Damping of ship-induced primary waves in groyne fields

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Ships in rivers create waves and these can have a negative impact on fish habitats along the river banks. A modelling study is carried out to investigate how these ship-induced waves can be damped in groyne fields by making structural modifications to the groynes. For this purpose, different types of openings (notches) are applied to the groynes. Next, hydro-ecologic indicators are used to assess the impact of notching of groynes on fish habitat suitability. The results suggest that relatively simple modifications can significantly improve the ecological value of the groyne fields.

***Keywords**: ship-induced waves, groyne field, ecological preservation, hydraulic modelling.*

Methods

- Reducing the primary wave effect
- 2D hydrodynamic numerical model study (Xbeach)
- Area of interest based on living habitat vulnerable fauna
- Ecological indicators:
    - Maximum water level range in a timestep of 60 seconds
    - Maximum velocity range in a timestep of 60 seconds

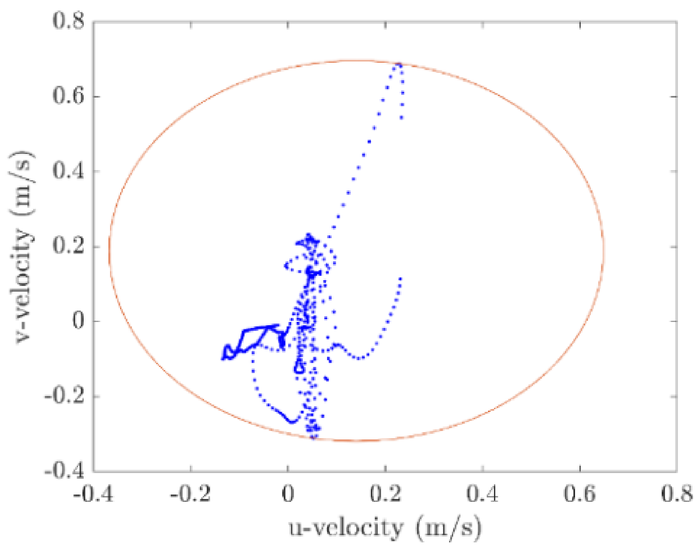

Figure 1: plot of the u- and v- directed velocity values during ship passing to determine the maximum velocity range.

Results

- Notch study dependencies: notch location, notch width, notch depth, notch shape, and number of notches.
- Optimal notch design
- Varying vessel sizes
- Varying river water levels
- Attached side channel

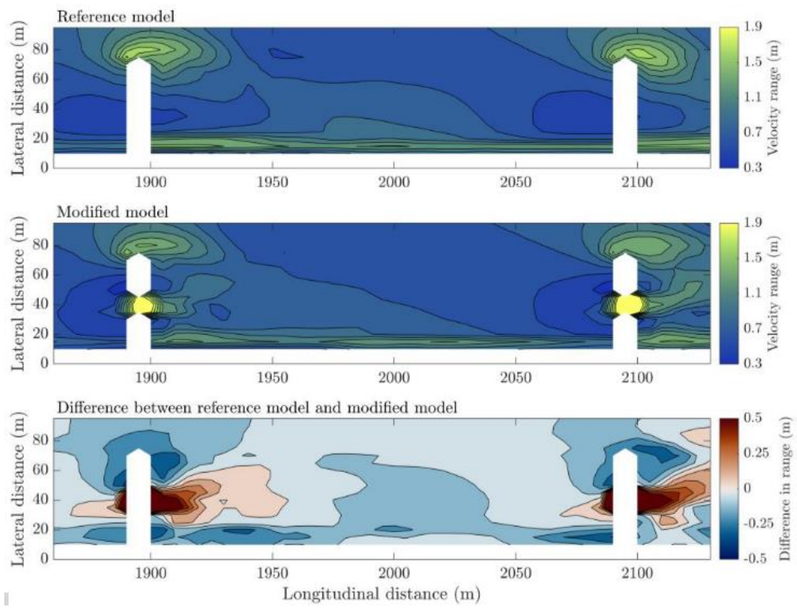

Figure 2: Flow velocity range during passing of a ship (travelling upstream). The base flow in the main channel is from left to right.

Conclusions

- The habitat quality in the groyne field and side channel can be increased by placing notches in groynes
- The maximise the fauna habitat quality, the notch location and discharge through the notch are the most important parameters to optimise

Further reading

Pasman, R., Schielen, R. M. J., Bricker, J., van der Hout, A. J., Uijttewaal, W.S.J., Mosselman, E. & Huthoff, F. (2020). Damping of ship induced waves by modifying groynes with the aim of increasing quality of fauna habitats.