Supplementary information: simulation setup

- Simulated time series (duration= 1080 s, sampling=1.9 Hz) from JONSWAP spectra with $\alpha = 0.008, 0.016$, $\gamma = 3.3, 6.6$, T_p from 6 s to 12 s with interval 0.5 s, in total 1040 time series.
- Nonlinear spatio-temporal evolution (10 km):
  - for shallow water waves (h=10 m) using the KdV equation
  - for deep water waves (h=100 m) using the NLS equation
  - detect rogue waves ($H_{max}/H_s > 2$) after propagation

Nonlinear elevation evolution by the KdV equation

Nonlinear evolution by the NLS equation
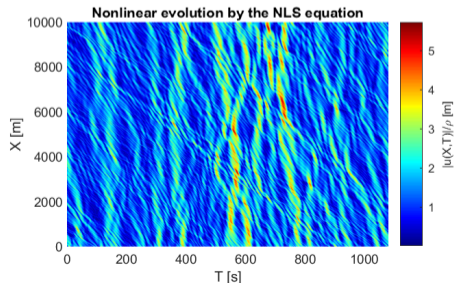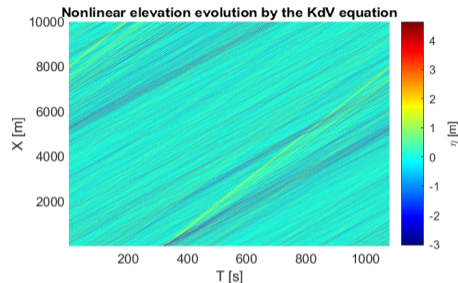
Further results: Deep water waves

- Deep water waves:
  - After propagation, rogue waves found in most cases.
  - The presence of a strongly outstanding NLS soliton ($A_2/A_1 \leq 0.6$) increased the heights of rogue waves.

Nonlinear evolution by the NLS equation