

A New Method for Extreme Statistics Using Annual Maximum Wind Speed and Wave Height Data with Trend of Increasing or Decreasing

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1. INTRODUCTION

Annual maximum wave height or wind speed may have increasing or decreasing trend under the influence of climate change. As such data is not homogeneous, it is desirable to use it for extreme statistics after revising it taking the trend into consideration^[1]. In this paper, a new method is presented for extreme statistics using annual maximum data with trend, and the difference between the results using the proposed method and the conventional one without preprocessing the data is shown.

2. CONSIDERATION OF TREND OF INCREASING OR DECREASING

For example, the increasing rate of the annual maximum wave height is 0.0476 m/year for Hachinohe Wave Station. The wave height data can be revised to adjust to the climate condition in the middle year of the data period (1974~2009) considering the increasing trend using the following formula.

$$H_r(X) = H(X) + 0.0476(1991.5 - X)$$

,where X is year, H is observed annual maximum wave height and H_r is revised one.

Extreme statistics have been carried out using the observed data (data set 1) and revised one (data set 2) with the method proposed by Goda(2008) ^[1]. The best distribution function has been selected from nine functions by comparing MIR values for data set 1. The best distribution function can be selected for data set 2 in the same way, too. But, if the best function for data set 1 and that for data set 2 are different, the 50-year wave heights for data set 1 and data set 2 cannot be compared because the difference of the functions affect the result. Therefore, as for data set 2, the same function as the data set 1 has been selected for comparison. As the 50-year wave heights for two kinds of data sets are 8.34m and 7.97m, the relative error is 4.4%. And, the relative change rate of annual maximum wave height is $0.0476/8.34 \times 100 = 0.571$ %/year.

3. RESULTS FOR ALL STATIONS

The same analyses have been carried out for all wave and wind stations. The results for wave stations are shown in Fig.1. The larger the annual change rate is, the larger the relative error is. Therefore, when the change rate of increasing or decreasing trend is large, the error of estimating 50-year value is large without preprocessing observed data.

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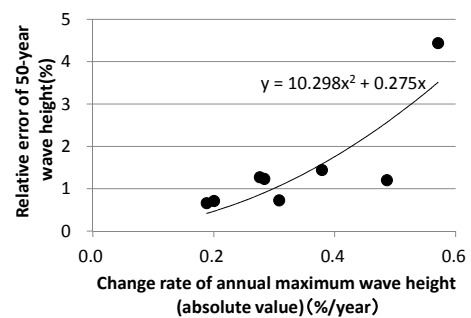


Fig.1 Relationship between the relative change rate of annual maximum wave height and relative error of 50-year wave height