length-to-height ratios of cross-sectional settings of aeolian sand ripples. The application of the above-mentioned statistical procedure allows one to infer that both heights and length-to-height ratios, considered separately, reveal self-dependencies. The interpretation of this fact follows from the physics of aeolian sand ripples. It is highly probable that the procedure detects

a cumulative effect of different dependent and superimposed mechanisms producing ripples.