Geophysical Research Abstracts
Vol. 15, EGU2013-4945, 2013
EGU General Assembly 2013

Use of historical information in extreme storm surges frequency analysis

Yasser Hamdi (1), Claire-Marie Duluc (1), Yves Deville (2), Lise Bardet (1), and Vincent Rebour (1)
(1) Institut de Radioprotection et de Sûreté Nucléaire IRSN, (2) Alpestat

The prevention of storm surge flood risks is critical for protection and design of coastal facilities to very low probabilities of failure. The effective protection requires the use of a statistical analysis approach having a solid theoretical motivation. Relating extreme storm surges to their frequency of occurrence using probability distributions has been a common issue since 1950s. The engineer needs to determine the storm surge of a given return period, i.e. the storm surge quantile or design storm surge. Traditional methods for determining such a quantile have been generally based on data from the systematic record alone. However, the statistical extrapolation, to estimate storm surges corresponding to high return periods, is seriously contaminated by sampling and model uncertainty if data are available for a relatively limited period. This has motivated the development of approaches to enlarge the sample extreme values beyond the systematic period. The nonsystematic data occurred before the systematic period is called historical information. During the last three decades, the value of using historical information as a nonsystematic data in frequency analysis has been recognized by several authors. The basic hypothesis in statistical modeling of historical information is that a perception threshold exists and that during a giving historical period preceding the period of tide gauging, all exceedances of this threshold have been recorded. Historical information prior to the systematic records may arise from high-sea water marks left by extreme surges on the coastal areas. It can also be retrieved from archives, old books, earliest newspapers, damage reports, unpublished written records and interviews with local residents. A plotting position formula, to compute empirical probabilities based on systematic and historical data, is used in this communication paper.

The objective of the present work is to examine the potential gain in estimation accuracy with the use of historical information (to the Brest tide gauge located in the French Atlantic coast). In addition, the present work contributes to addressing the problem of the presence of outliers in data sets. Historical data are generally imprecise, and their inaccuracy should be properly accounted for in the analysis. However, as several authors believe, even with substantial uncertainty in the data, the use of historical information is a viable mean to improve estimates of rare events related to extreme environmental conditions. The preliminary results of this study suggest that the use of historical information increases the representativity of an outlier in the systematic data. It is also shown that the use of historical information, specifically the perception sea water level, can be considered as a reliable solution for the optimal planning and design of facilities to withstand extreme environmental conditions, which will occur during its lifetime, with an appropriate optimum of risk level. Findings are of practical relevance for applications in storm surge risk analysis and flood management.