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On the run-up levels and relative mean persistence

Giuseppe Barbaro, Maria Chiara Martino
Department of Mechanics and Materials, "Mediterranea" University of Reggio Calabria,
Reggio Calabria, Italy

ABSTRACT

This paper presents a new expression to estimate the return period of a sea storm where the run-up exceeds a fixed threshold and to evaluate the mean persistence. The run-up is an aleatory phenomenon linked to significant wave heights of sea states verified during sea storms in different locations, therefore its estimate can be dealt with using a method of probability. Using the wave data of the Italian wave metric net and of the United Kingdom met office we obtained the run-up in a location along the Jonian Sea (Italy).

KEY WORDS: equivalent triangular storm; equivalent sea; sea state; wave data; run up; return period; mean persistence.

INTRODUCTION

In the paper we estimate the return period of a sea storm where the run-up exceeds a fixed threshold and we evaluate the mean persistence that is time duration in which this threshold is exceeded.
To do this, it is necessary to consider the concept of equivalent triangular storm. In fact, we can associate with each actual sea storm an equivalent triangular storm, e.t.s., so defined: the height a of the triangle is equal to the maximum significant wave height in the actual storm, the base b of the triangle (that is the duration of the e.t.s.) is such that the maximum expected wave height of the triangular storm is equal to the maximum expected wave height of the actual storm.
Fig. 1 illustrates the behavior of a sea storm recorded at Crotone along the Jonian Sea (Italy) and the relative e.t.s.. In the same figure the comparison between the probabilities that, in the actual sea and in the equivalent sea, the maximum significant wave height H_{max} exceeds a fixed threshold H is shown.
We can call equivalent sea the sequence of the e.t.s.. Thus the equivalent sea consists of the same number of storms as the actual sea, each of them with the same maximum H_s. As a consequence the return period of a storm whose significant wave height exceeds a fixed threshold h is the same in the actual storm and in the equivalent sea. Also, comparisons between the probability of exceedance of H_s, $P(H_s > h)$ of the actual sea and the $P(H_s > h)$ of the equivalent sea show some minor discrepancies for $h > h_{crit}$, and these discrepancies disappear as h grows. Hence, we can assume for the equivalent sea the same $P(H_s > h)$ of the actual sea. Thus we shall work on the equivalent sea rather than on the actual sea and in doing so we shall greatly simplify the treatment.

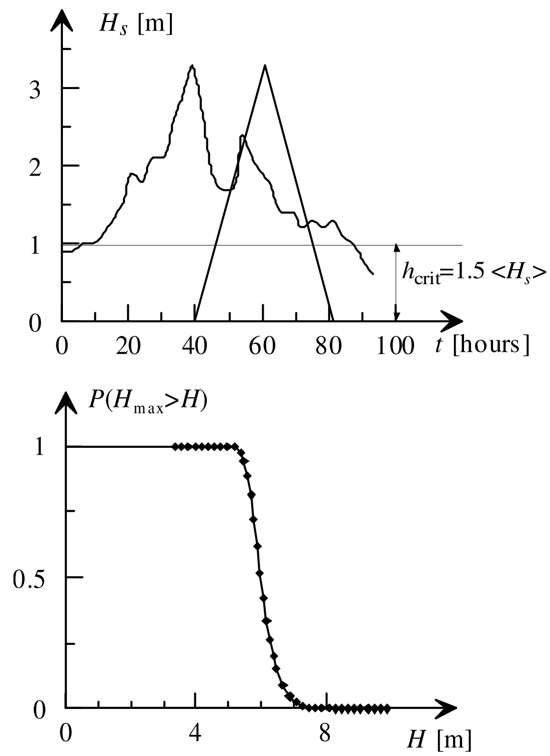

Fig. 1. A sea storm recorded at Crotone (Jonian Sea) and its e.t.s.. The $P(H_{max} > H)$ of the e.t.s. (points) coincides with the $P(H_{max} > H)$ of the actual storm (continuous line).