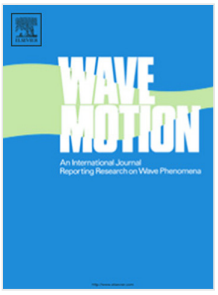
Accepted Manuscript



Laboratory study on the evolution of waves parameters due to wave breaking in deep water

Liang Shuxiu, Zhang Yihui, Sun Zhaochen, Chang Yanling

PII: S0165-2125(16)30111-1
DOI: http://dx.doi.org/10.1016/j.wavemoti.2016.08.010
Reference: WAMOT 2097

To appear in: *Wave Motion*

Received date: 18 February 2016
Revised date: 21 July 2016
Accepted date: 28 August 2016

Please cite this article as: L. Shuxiu, Z. Yihui, S. Zhaochen, C. Yanling, Laboratory study on the evolution of waves parameters due to wave breaking in deep water, *Wave Motion* (2016), http://dx.doi.org/10.1016/j.wavemoti.2016.08.010

Laboratory study on the evolution of waves parameters due to wave breaking in deep water

Liang Shuxiu, Zhang Yihui, Sun Zhaochen*, Chang Yanling
(State Key Laboratory of Coastal and Offshore Engineering, Dalian University of Technology, Dalian 116024, China)

Abstract: Understanding of the occurrence of the wave breaking, the process of the wave breaking and evolution of waves after they breaks in deep water is crucial to simulate the growth of wind wave in ocean. In this study, deep-water breaking waves with various spectral types, center frequencies and frequency bandwidths are generated in a wave flume based on energy focusing theory. The time series of the wave surface elevation along the flume are obtained by 22 wave probes mounted along the central line of the flume. The characteristics of deep-water wave breaking are analyzed using the spectrum analysis based on the Fast Fourier Transform (FFT). For small center frequency the maximum height of wave surface generated using the Pierson-Moscowitz (P-M) spectrum is produced and the impact of the frequency width is small in wave breaking zone. While the spectral type has a significant impact on the local wave steepness during breaking, the influence of center frequency and frequency width on the local wave steepness is very weak. The significant wave steepness changes significantly after wave breaking, but it remains stable in the upstream or the downstream of wave breaking zone. After wave breaking, the peak frequency remains stable, but the spectrally weighted wave frequency changes significantly. The relationship between the level of downshift and the incident wave steepness is approximately linear. By analyzing the energy spectra, it is found that the energy loses near high frequency of controlling frequencies range and increases near peak frequency during the wave breaking. After wave breaking, the total energy dissipates remarkably with increasing breaking intensity.

Keywords: energy focusing; wave breaking; wave surface; wave steepness; peak frequency;

1 Introduction

Wave breaking as a common phenomenon is an important element in many oceanographic and off-shore engineering [1]. The breaking of surface waves in deep water plays a significant role in the air-sea interaction, which involves complex processes such as energy transferring from wind to surface waves and from surface waves to water, turbulence generation due to wave breaking, etc. These fluid dynamics processes leads to waves deformation, surface currents generation and turbulence re-distribution [2-5]. Wave breaking in deep water occurs mainly in the form of

* Corresponding author.
E-mail address: sunzc@dlut.edu.cn