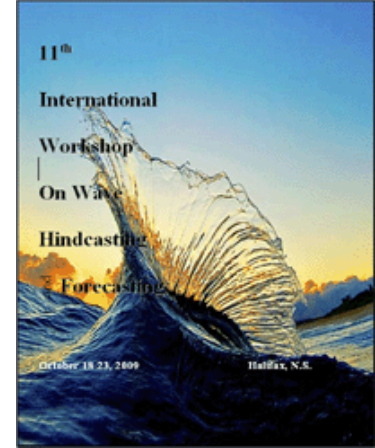




Anthropogenic storms in the Baltic Sea

Victor Alari, Ants Erm and Urmas Raudsepp

Marine Systems Institute at Tallinn University
of Technology

Email: victor@sea.ee



Presentation outline

- Motivation

Analysis of the properties of wakes induced by high speed vessels, interaction of wakes with the coastal zone and the society.

- Study area
- Vessel park
- Wake properties
- Wake impacts
- Conclusions
- The future

Study area (1)

- Shallow
- Tideless
- Maximum
Hs 8 m and
peak period
10 s



Study area (2)

- 40-50 crossings of high speed crafts per day in 1999-2008
- 18 crossings of high speed ferries in 2009 and future

- Maximum
Hs 5 m

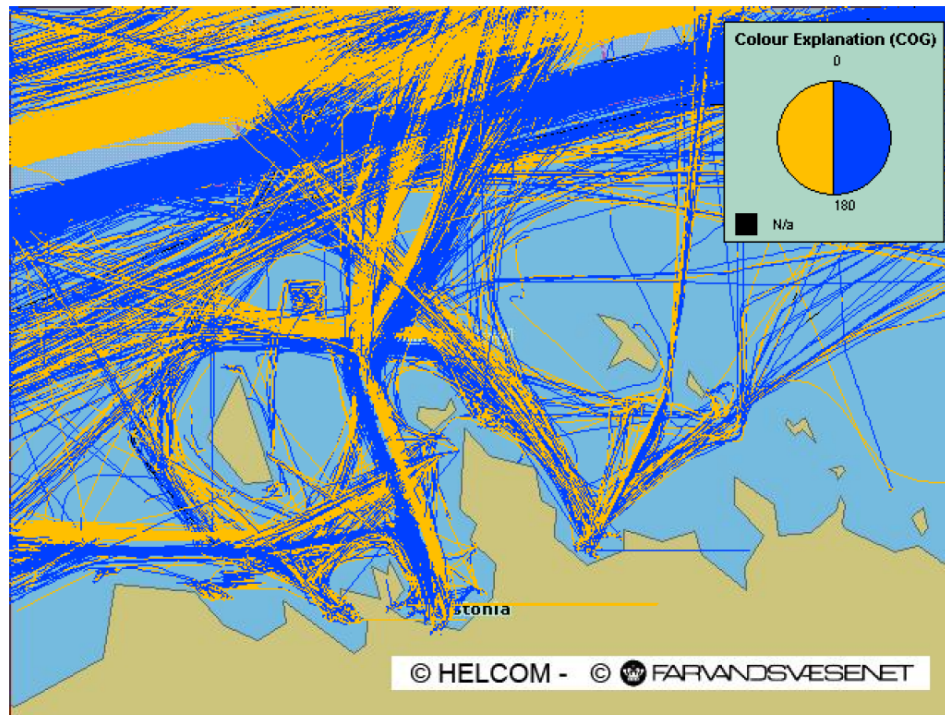


Study area (2)

Historical Track

GATEHOUSE

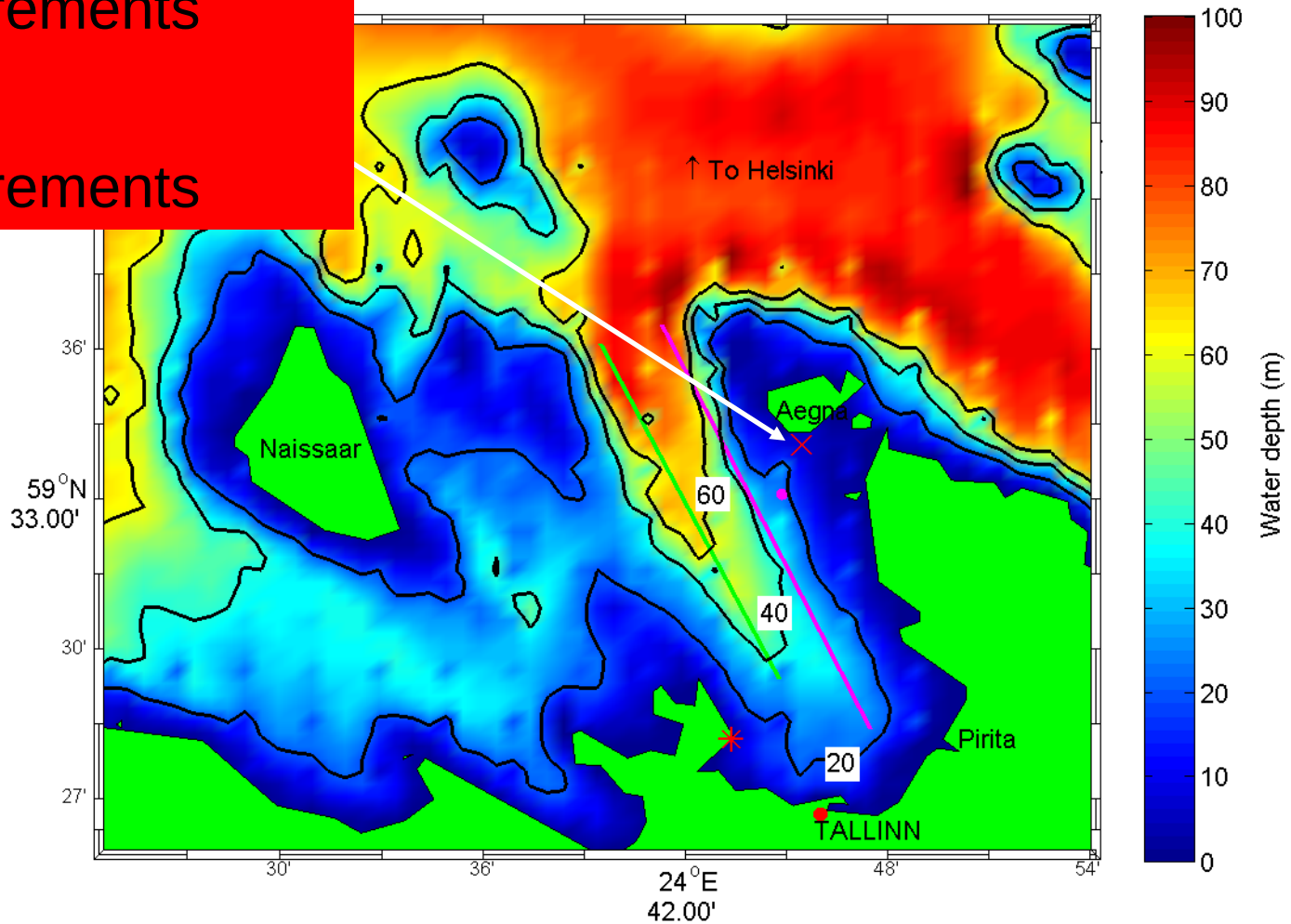
Area : TallinnMuuga
Start : 15th April, 2009 00:00
End : 14th May, 2009 23:59



Study area (4)

Wave
measurements

Optical
measurements



The fleet



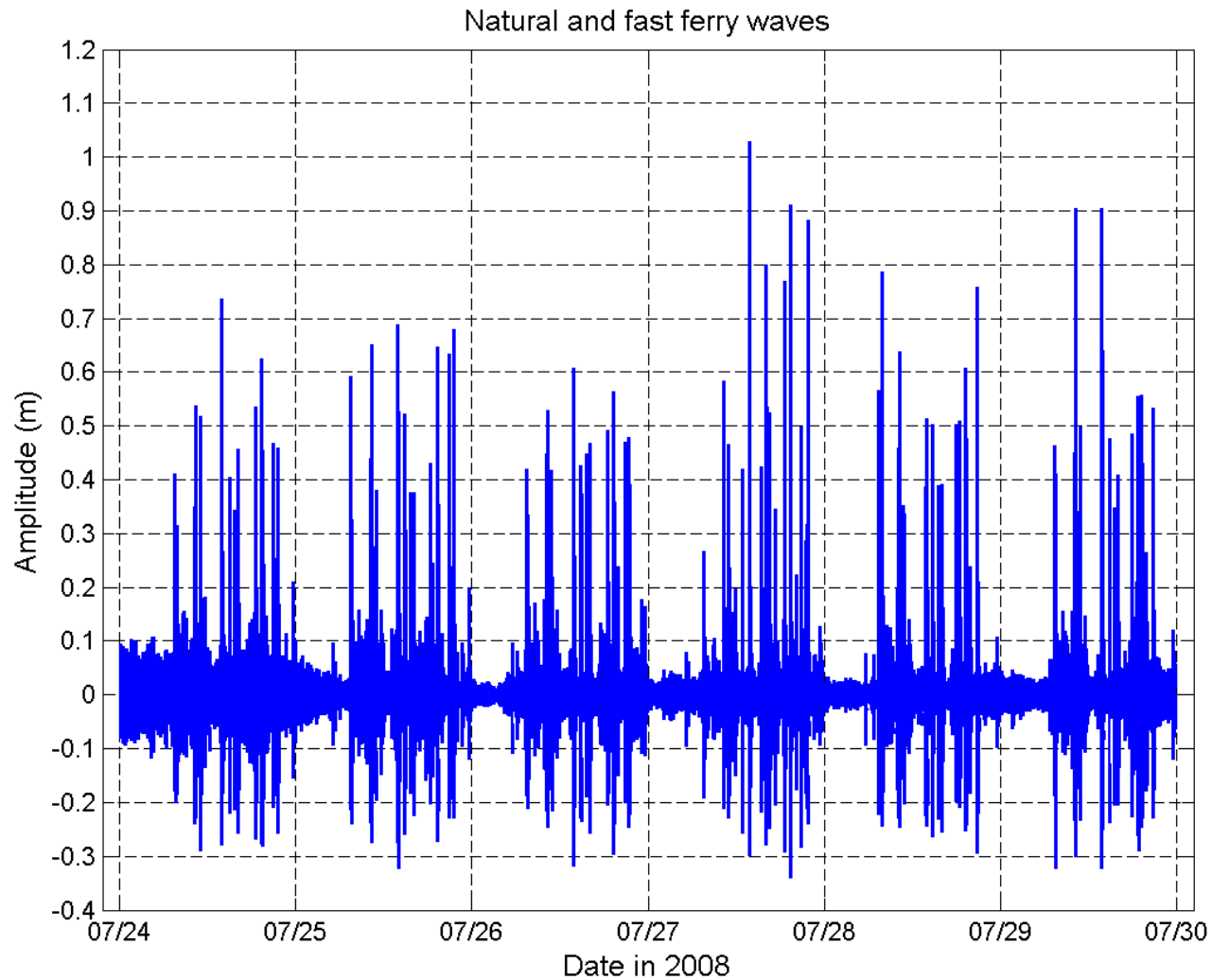
$$F_H = \frac{U}{\sqrt{gh}} = 38 \text{ knots} / \sqrt{9.81 * 40} \approx 1$$



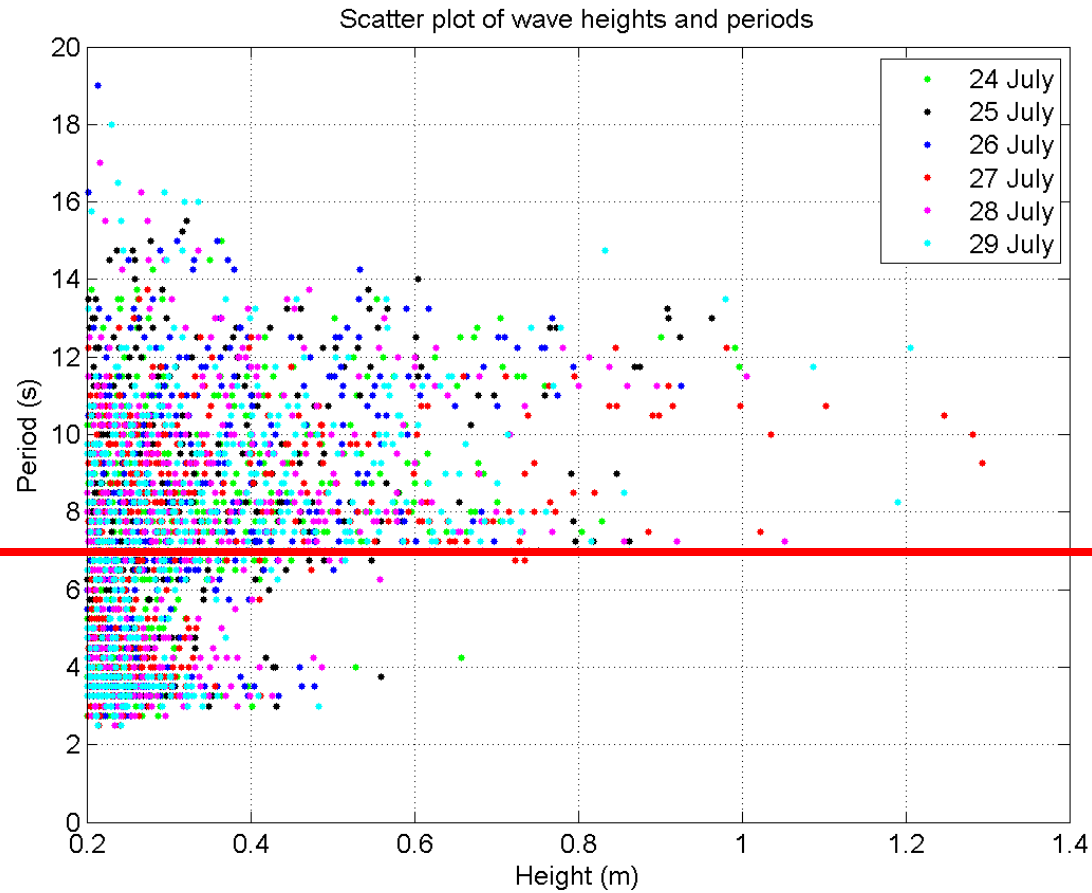
$$F_H = \frac{U}{\sqrt{gh}} = 28 \text{ knots} / \sqrt{9.81 * 40} \approx 0.73$$



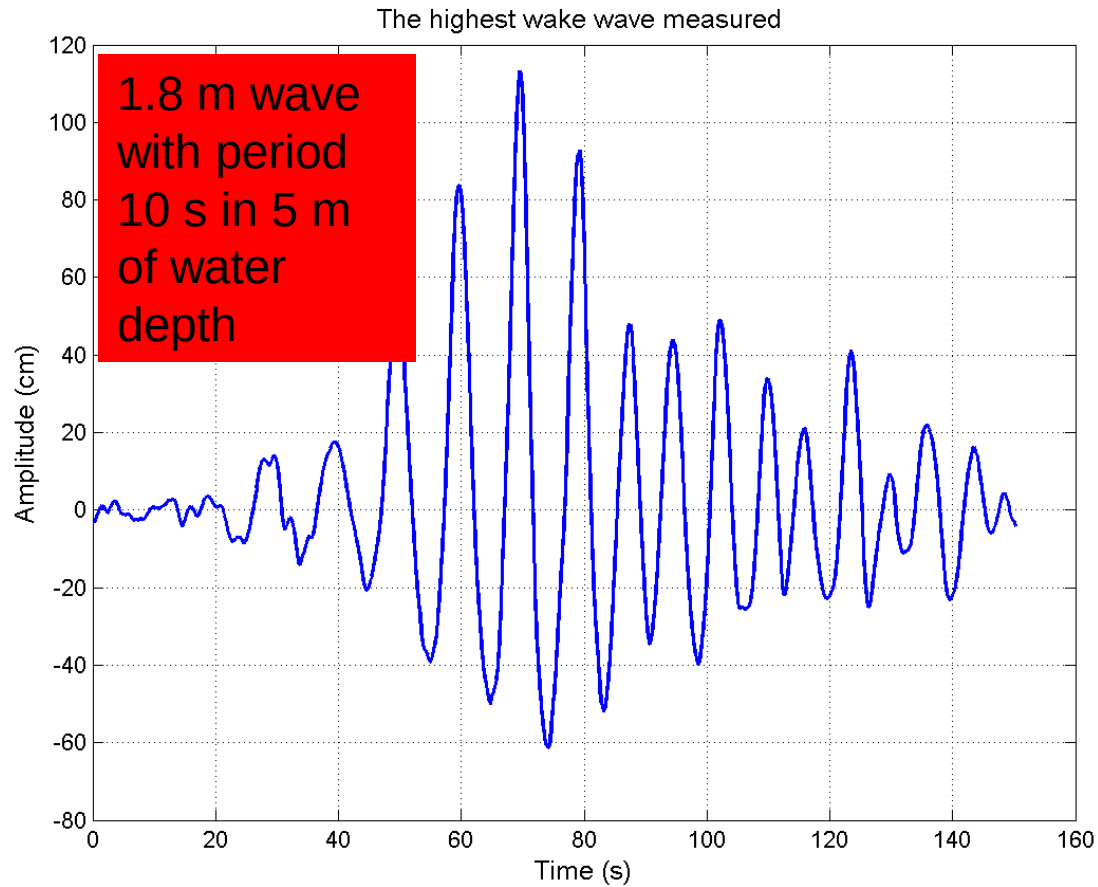
Wake properties (2)



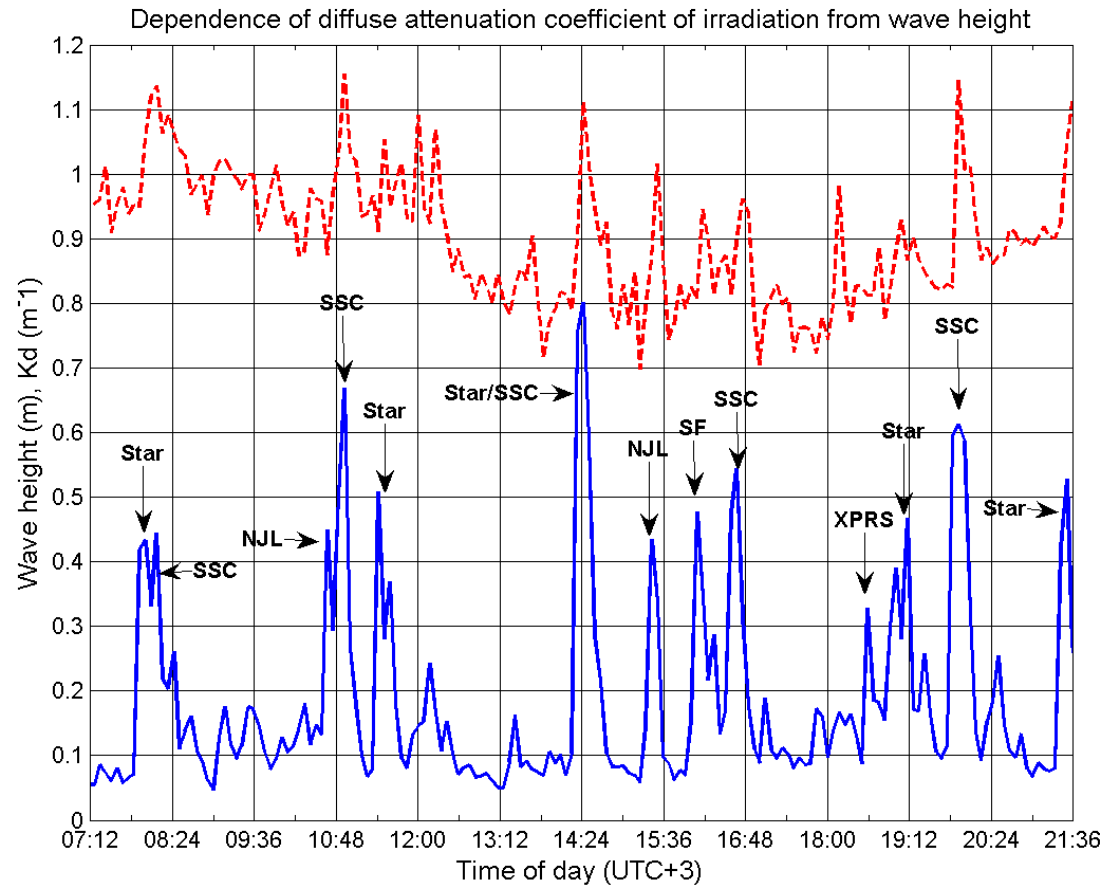
Wake properties (3)



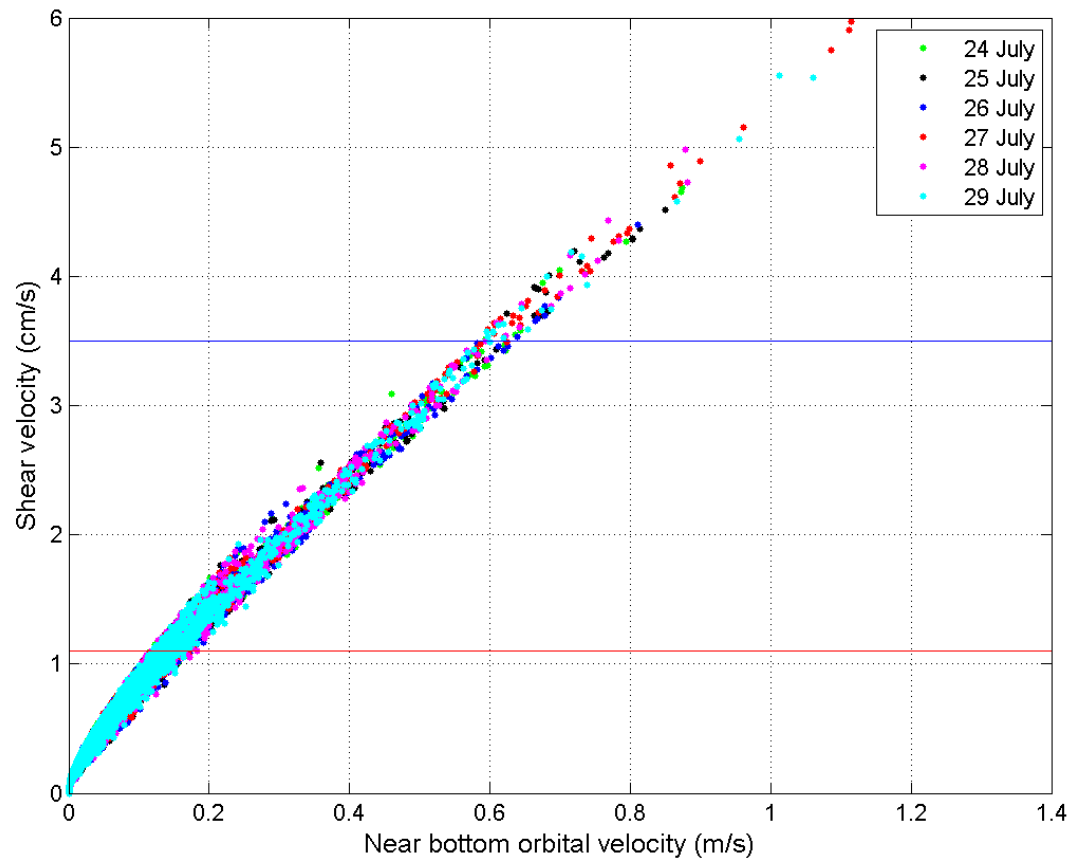
Wake properties (4)



Impact of wakes (1)



Impact of wakes (2)



Conclusions

- Non-linear (crest-trough asymmetry), high (over 1 m every day), long-crested (periods from 8-15 s), mixing (near bottom speeds over 1 m/s)
- Intensive resuspension of sediments, worsening of underwater light field
- Dangerous for humans, ecosystem, navigation, infrastructure and coasts.
- 10 min = safe environment.

The future...

- Is connected with past: 4 PhD thesis, ~40 peer-reviewed papers, ~10 technical studies etc
- And do we learn from the past?
- Of course, not!
- The dangerous waves still propagate and still make damage.

A fact

- A man was killed, when fast ferry wakes capsized the fisherman's boat in Tallinn Bay. He did not drown, he died in pneumonia.



A mystery

- 55 m long cargo vessel (M/S Zenitas) capsized in Tallinn Bay on 6 June 2000, when making a 90 degree turn to alter course. The ship was not overloaded. Formal investigation found, that it had listed due to false loading.
- The first officer drowned with the ship, captain lived.
- The sea state was Beaufort 0.
- A fast ferry passed the accident site just minutes before and as usual, creating long-crested unexpected waves.
- Is it a coincidence?

The sea does not forgive
mistakes!