MODELLED RATES OF POTENTIAL BULK AND NET SEDIMENT TRANSPORT ALONG THE GULF OF RIGA COASTLINES

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16.11.2023

Introduction

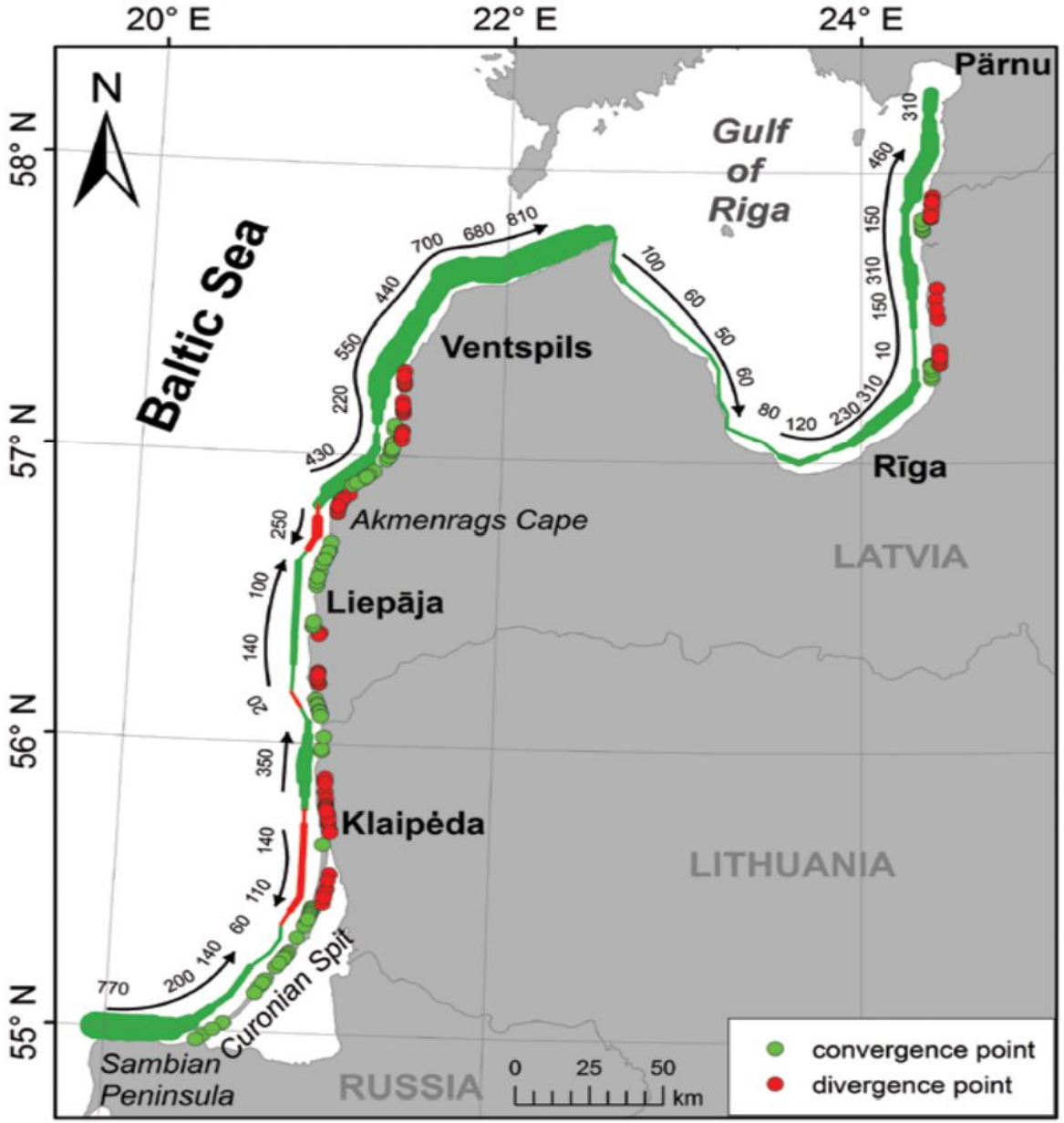
RESEARCH AIMS:

1) Quantify the rates of longshore sediment transport along the coastline of the Gulf of Riga

2) Identify the sediment transport convergence and divergence zones for that area

The research motivation:

Previous studies of longshore sediment transport have had a courser resolution grid (about 5.5km) which is not sufficient for analysis of fine scale features



(Viska & Soomere, 2014)

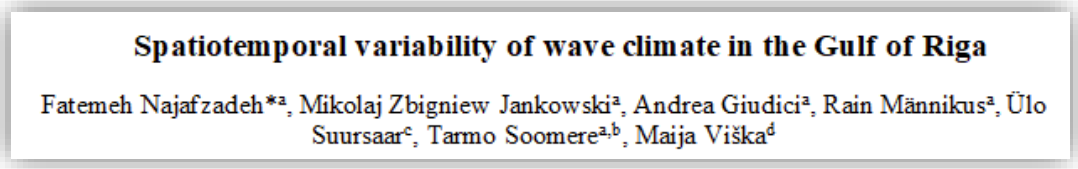
Methods – The wave model SWAN

SWAN wave model - cycle III, version 41.31A.

It is a third-generation spectral waves model, that creates sets of waves sequences through solving the wave action balance equation. Parameters of interest: Hsig, Dir.

1) Published in Estuarine, Coastal and Shelf Science.

2) Accepted after peer-review in Oceanologia.



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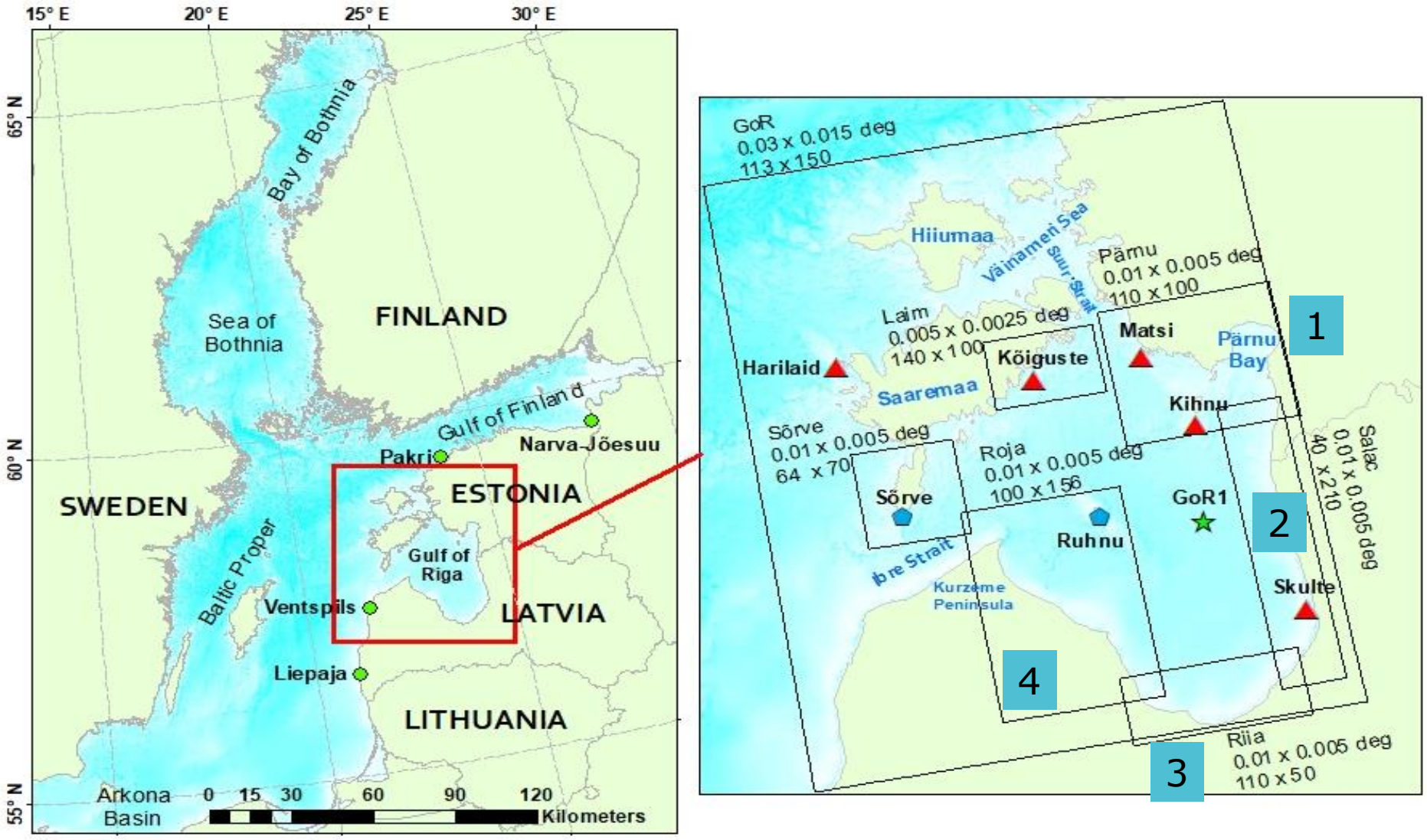
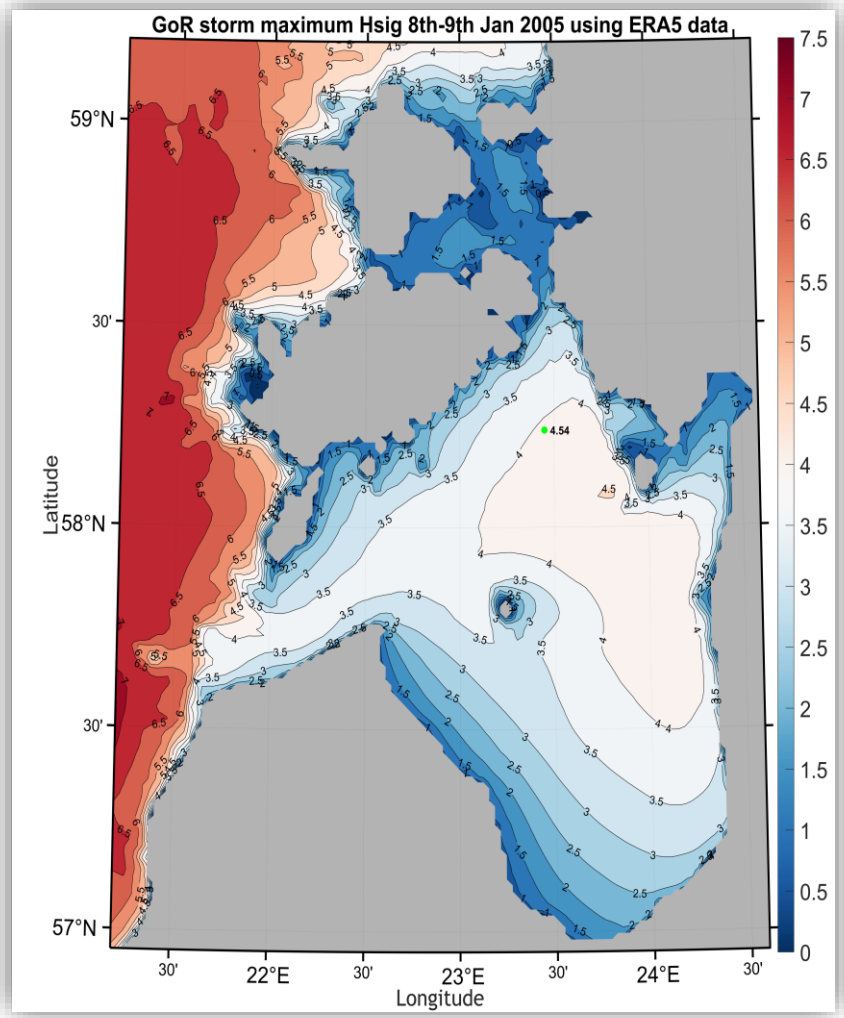
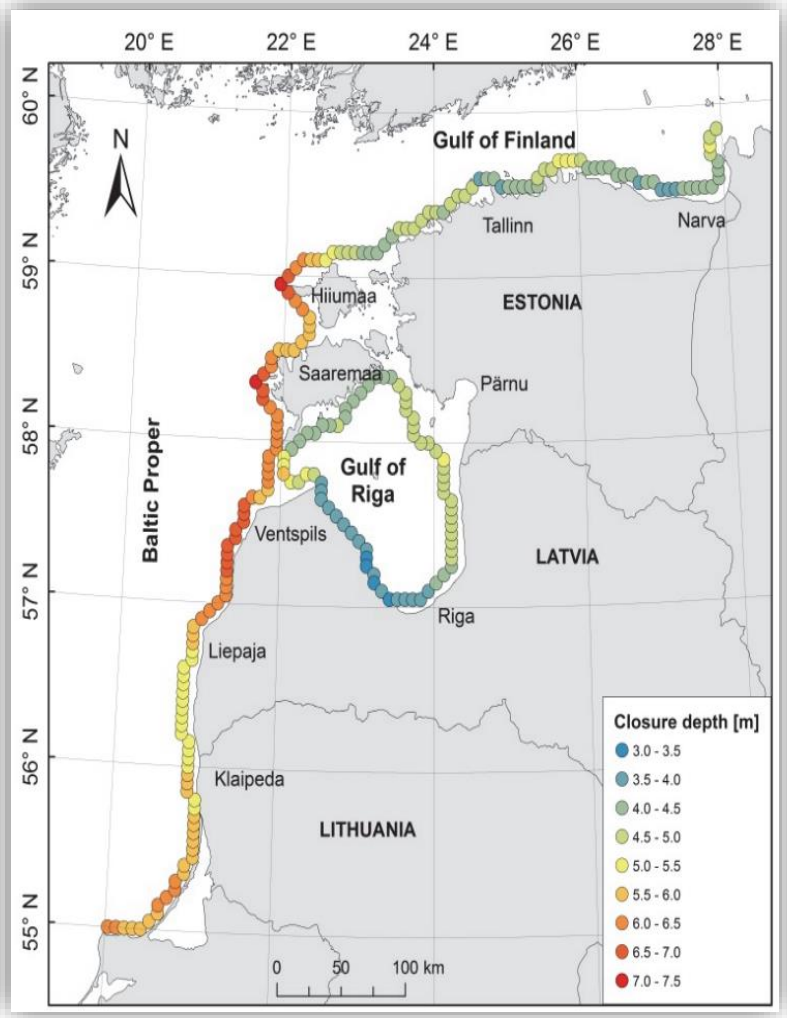
Methods – the GoR SWAN grid system

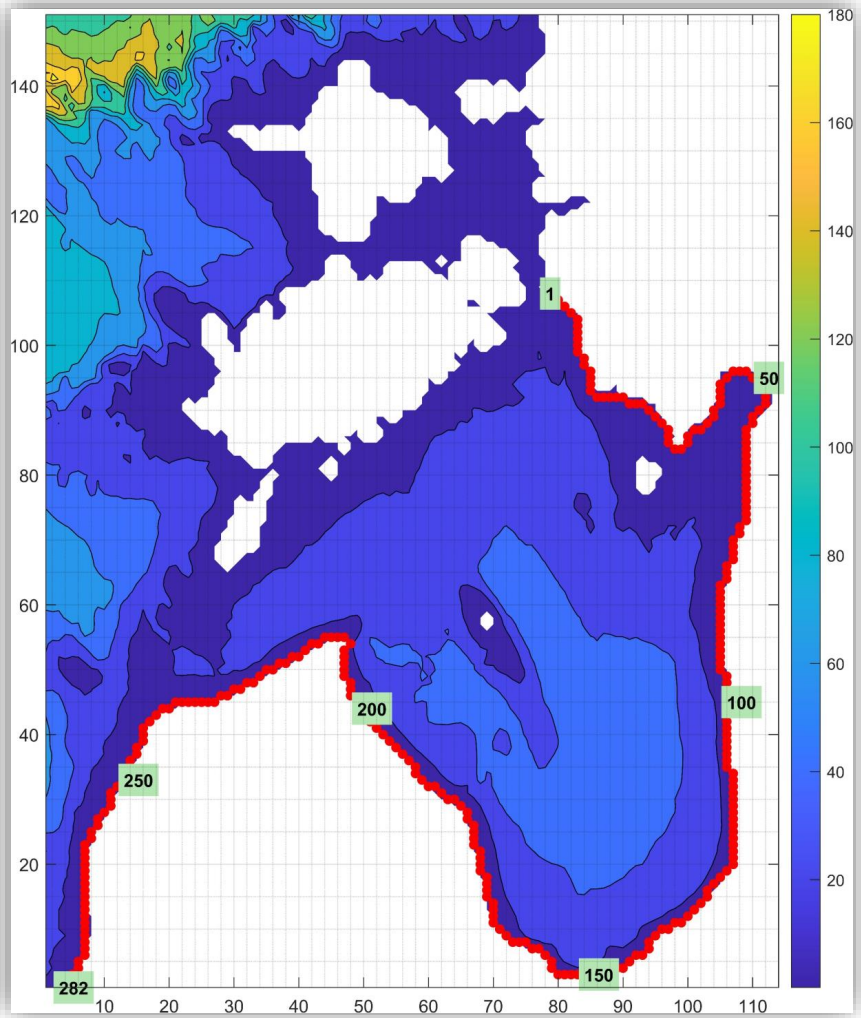
Triple-nested rectangular grid system, each level of increased density. Finest resolution used is 560m.



Wave data, point selection, beach closure depth







Storms/95-percentile Hsig => estimate of closure depth => Selection of suitable depth points

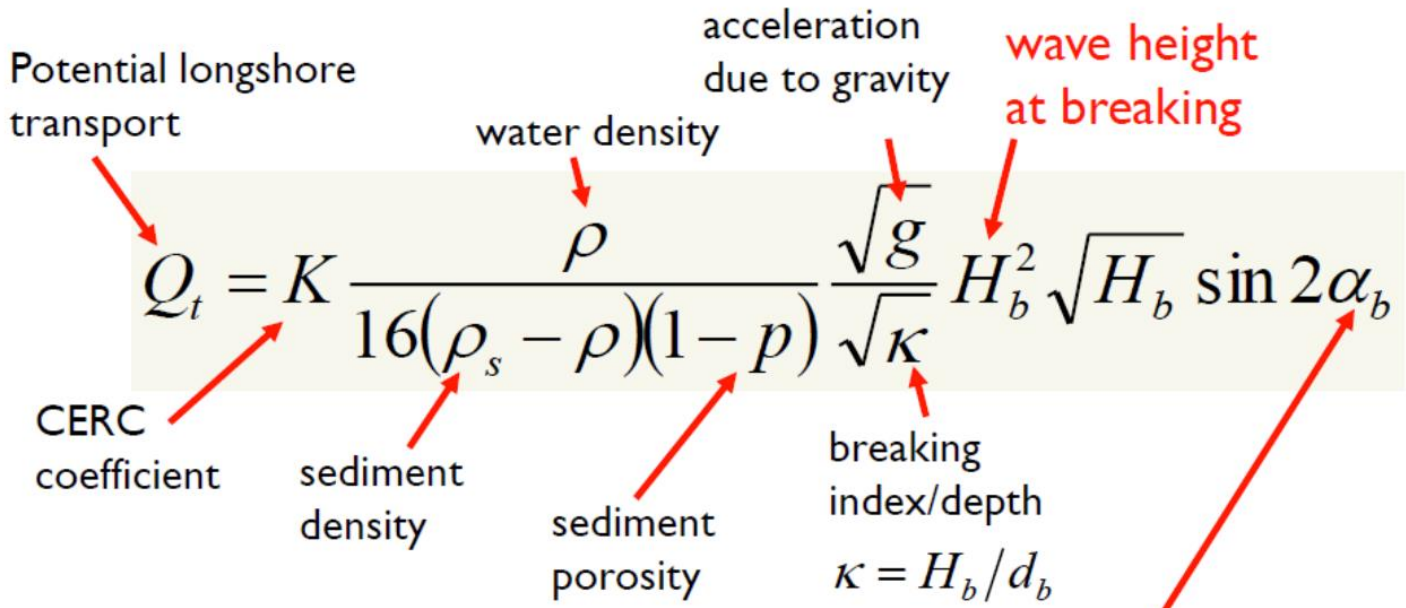
(Najafzadeh et al., 2023)

(Soomere et al., 2013)

Methods – the CERC formula

Transport intensity from properties of waves and sediment

CERC method *(Coastal Engineering Research Council)*



Wave-driven longshore sediment transport is proportional to the wave energy flux (wave power)

angle between the wave crests and the isobaths at the breaking (includes information about wave period via refraction)

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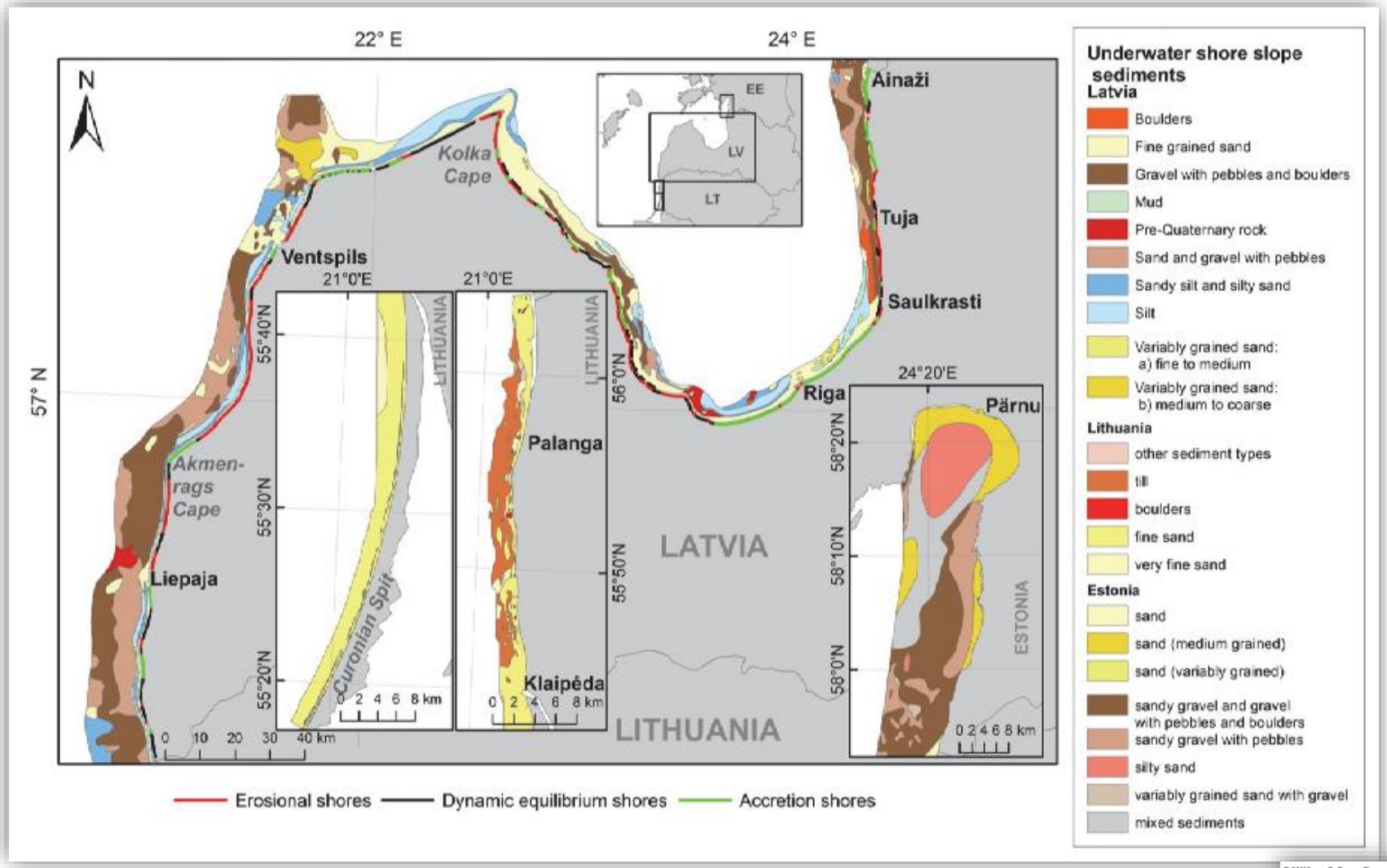
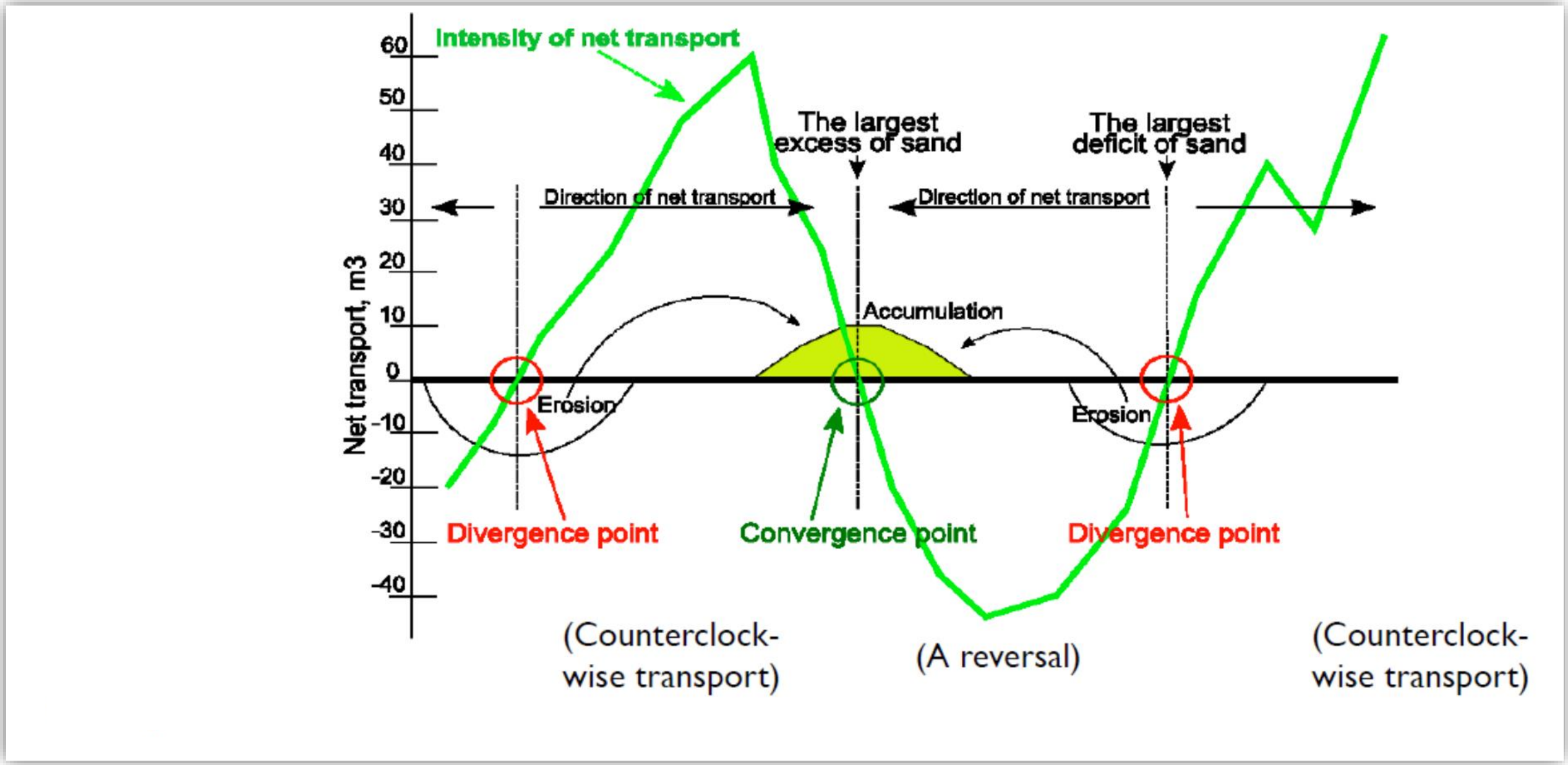
Method limitation – sediment availability

The model results are invariant with the grain size and density of available sediments along the studied coastline. This is one of the areas for improvement (currently ongoing).

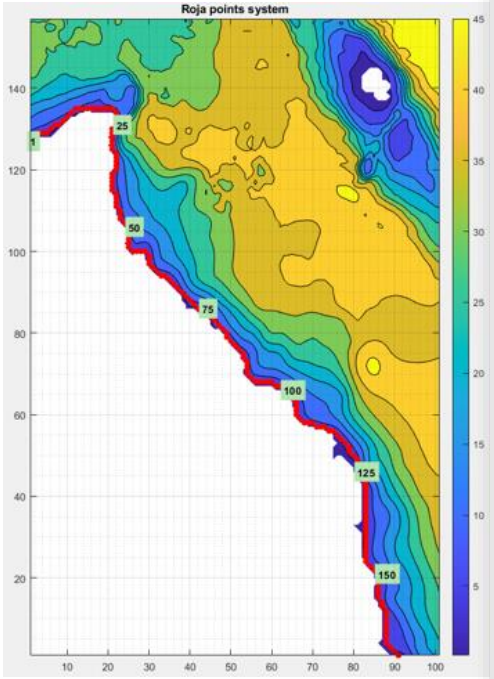


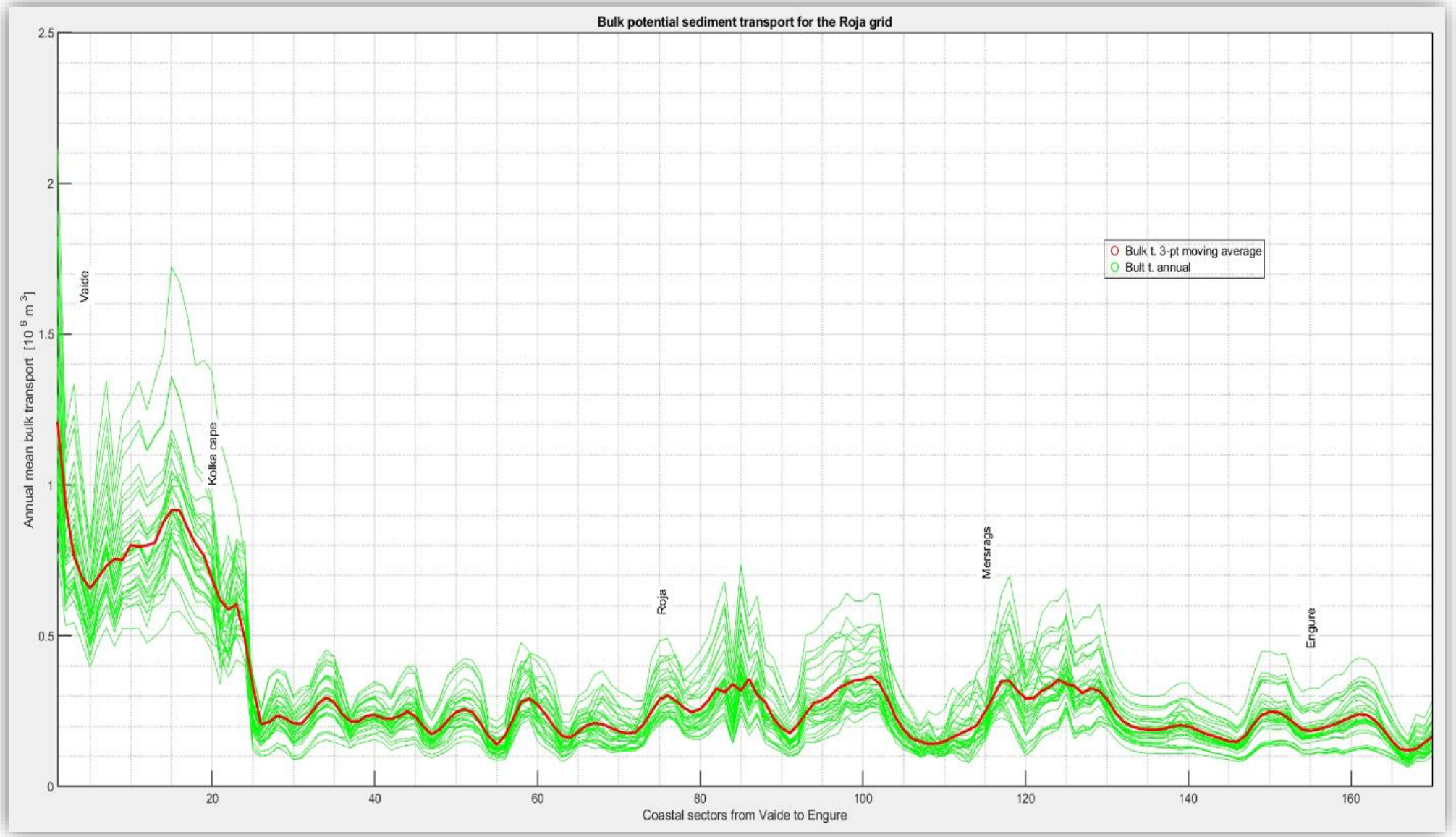
Viška M., Soomere T. 2013. Simulated and observed reversals of wave-driven alongshore sediment transport at the eastern Baltic Sea coast. *Baltica*, 26(2), 145–156.

Tutorial on reading the net transport figures

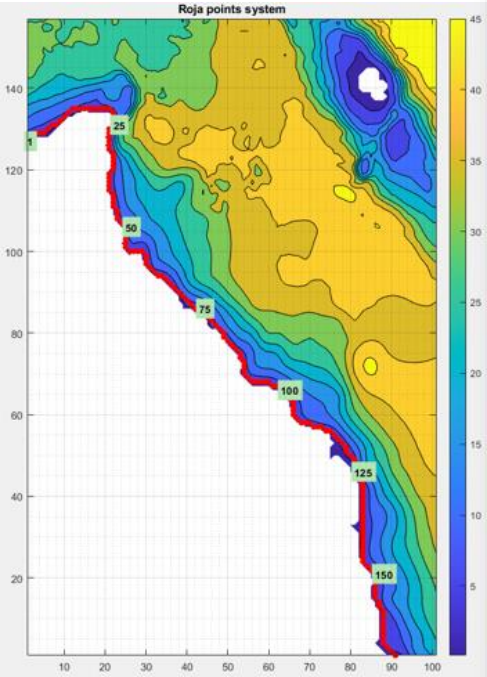


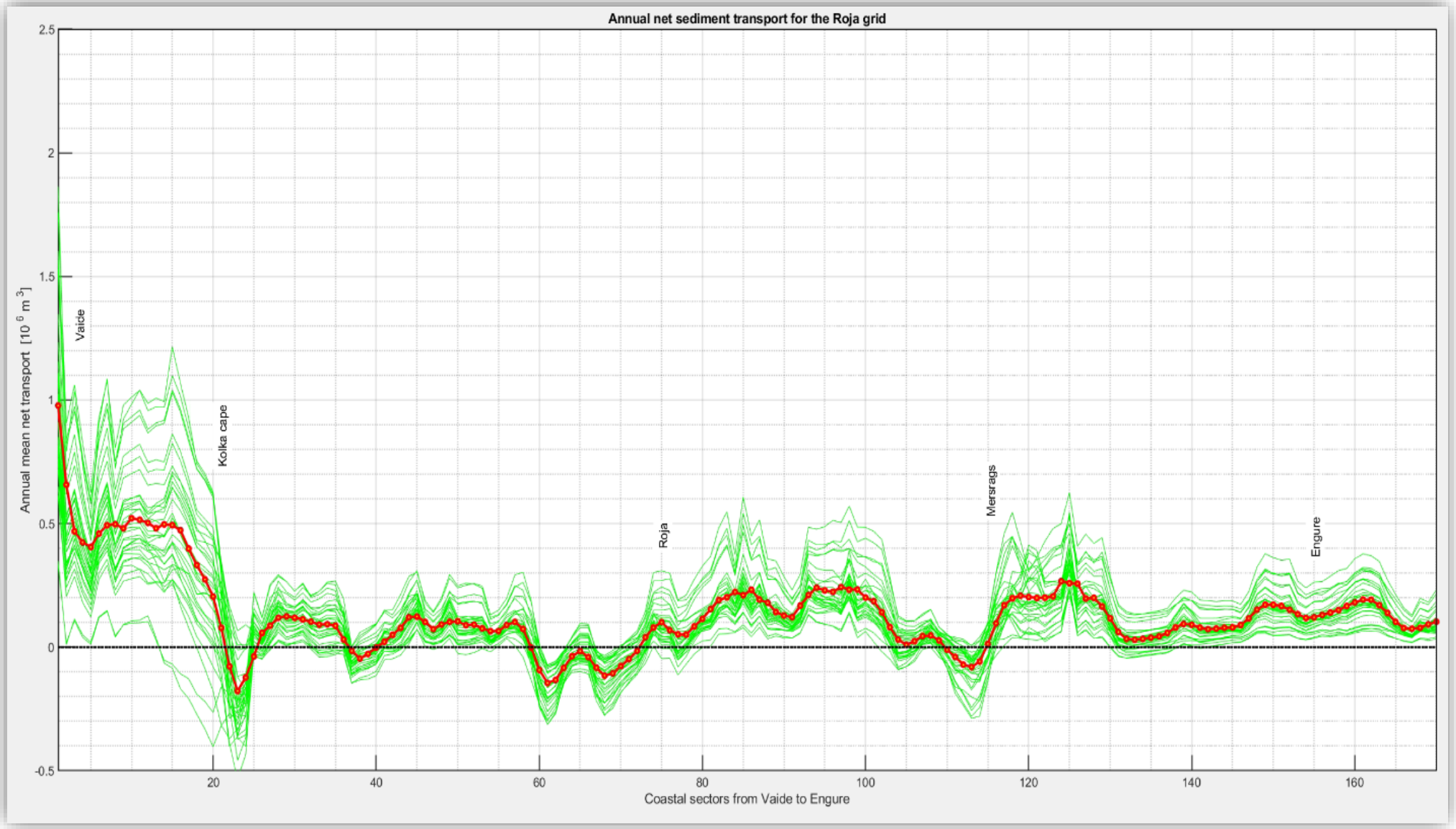
Results: Bulk transport - Roja



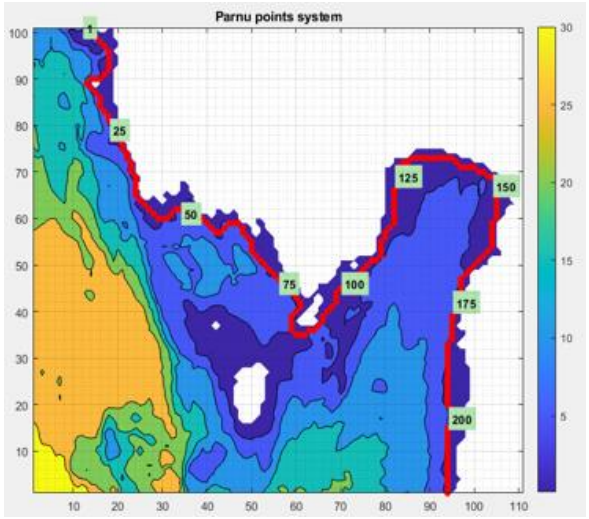


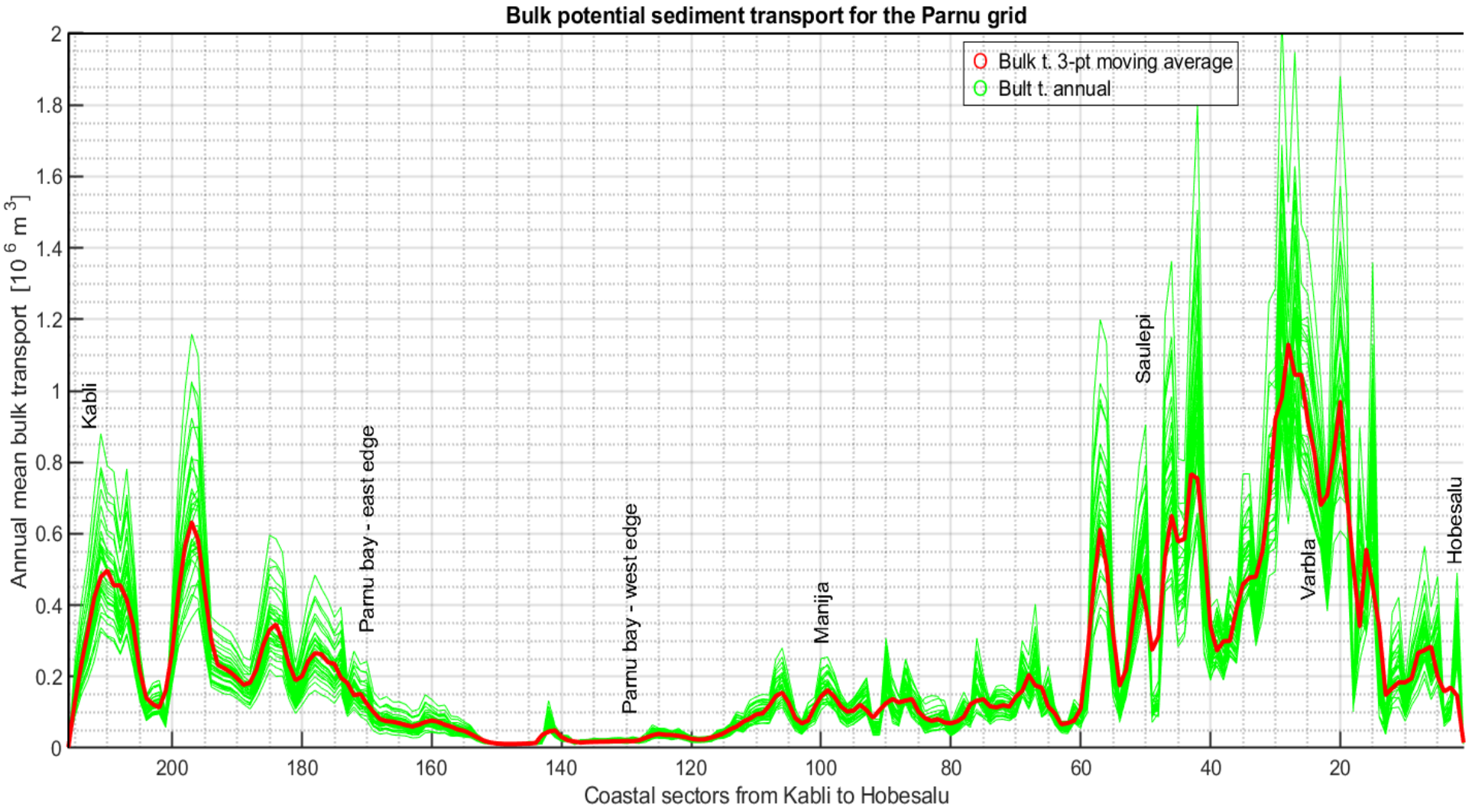
Results: Net transport - Roja





Results: bulk transport - Parnu





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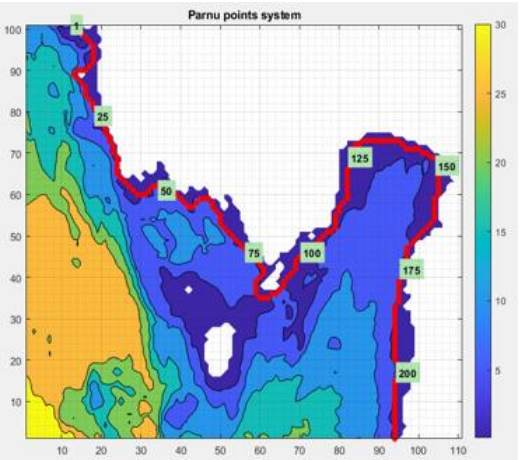
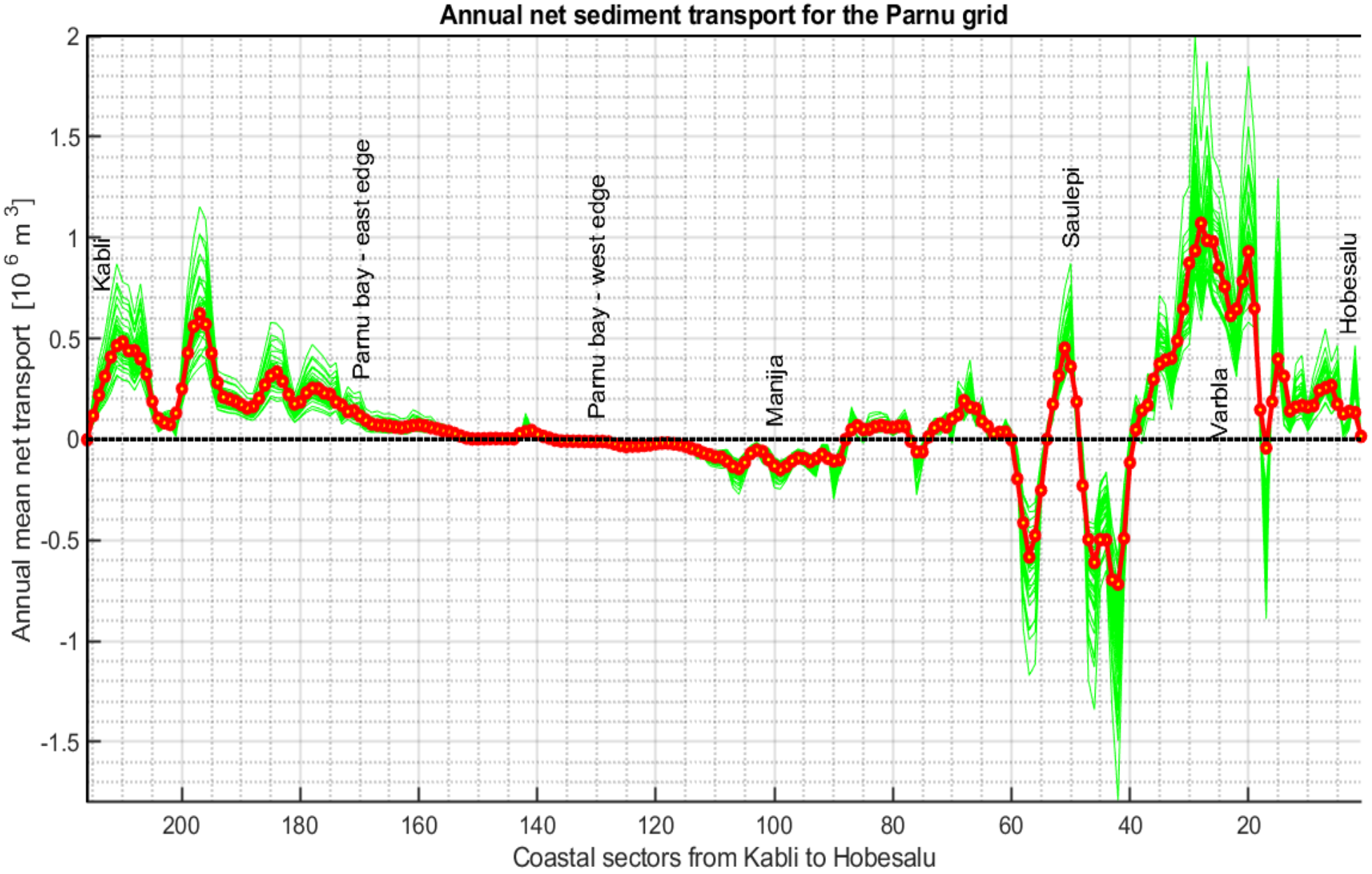
Results: net transport Parnu





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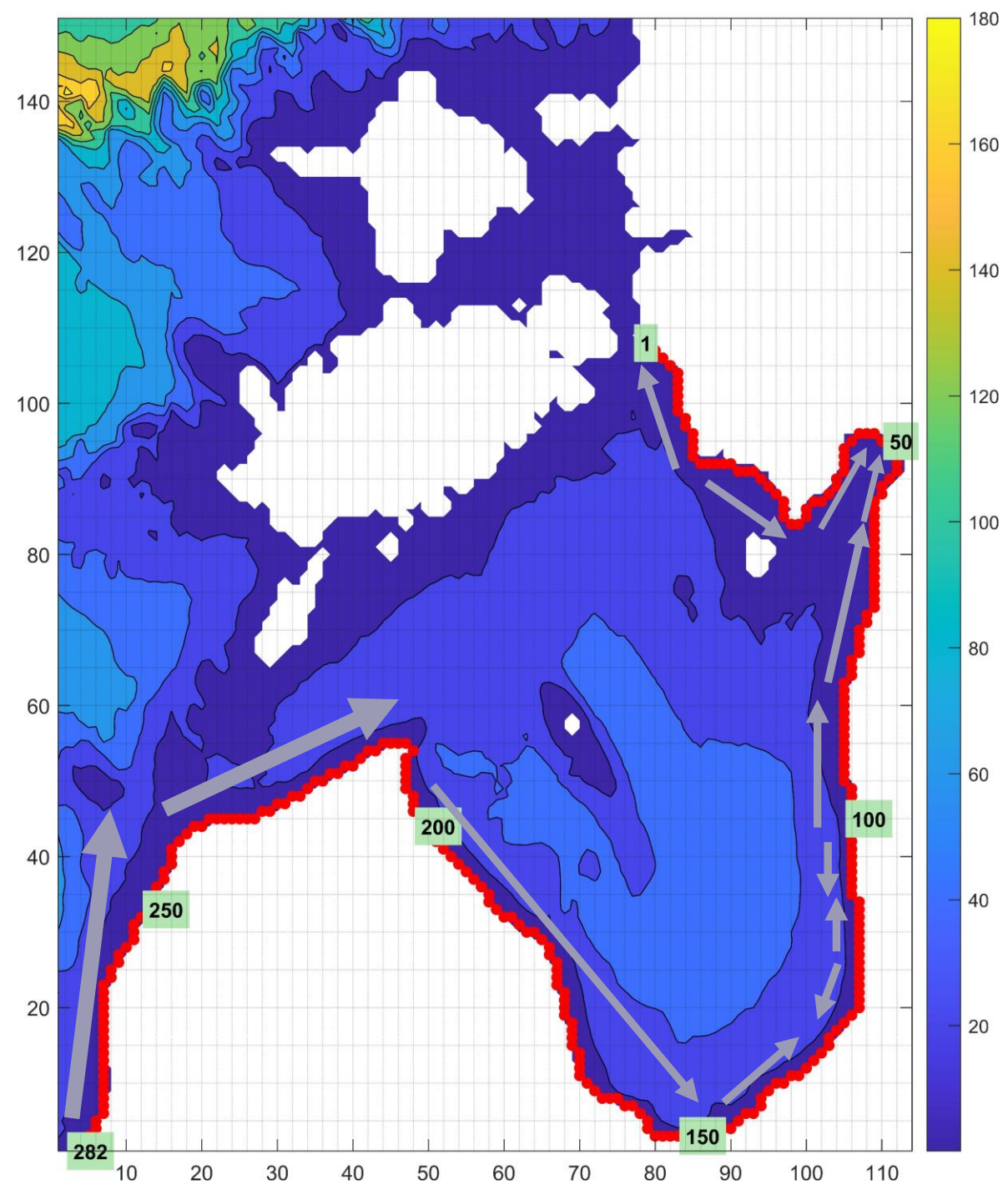

The significant trends observed along the eastern Latvian coastline are consistent with the previous results for, both direction and magnitude.

There is a very significant decrease in the rates of potential sediment transport west of the Kolka cape in Latvia, but the transport direction remains the same.

North of Riga there are several cells with reversals in the direction of potential sediment transport. This is consistent with other research undertaken in that area, where such zones have been observed (Knaps, 1966; Ulsts, 1998; Eberhards, 2003).

Parnu Bay experiences some accumulation and as a result has a regular need for harbour dredging. However, the coastline of southern Estonia has very limited amount of fine-grained sediments, making potential transport calculations for that segment unnecessary.

Concluding Remarks and Future Goals

Conclusions:

There is reasonable agreement in magnitude and directional components of the longshore sediment transport, with the higher resolution findings, revealing certain patterns with enhanced clarity.

Future goals:

1) Refining the results – there are still areas for improvement in the model results quality, as some of the finer scale fluctuations in transport rates appear to be too variable to reflect the reality.

2) Extending the methodology further along the coastline to the west and southwards from Kolka Cape, at least to the Sambian Peninsula and also possibly to the Polish coastline.

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This research is supported by:
1) Estonian Research Council (grant PRG1129)
2) European Economic Area (EEA) Financial Mechanism 2014-2021 Baltic Research Programme (grant EMP480)

Thank you for your attention ☺

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