Preliminary experimental study on the detection of internal solitary wave by optical remote sensing

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Introduction

Optical remote sensing is one of the most important methods for large-scale observation of ocean internal solitary wave (ISW), which has the advantages of wide width and high temporal resolution. However, the optical remote sensing image is affected by cloud, sea condition and imaging angle, which brings difficulty to extract and retrieve ocean internal wave information from the optical remote sensing image. Currently, parameter inversion of internal solitary wave on optical remote sensing image is still based on the inversion model of SAR image. Therefore, a new approach is proposed to establish an experimental system of optical remote sensing to detect internal solitary wave in the laboratory, which aims to explore the response characteristics of optical remote sensing images caused by internal solitary waves.

Experimental Setup

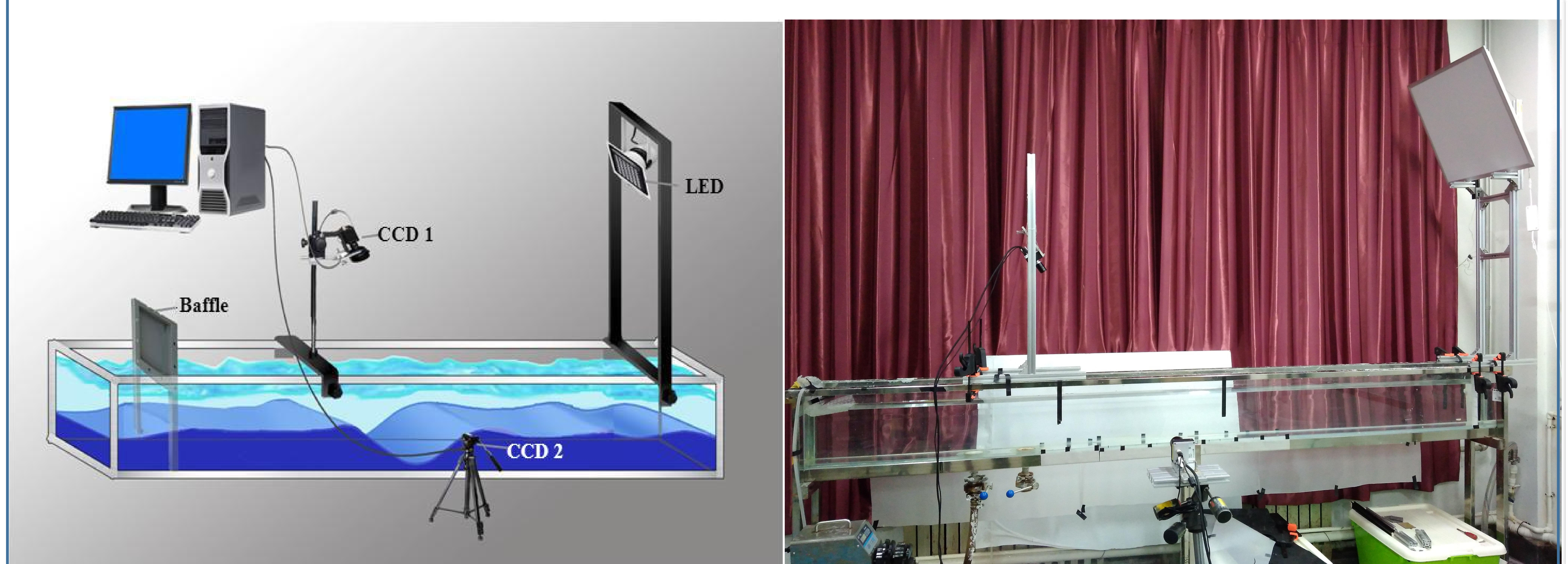

Fig. 1 The schematic diagram and raw photograph of experimental system

- three-dimensional ISW flume: 300×15×30 cm
- CCD camera: 1920×1080 pixels, 50Hz
- LED：DC parallel surface light source, 55W

Methods

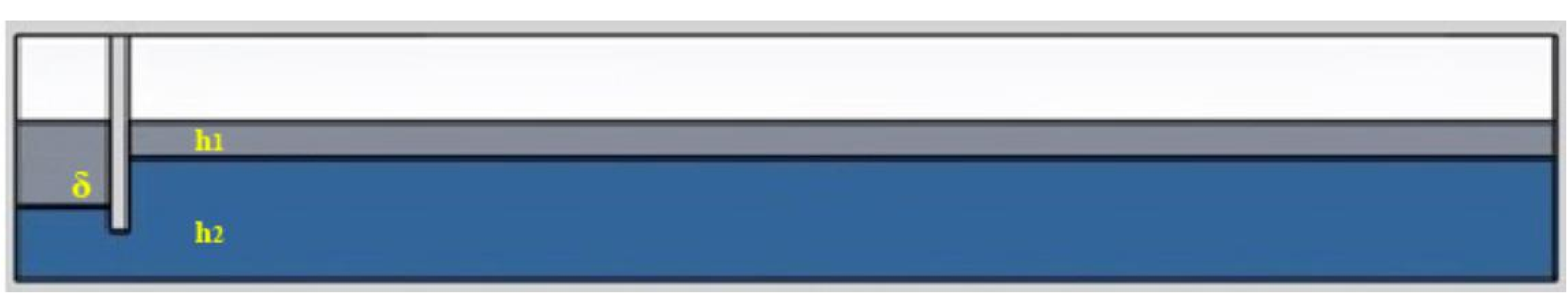

Fig. 2 Different amplitudes are generated by different collapse heights

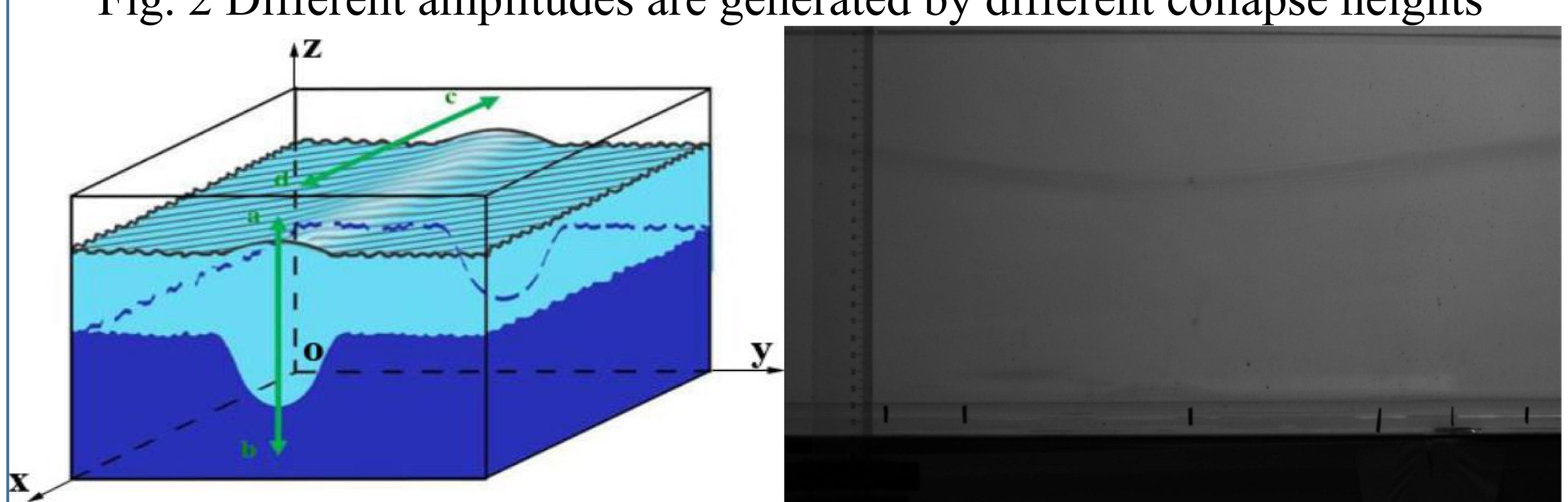

Fig. 3 The schematic diagram of linear time series sampling line

The response of the optical remote sensing image corresponds to the vertical displacement of the internal solitary wave. The linear time series sampling method is adopted to data processing with different conditions, including collapse height and stratification.

Results

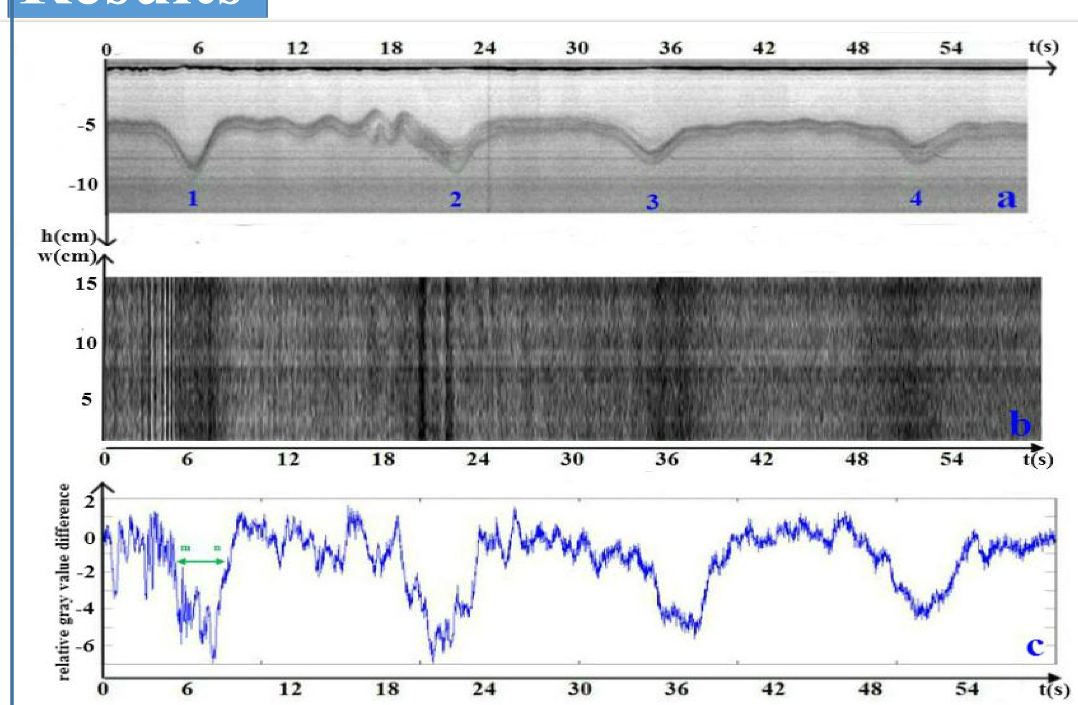

Fig. 4 The simulated optical remote sensing images in the laboratory

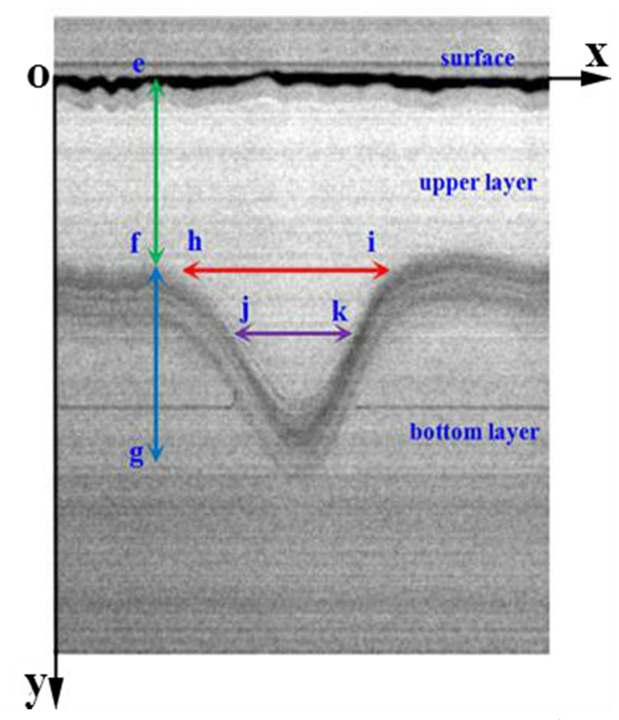

Fig. 5 Parameters extraction on the images

The propagation of ISW has been obviously observed on the images derived from both CCD cameras.

Table 1 Characteristic parameters of ISW

Parameters	No.1 ISW	No.2 ISW	No.3 ISW	No.4 ISW
A(cm)	37.65	32.35	27.35	21.76
L(cm)	22.78	27.71	29.56	29.97
D(cm)	53.78	54.19	62.81	66.50

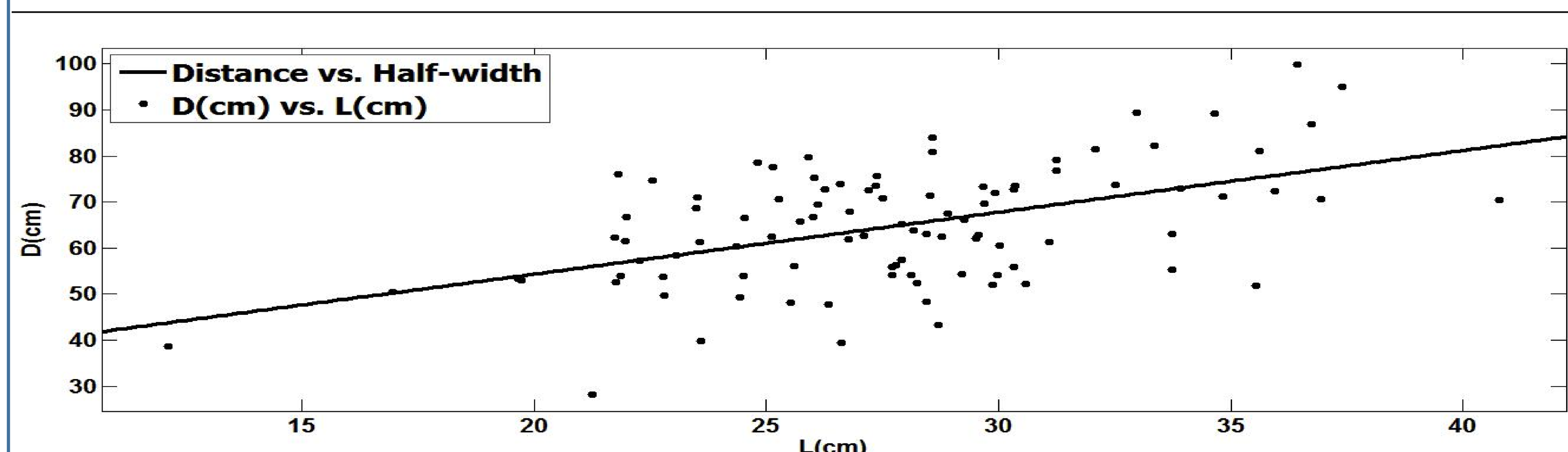

Fig. 6 The relationship between Distance and Half-width is D=1.34L

The relative gray value difference is aslo positively correlated with the amplitude of the internal solitary wave.

Table 2 Δgray-A under different stratification

Stratfication	3:21	3:17	5:17	7:17
Slope	1.90	1.21	1.17	0.32

Conclusion

The characteristic parameters of optical remote sensing images correspond to the wave factors of vertical profiles. The amplitude is proportional to the collapse height in a certain range. When the thickness of the lower layer is the same and the upper layer increases, the positive correlation coefficient decreases. The research provides a useful reference for quantitative inversion of ISW parameters on optical remote sensing image.

Acknowledge

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