

EXPERIMENTS AND SIMULATIONS ON EXTREME WAVES NEAR REFLECTIVE BEACHES

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Theoretical and Experimental Methods

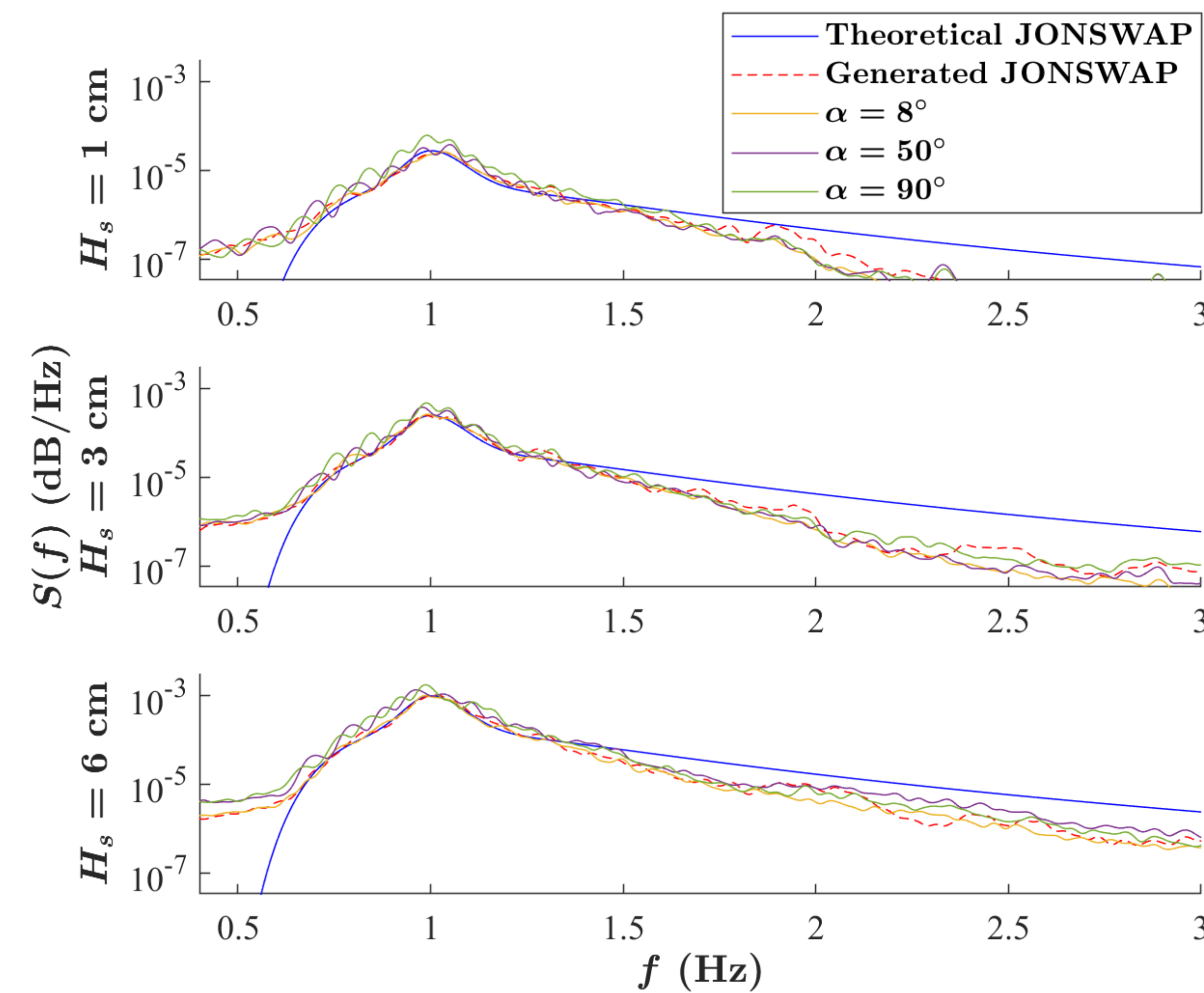
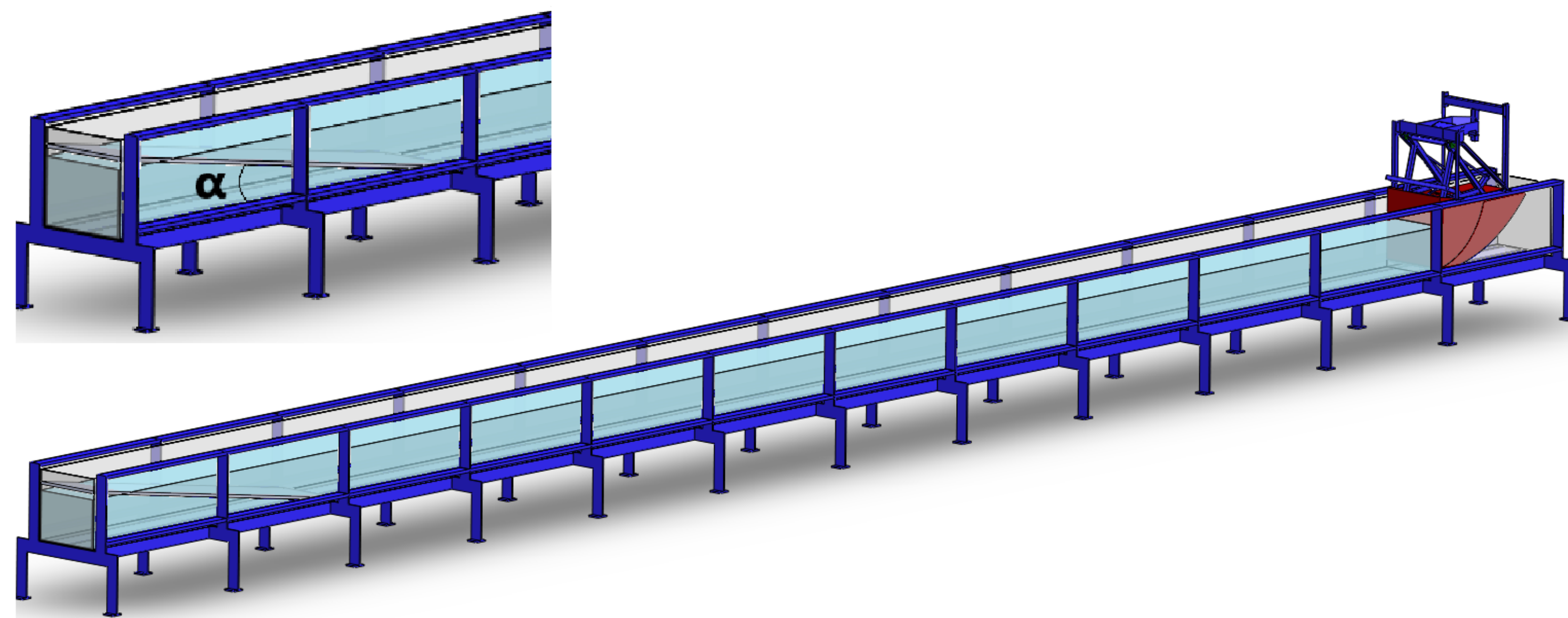
- Nonlinear Schrödinger equation (NLS) for unidirectional waves [1]

$$i(A_t + c_g Ax) + \lambda A_{xx} + \mu |A|^2 A = 0; c_g = \frac{\omega}{2k}, \lambda = -\frac{\omega}{8k^2}, \mu = -\frac{\omega k^2}{2}; \quad (1)$$

- Coupled Nonlinear Schrödinger equation (CNLS) for counter-propagating waves [2]

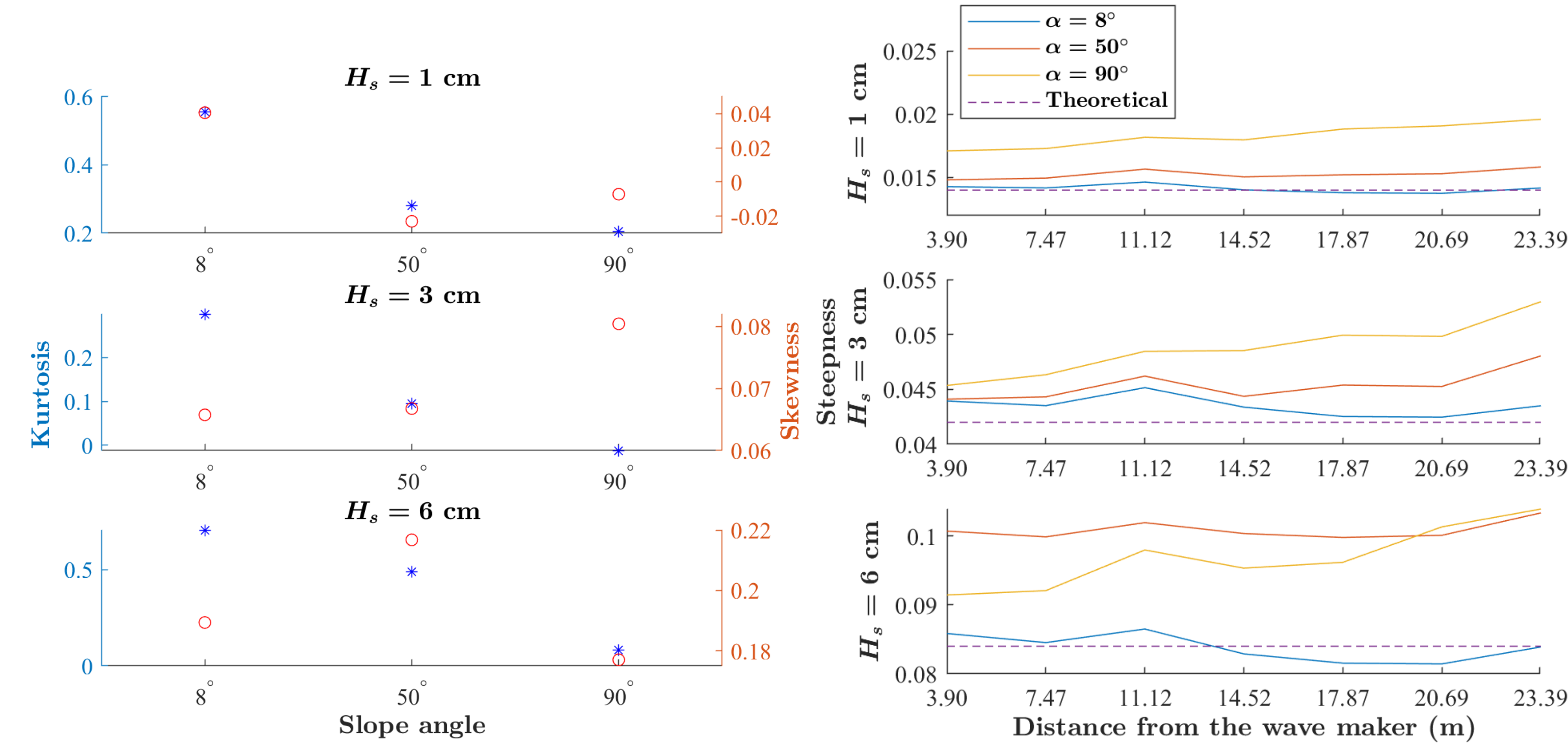
$$i(A_t + c_g Ax) + \lambda A_{xx} + \mu(|A|^2 - 2|B|^2)A = 0, \quad (2)$$

$$i(B_t - c_g Bx) + \lambda B_{xx} + \mu(|B|^2 - 2|A|^2)B = 0. \quad (3)$$

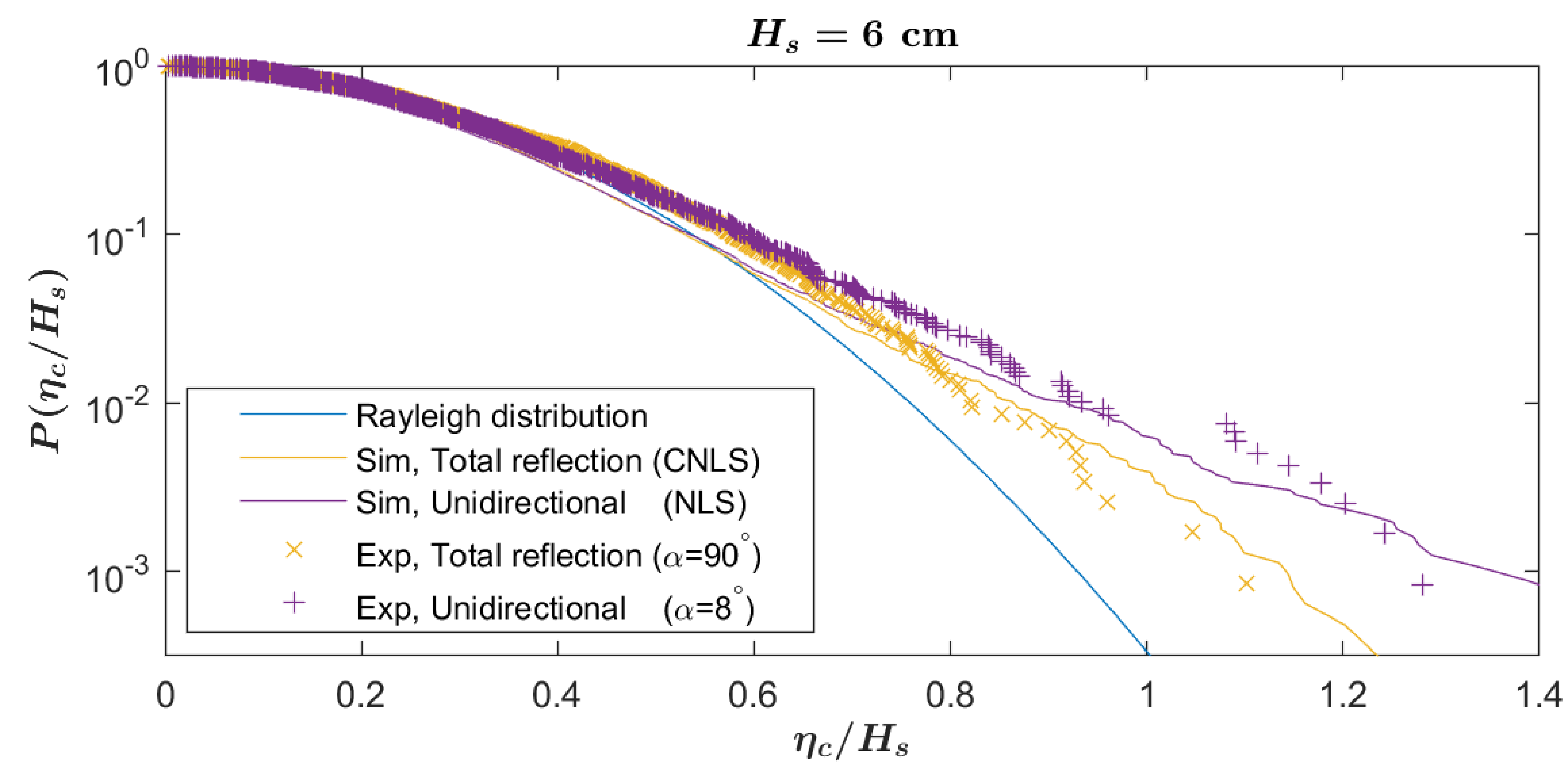


Results

- The kurtosis decreases with the increase of wave reflection, while there is no clear trend for the skewness;



- Probability of exceedance - experiments vs. numerical predictions



Remarks

- The kurtosis decreases with the increase of wave reflection;
- A coupled wave framework has to be used to study extreme waves in reflective environments;
- A very good agreement is reached between numerical simulations, based on weakly nonlinear approach, and experimental results in the exceedance probability.

Acknowledgements

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References

- [1] Vladimir E Zakharov, Stability of periodic waves of finite amplitude on the surface of a deep fluid, *Journal of Applied Mechanics and Technical Physics* **9**, 190–194, 1968.
- [2] Makoto Okamura, Instabilities of weakly nonlinear standing gravity waves, *Journal of the Physical Society of Japan* **53**, 3788–3796, 1984.