UNDERWATER BARRED BEACH PROFILE TRANSFORMATION UNDER DIFFERENT WAVES CONDITIONS

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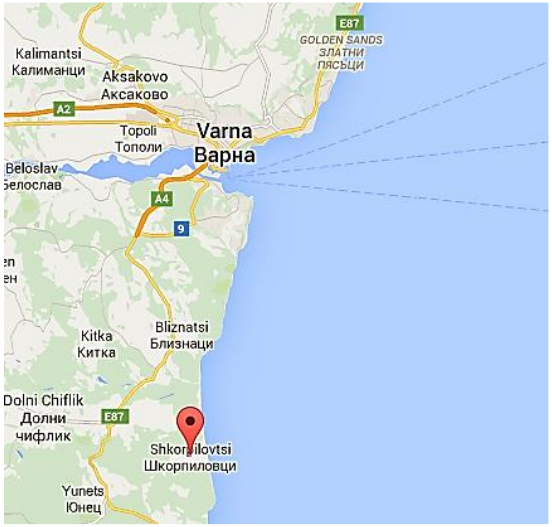
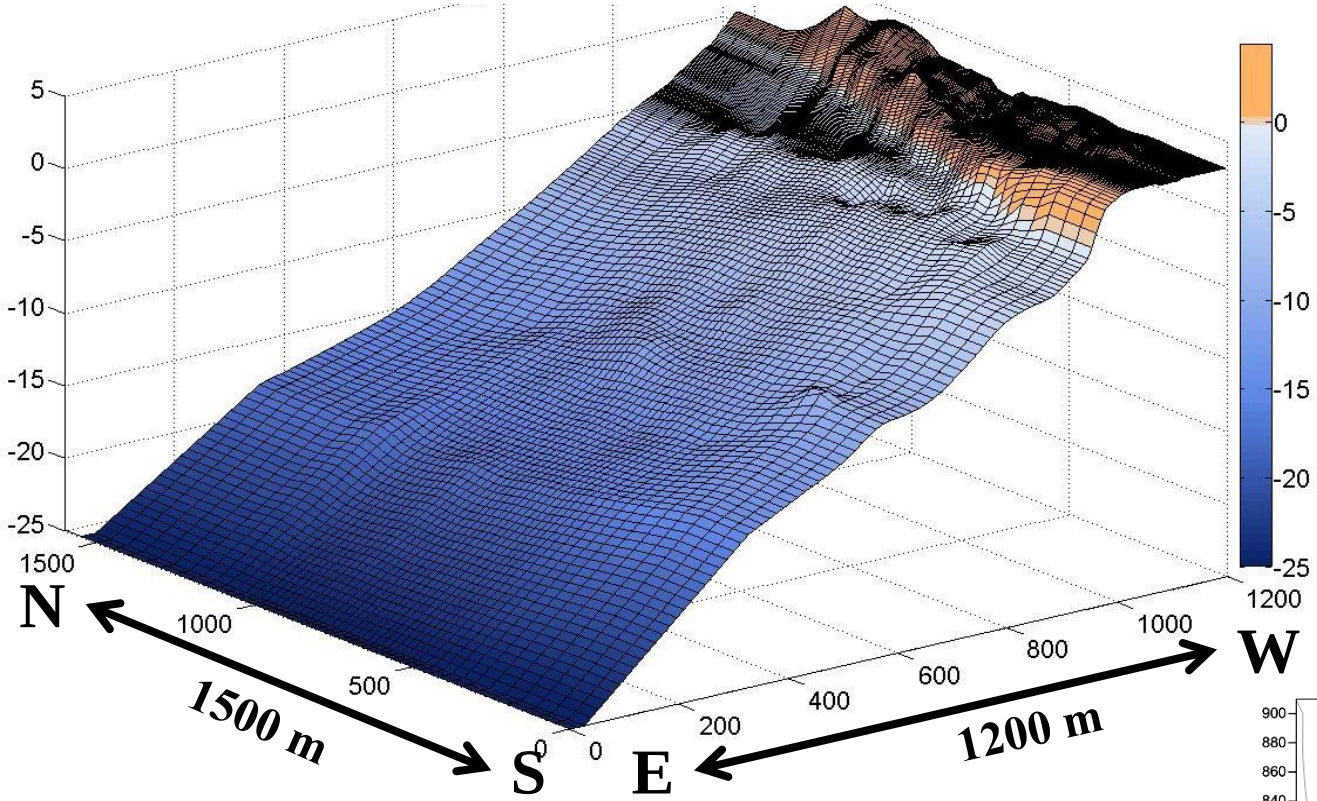
Study site: *Shkorpilovtsy (Bulgaria)*

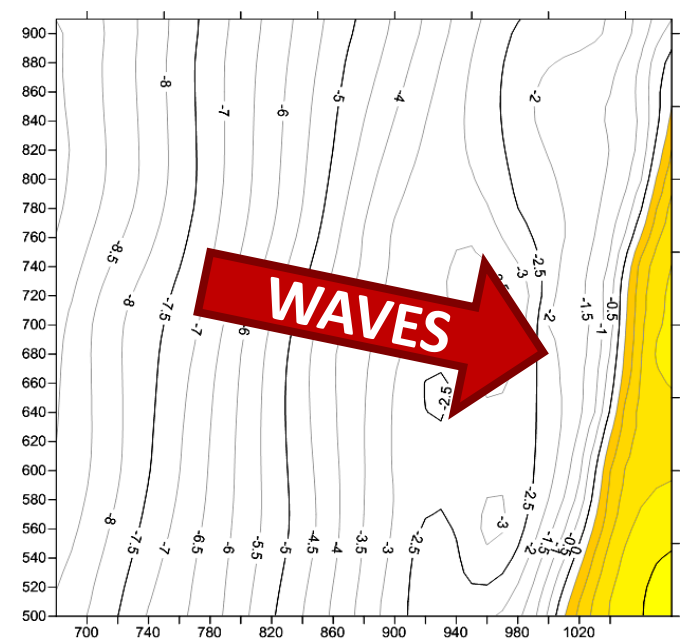


Toolkit: *xBeach modelling (hydrostatic mode)*
MIKE21 (for waves transformation analysis only)

Model Input

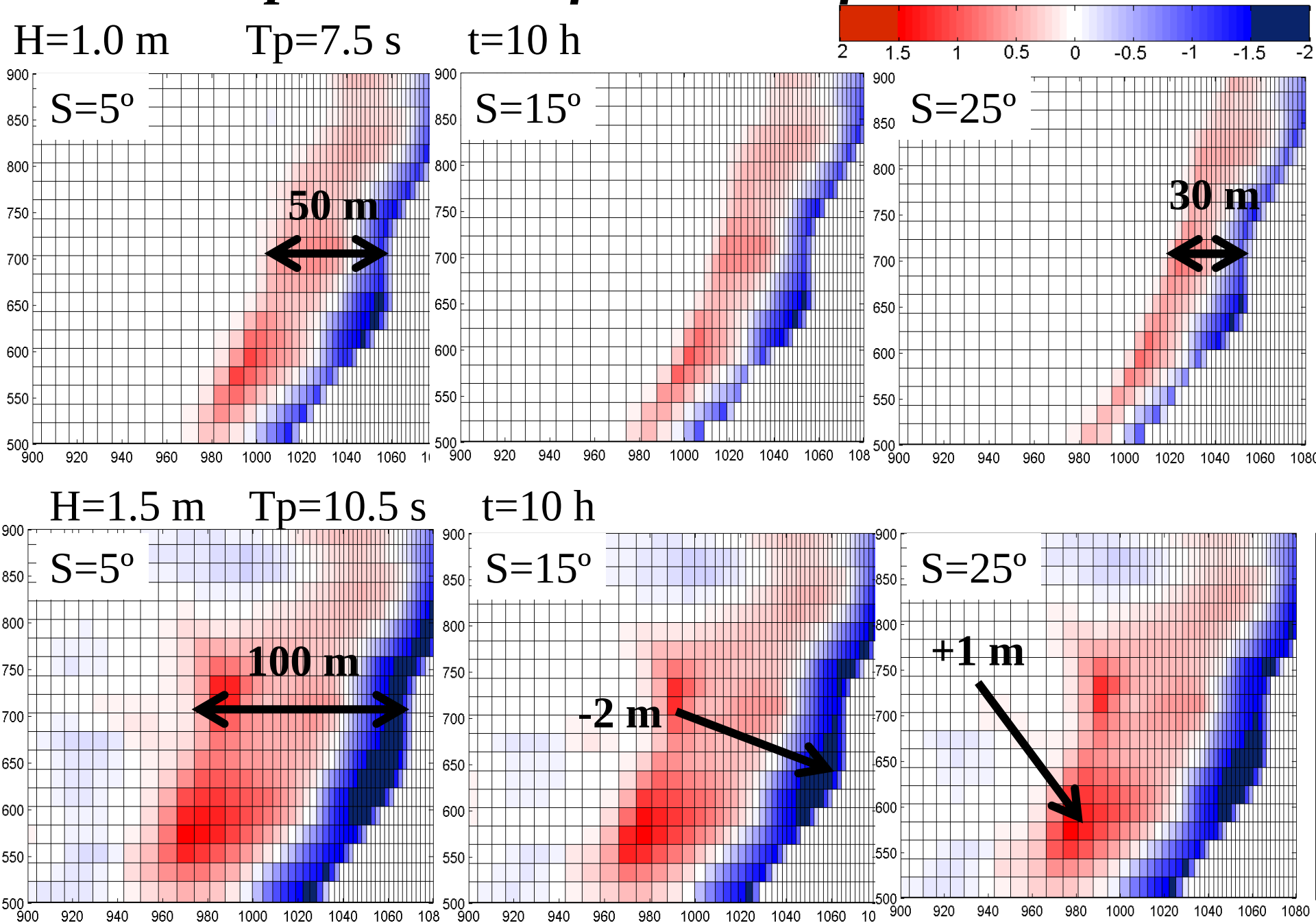


Computation grid:
based on 12 profiles
of bathymetry survey
on 27th of Sep 2007
(international experiment
"Shkorpilovtsy-2007")

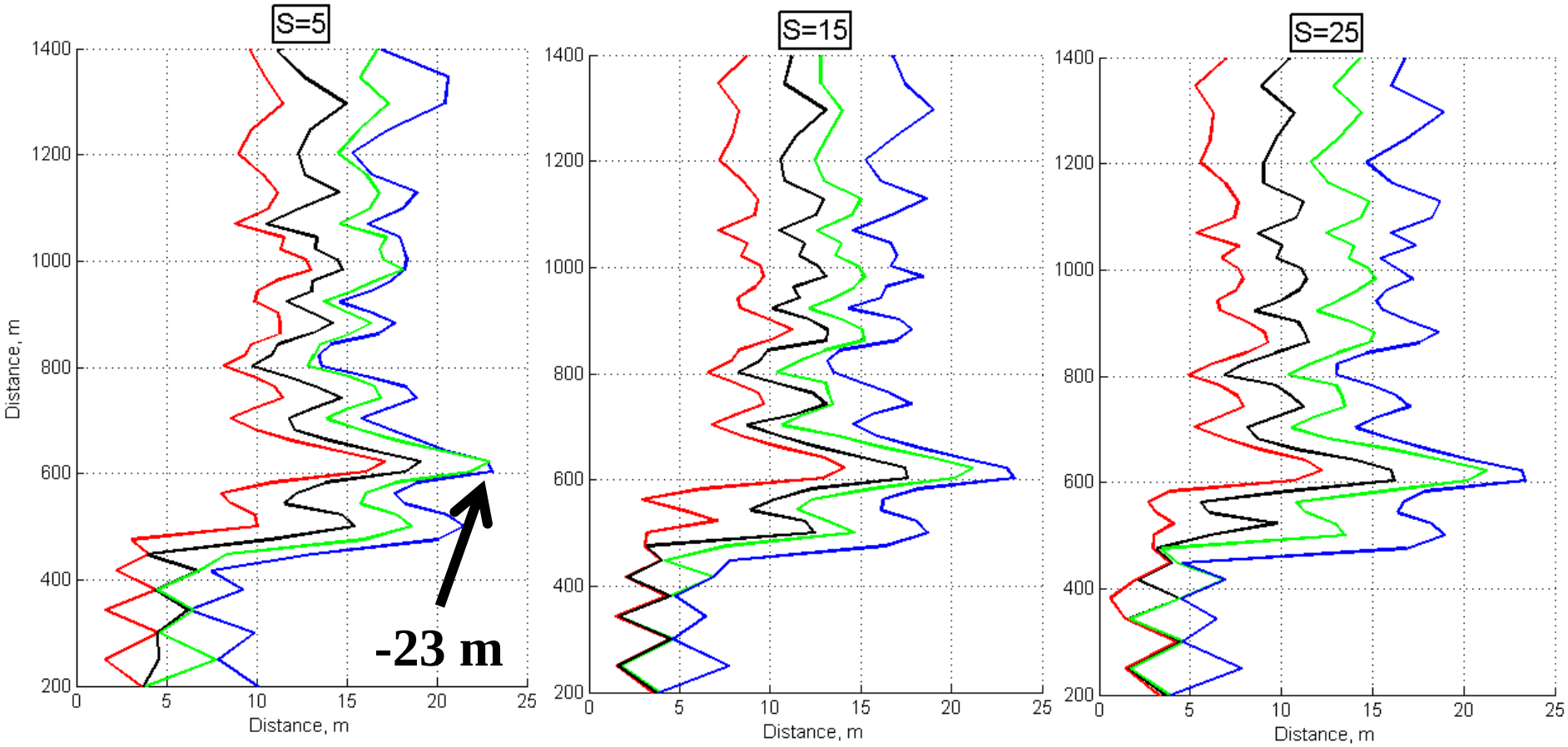


12 Waves regimes:
Period of spectral peak (Tp)=7.5 and 10.5 s
Significant wave height (Hs)=1.0 and 1.5 s
Angle of wave energy spreading (s) =5 °,15 °,25°
Wave input: JONSWAP (γ=3.3)
Model storm duration = 10 hours

Spatial view of bottom deformation



Shoreline regression



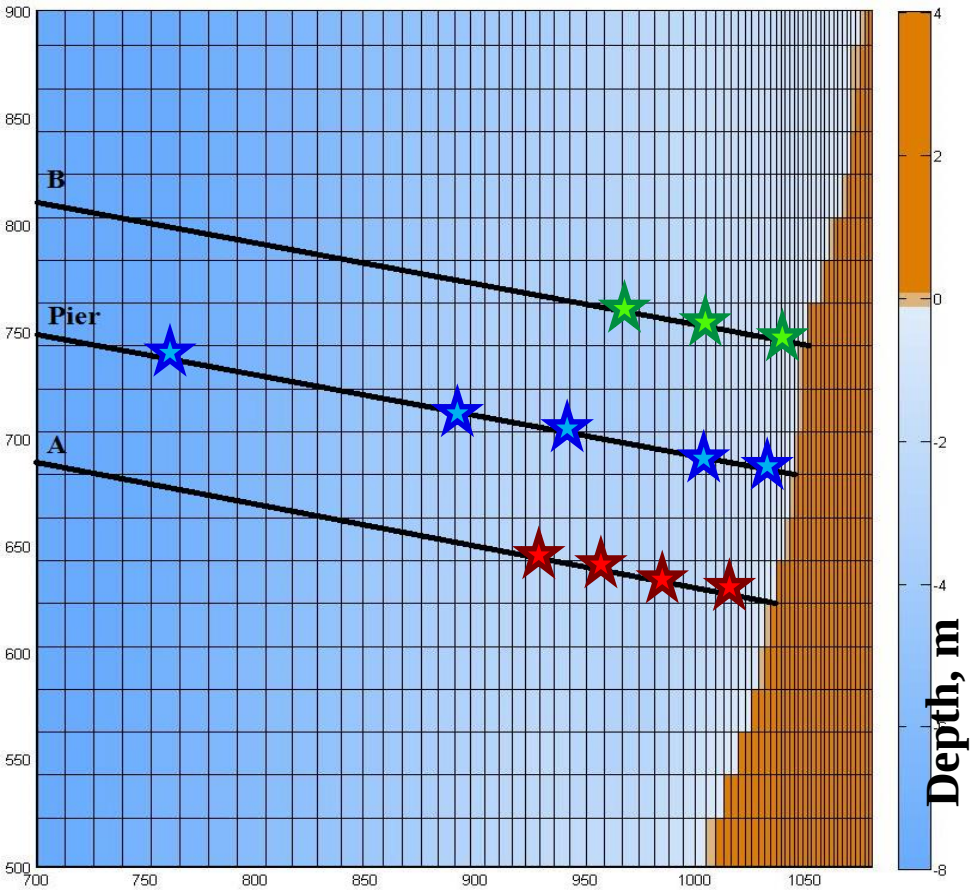
Red line: H=1.0 m Tp=7.5 s

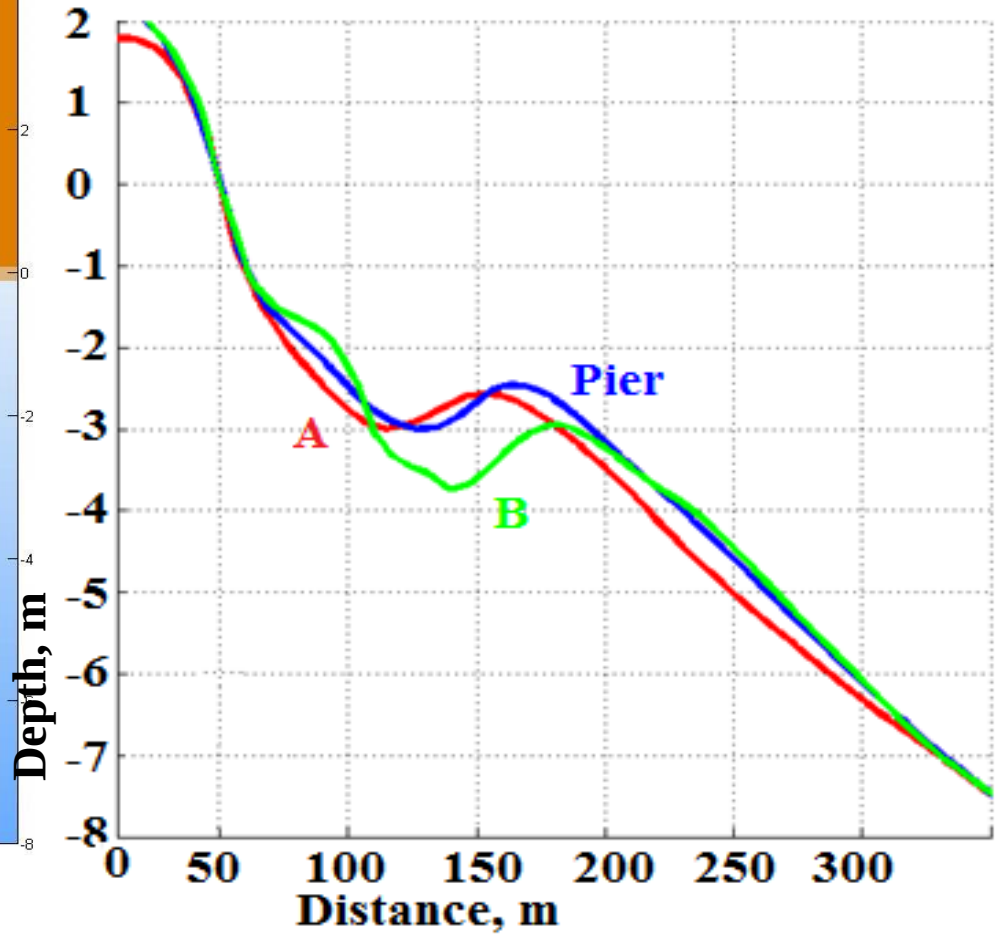
Black line: H=1.5 m Tp=7.5 s

Green line: H=1.0 m Tp=10.5s

Blue line: H=1.5 m Tp=10.5 s

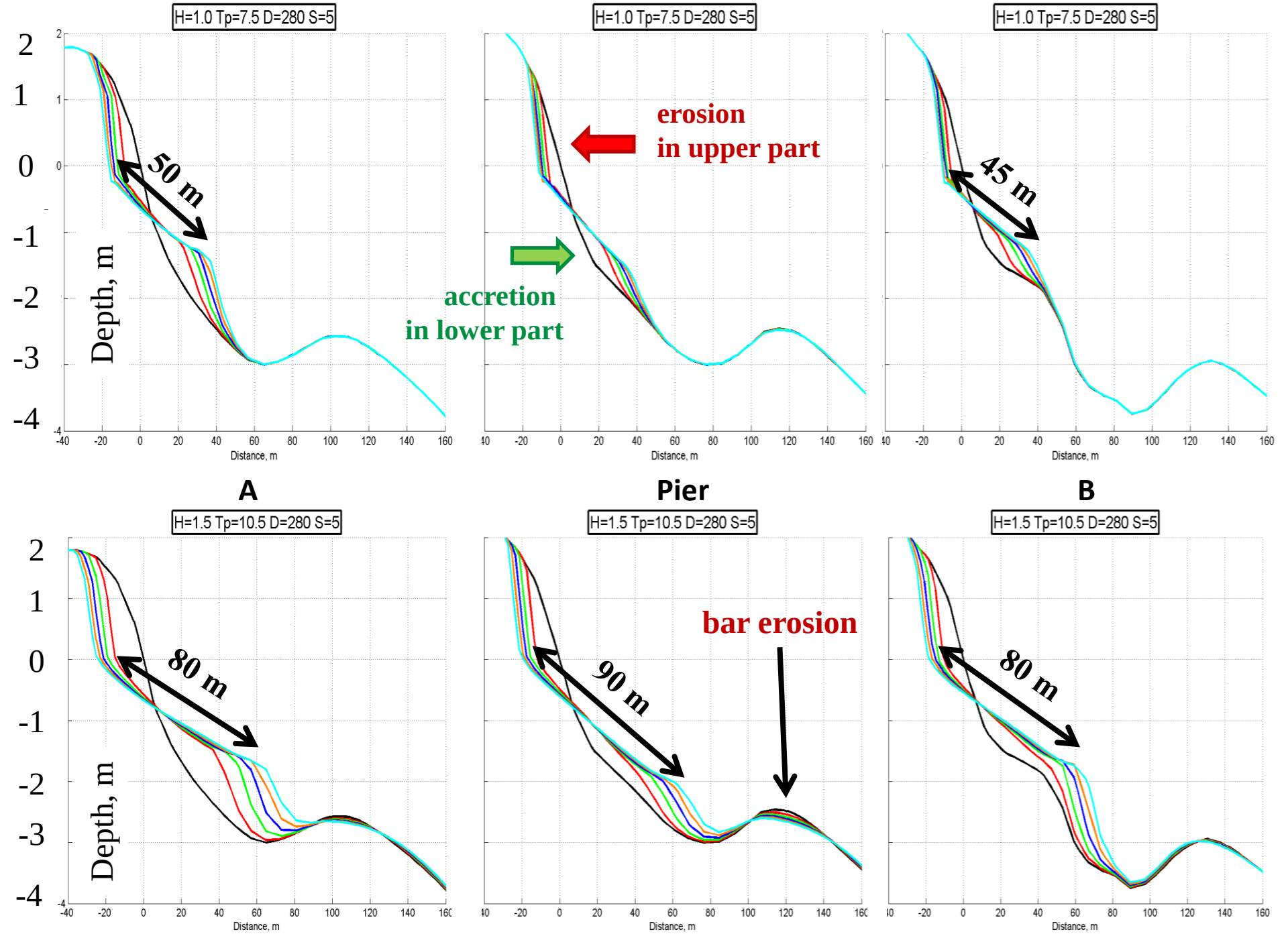
Profiles deformation analysis



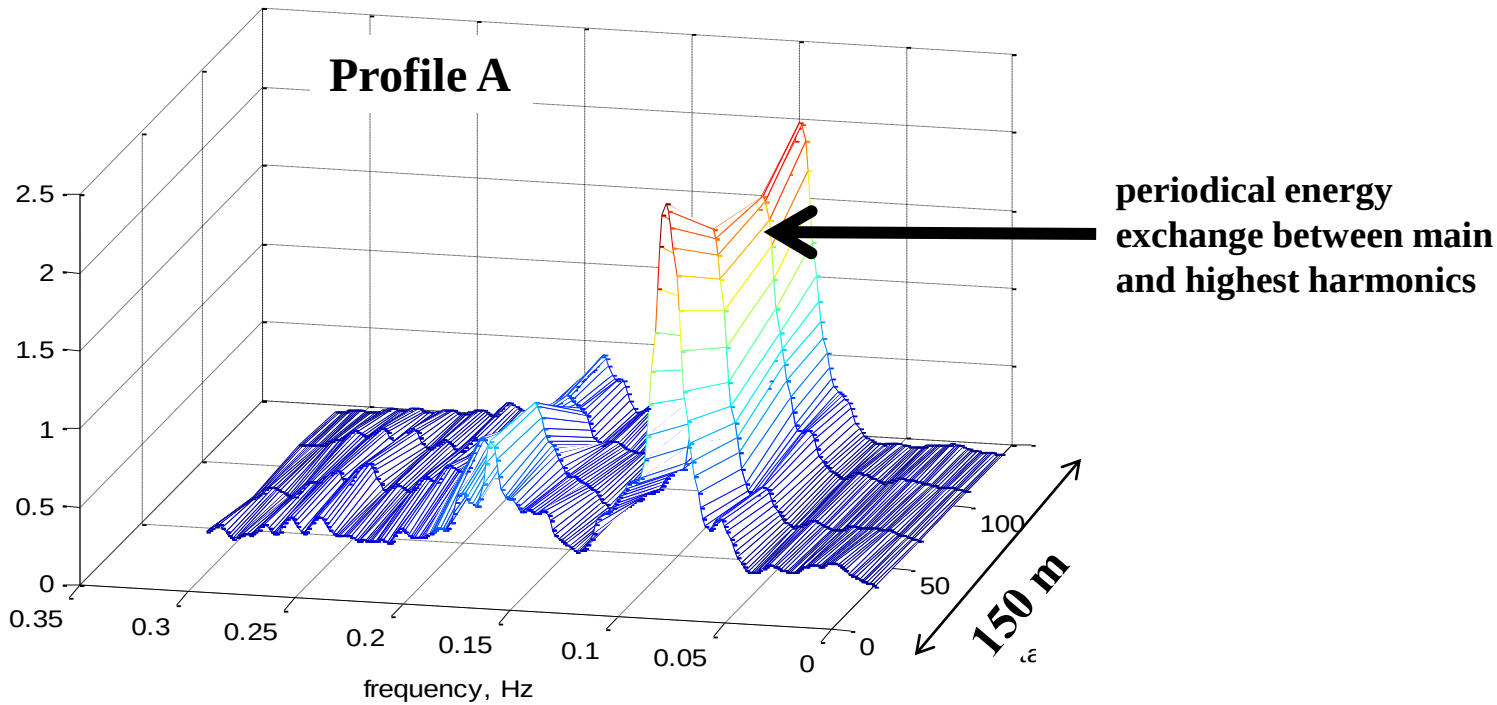


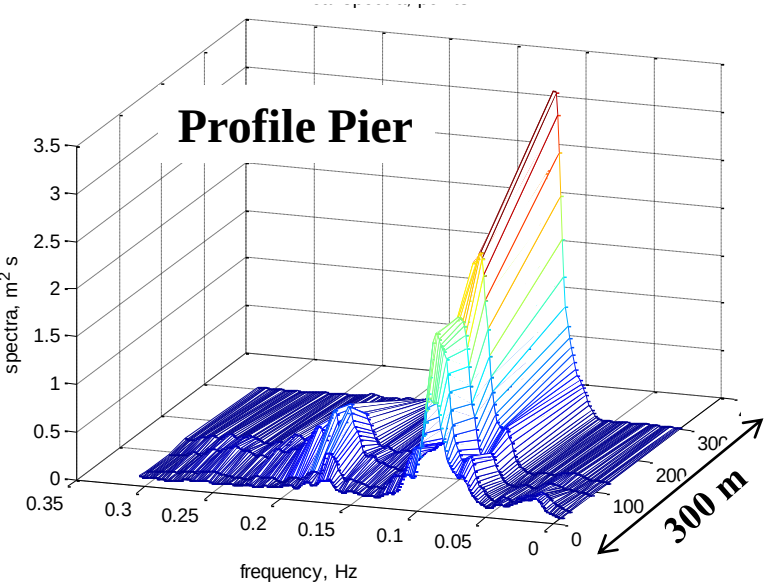
Maximal shoreline erosion ≈ profile A

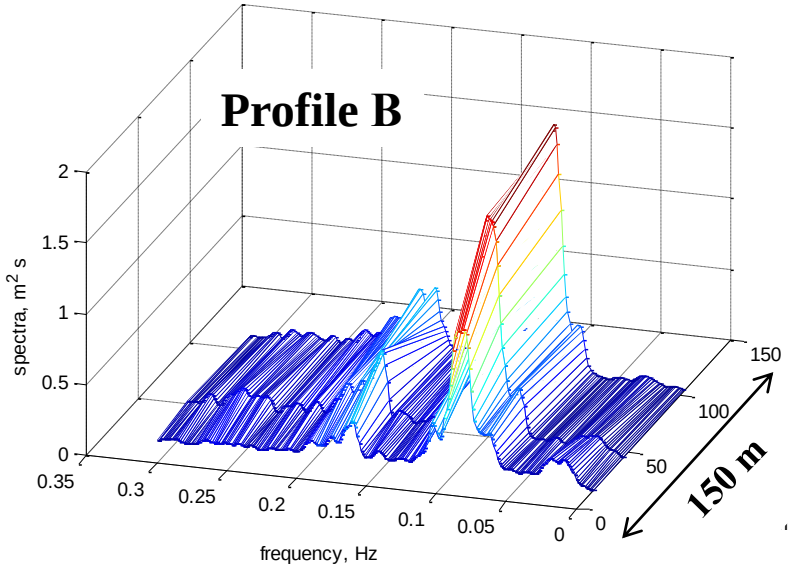
★ ★ ★ **wave data output from Mike21**


H=1.0 Tp=7.5 D=280 S=5
H=1.0 Tp=7.5 D=280 S=5
H=1.0 Tp=7.5 D=280 S=5
50 m
erosion
in upper part
accretion
in lower part
45 m
Depth, m
Distance, m
A
Pier
B
H=1.5 Tp=10.5 D=280 S=5
H=1.5 Tp=10.5 D=280 S=5
H=1.5 Tp=10.5 D=280 S=5
80 m
90 m
bar erosion
80 m
Depth, m
Distance, m

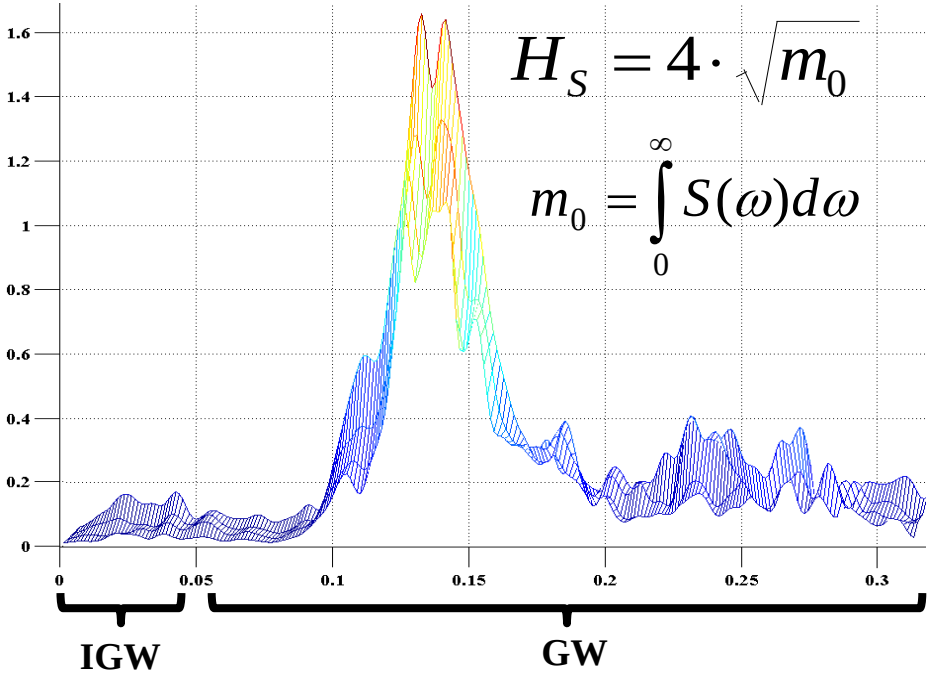
Waves transformation along profiles





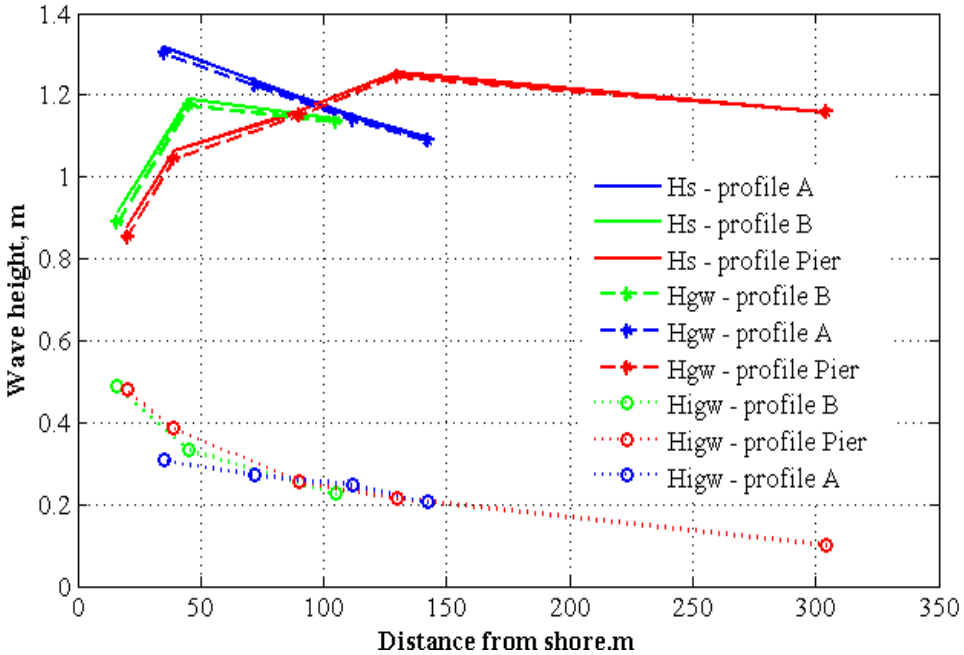


Waves transformation along profiles A, B, Pier

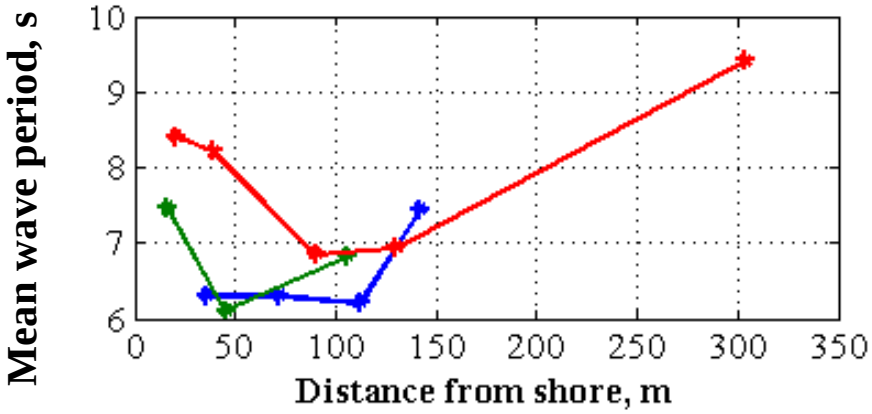


$$H_S = 4 \cdot \sqrt{m_0}$$

$$m_0 = \int_0^\infty S(\omega) d\omega$$



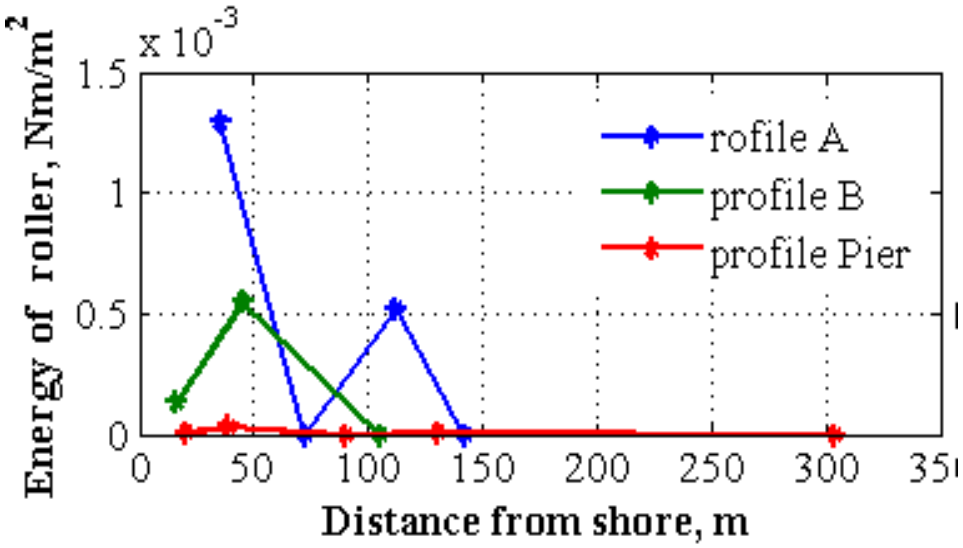
$$T_m = \frac{\int S df}{\int S f df} = \frac{m_0}{m_1}$$



Tp=10.5 s
H=1.0 m
S=5°

Wave breaking on profiles

Breaking slightly eliminated advance of IGW due to energy exchange between low- and high-frequency harmonics, as well as IGW dissipation.



Tp=10.5 s
H=1.0 m
S=5°

Results

- At increasing of significant height of a wave, the period and reduction of angle of wave energy spreading there is an increase in deformation of a bottom profile.

- The form and location of underwater terraced structure, which is formed under the influence of waves, depend on significant height and the period of waves.

- The period of spectral peak more influences on the speed of degradation of the coastline than significant wave height.

- Active impact of waves on deeper parts of an underwater profile begins at preservation of the same wave conditions more than 3 hours.

- There is heterogeneity of change of a bottom profile in the northern and southern directions which is caused by the features of transformation of irregular waves over this bottom profile leading to non-uniform variability of a field of infragravity waves.