

morphological trend analysis of beach and shoreface along the Belgian coast

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Flanders hydraulics Research
Quest4D final workshop

morphological trend analysis: methodology

- = study of morphological evolution of beach and shoreface along Belgian coast from 1997 until now

- based on: -beach measurements
-shoreface soundings

→ only digitally available data sets were used: 1997-2010

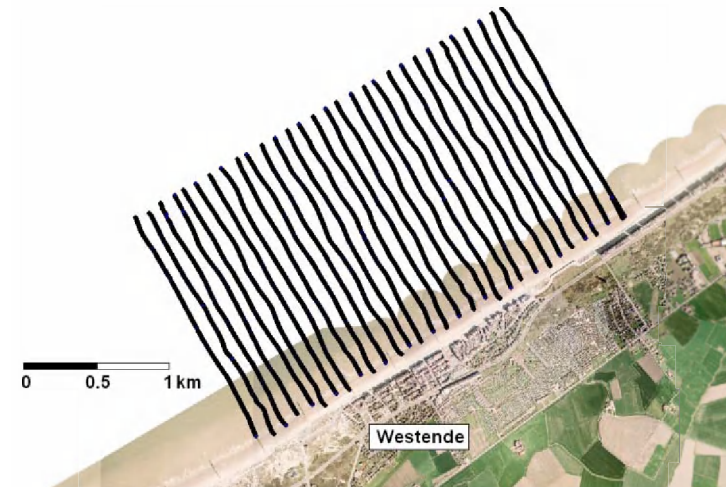
→ data sets were delivered by Coastal Division (Flemish Government)

- methodology: using GIS software

→ interpolation of data sets to topo-bathymetric grids (resolution 2m x 2m)

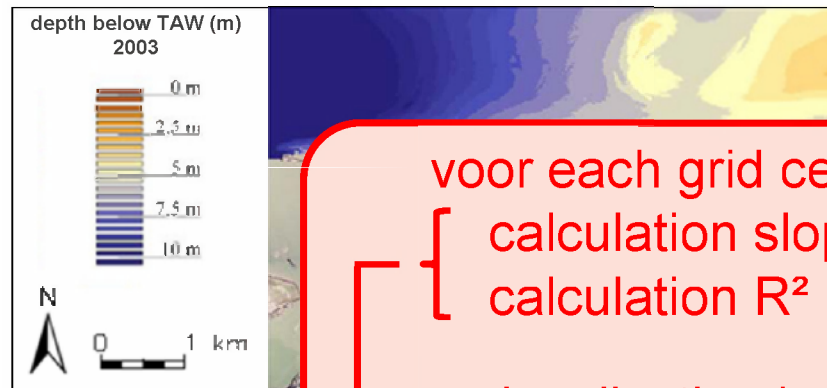
→ performing for each grid cell a trend analysis on time series of depth

values available for that grid cell



morphological trend analysis: methodology

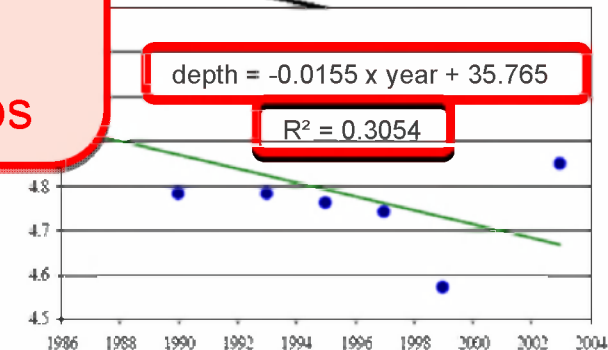
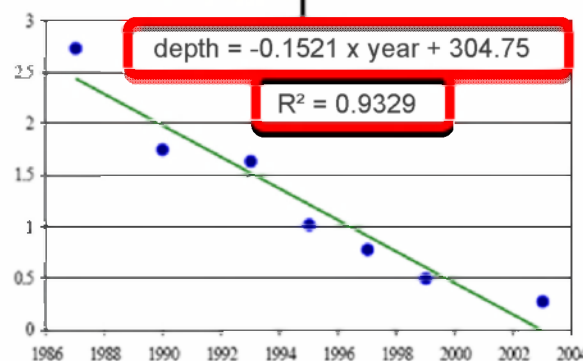
Method: linear least squares fit of a time series of depth values
applied to each grid cell



voor each grid cell:
[calculation slope
calculation R^2

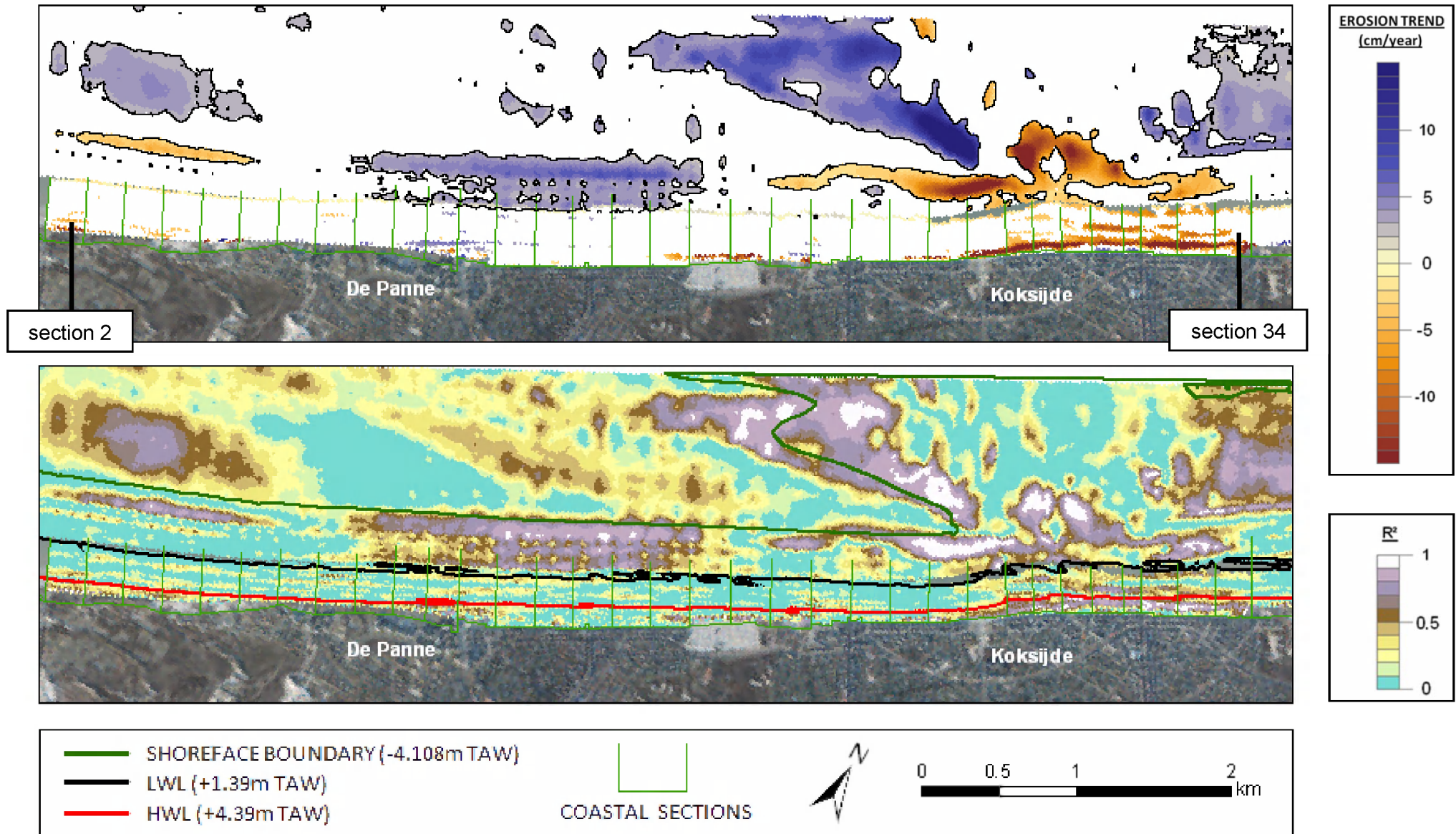
visualization in maps

$R^2 > 0.5 \rightarrow$ significant trend
sedimentation rate of seafloor
= 15 cm/year

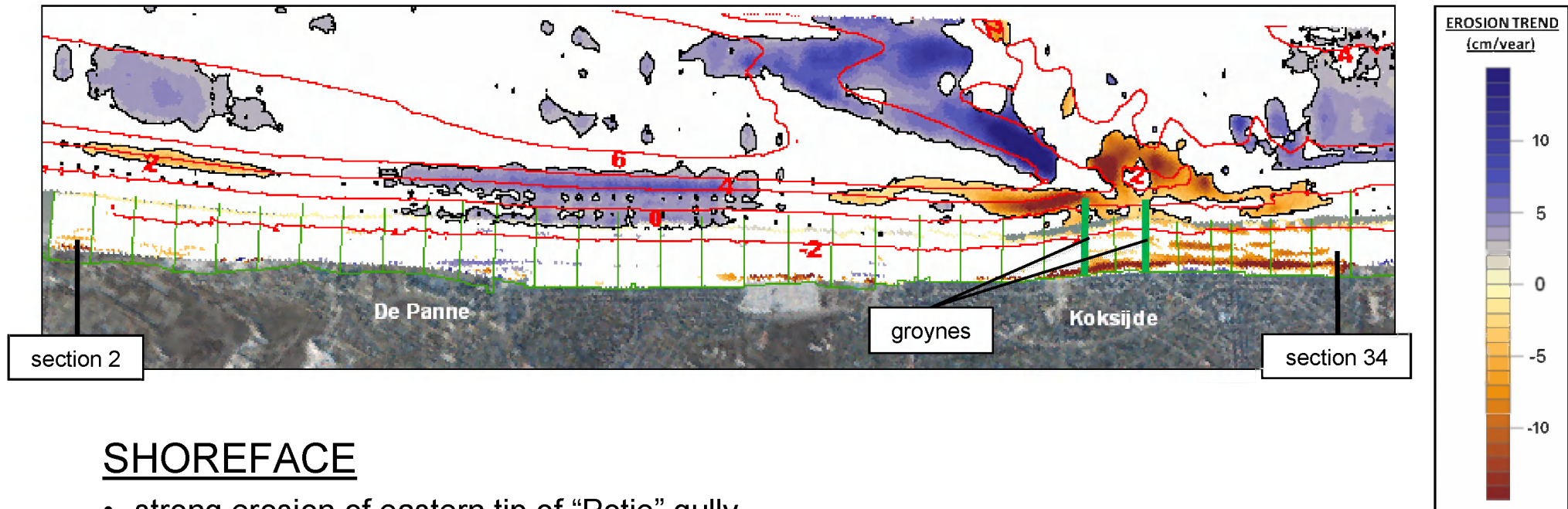


$R^2 < 0.5 \rightarrow$ no significant trend

morphological trend analysis: beach and shoreface: sections 2-34



morphological trend analysis: beach and shoreface: sections 2-34



SHOREFACE

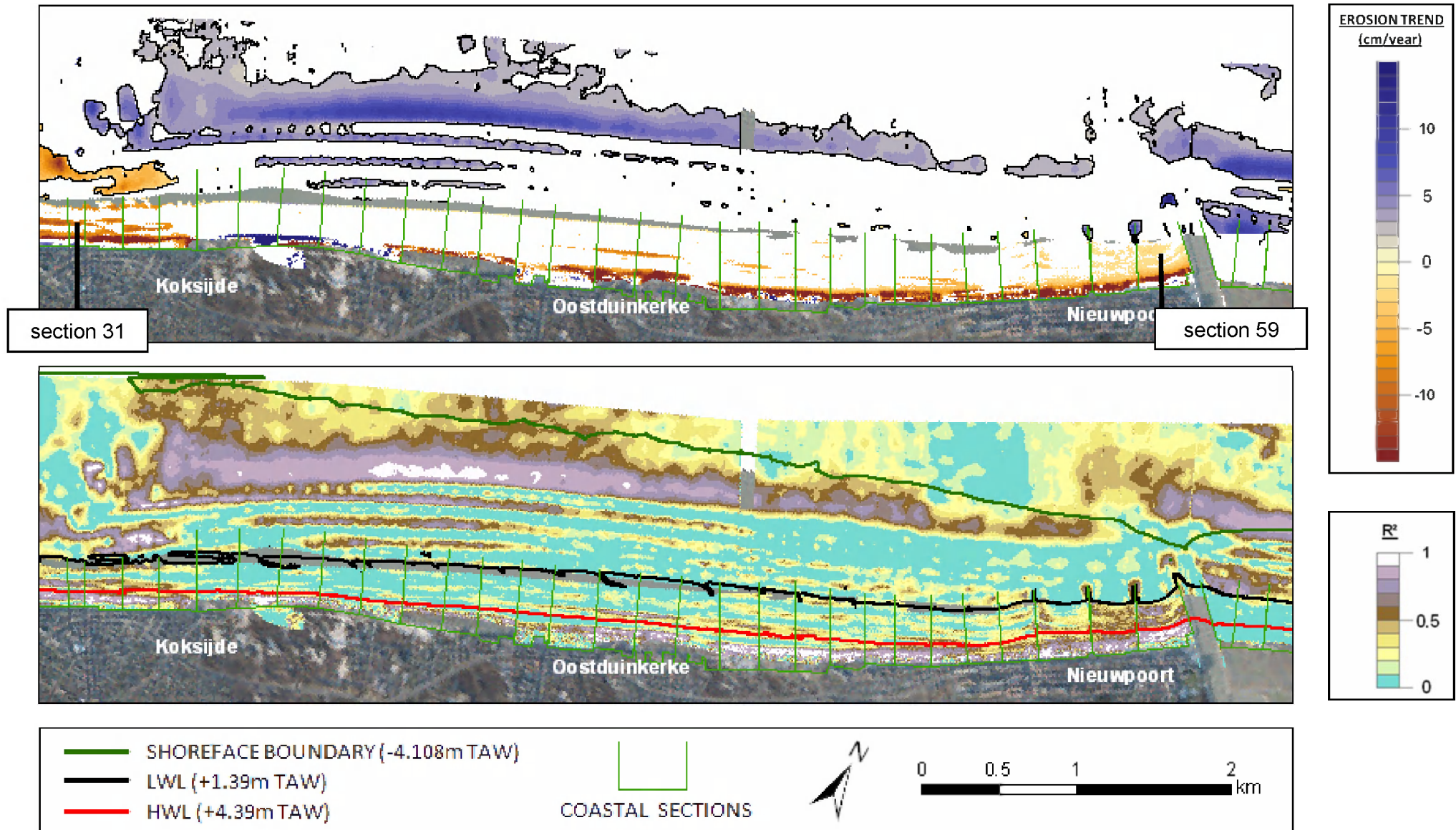
- strong erosion of eastern tip of “Potje” gully
- further eastern expansion of “Potje” by groynes Koksijde (constructed in ‘85- ‘86)
- strong sedimentation trend around groyne

BEACH

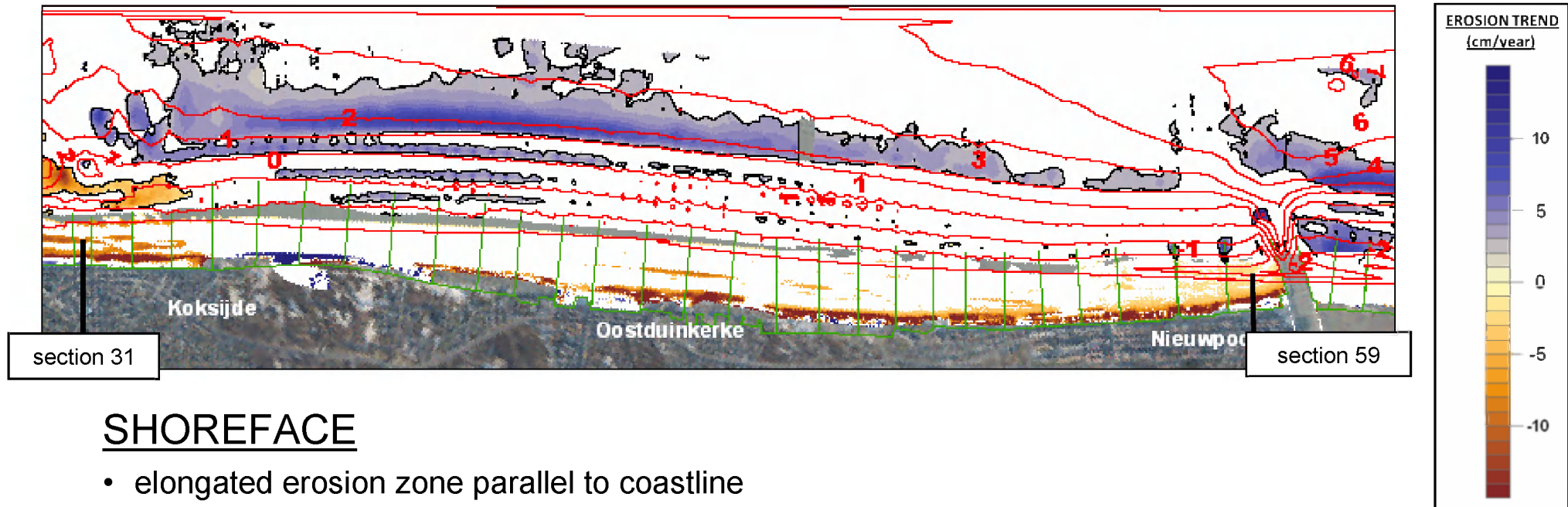
- sections 26-34: significant sedimentation at the foot of the dunes



morphological trend analysis: beach and shoreface: sections 31-59



morphological trend analysis: beach and shoreface: sections 31-59

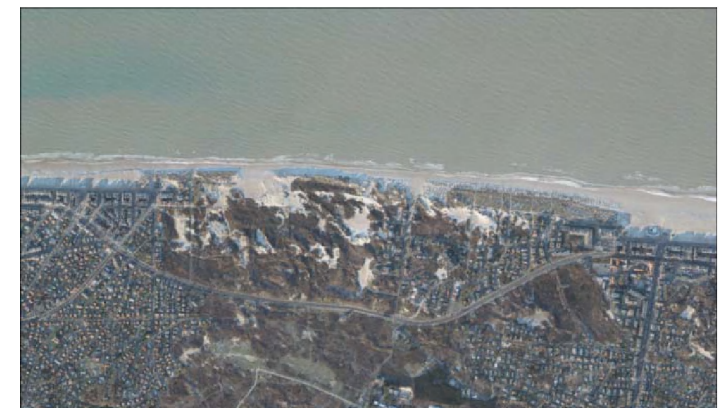


SHOREFACE

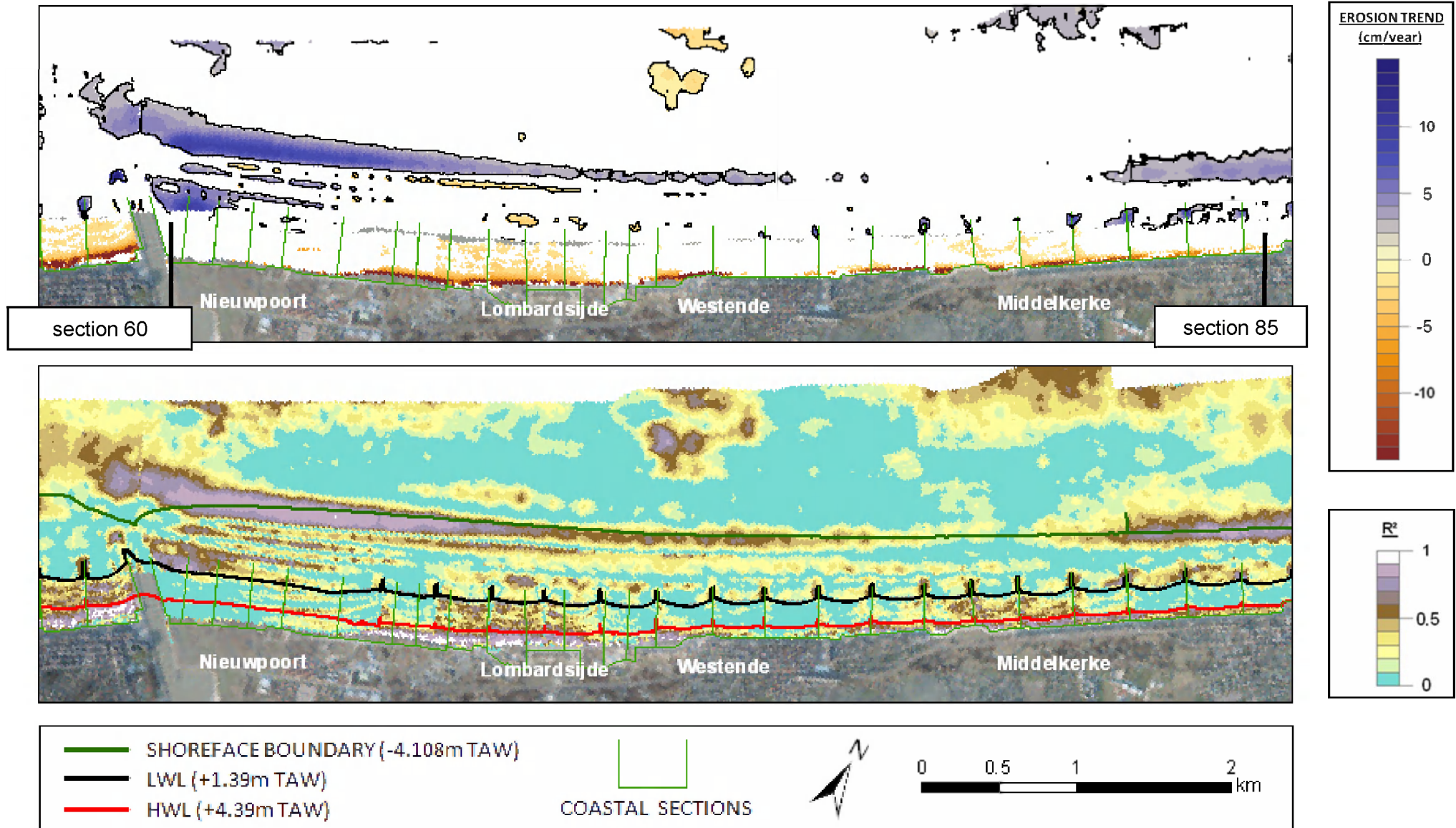
- elongated erosion zone parallel to coastline
→ erosion of the foot of the shoreface
(in transition zone between shoreface and seafloor)

BEACH

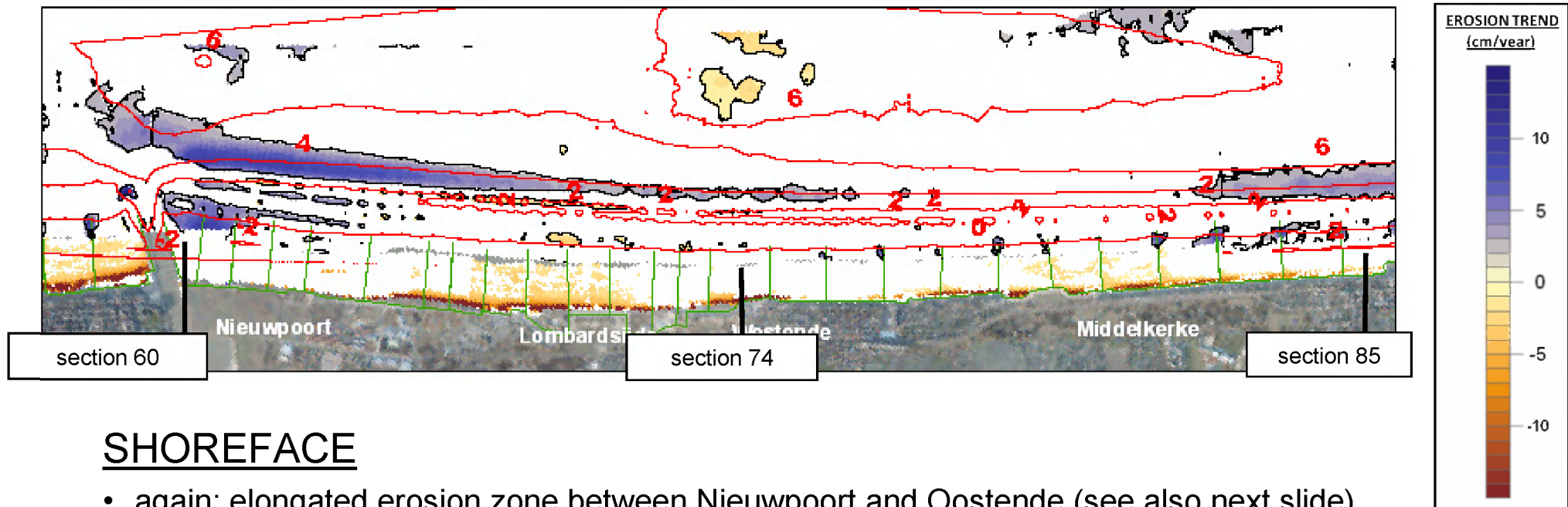
- sections 40-59: strong sedimentation of the foot of the dunes
- sections 36-38: erosion
→ dunes extend land inwards



morphological trend analysis: beach and shoreface: sections 60-85



morphological trend analysis: beach and shoreface: sections 60-85



SHOREFACE

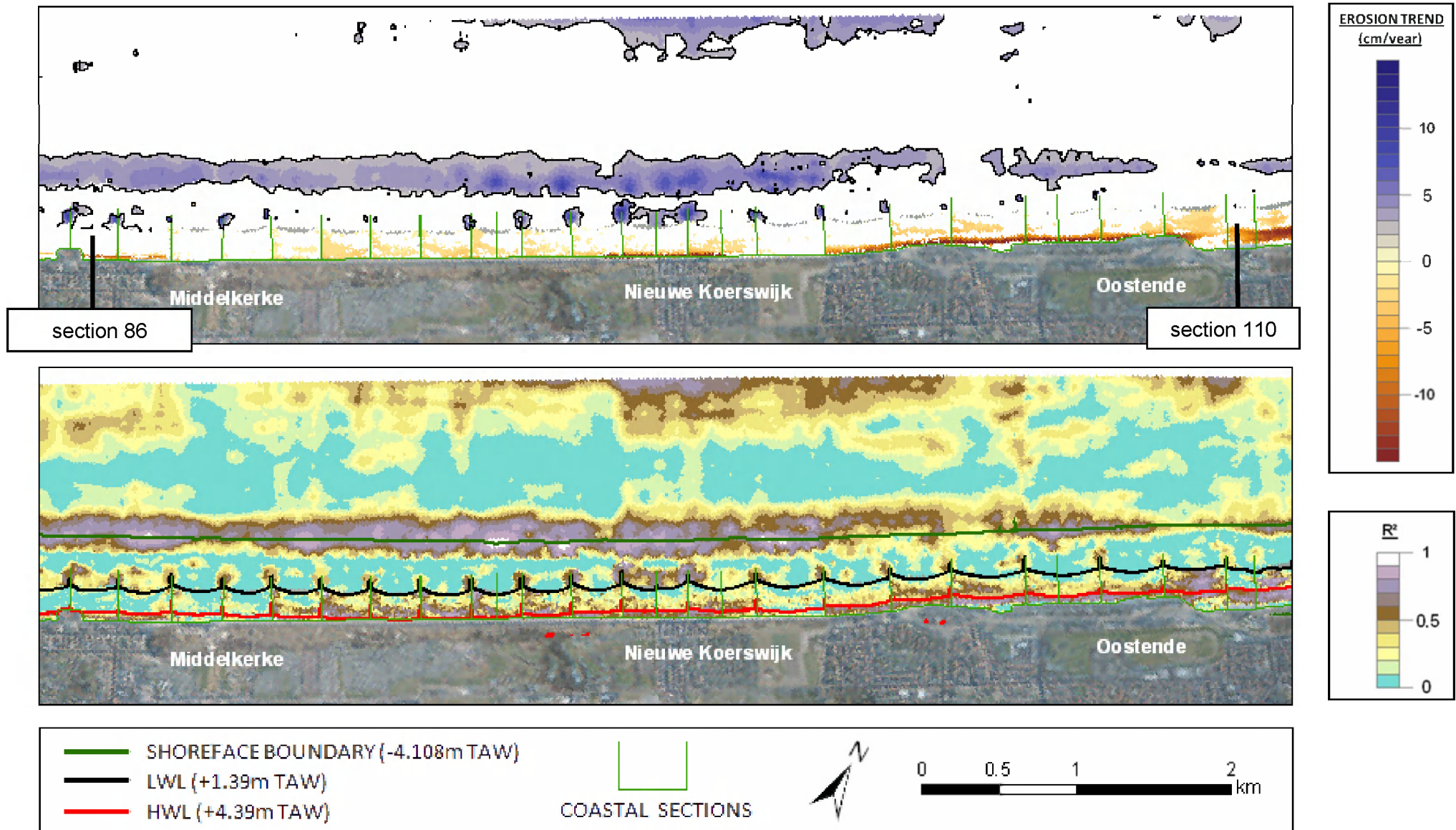
- again: elongated erosion zone between Nieuwpoort and Oostende (see also next slide)
→ erosion of the foot of the shoreface

BEACH

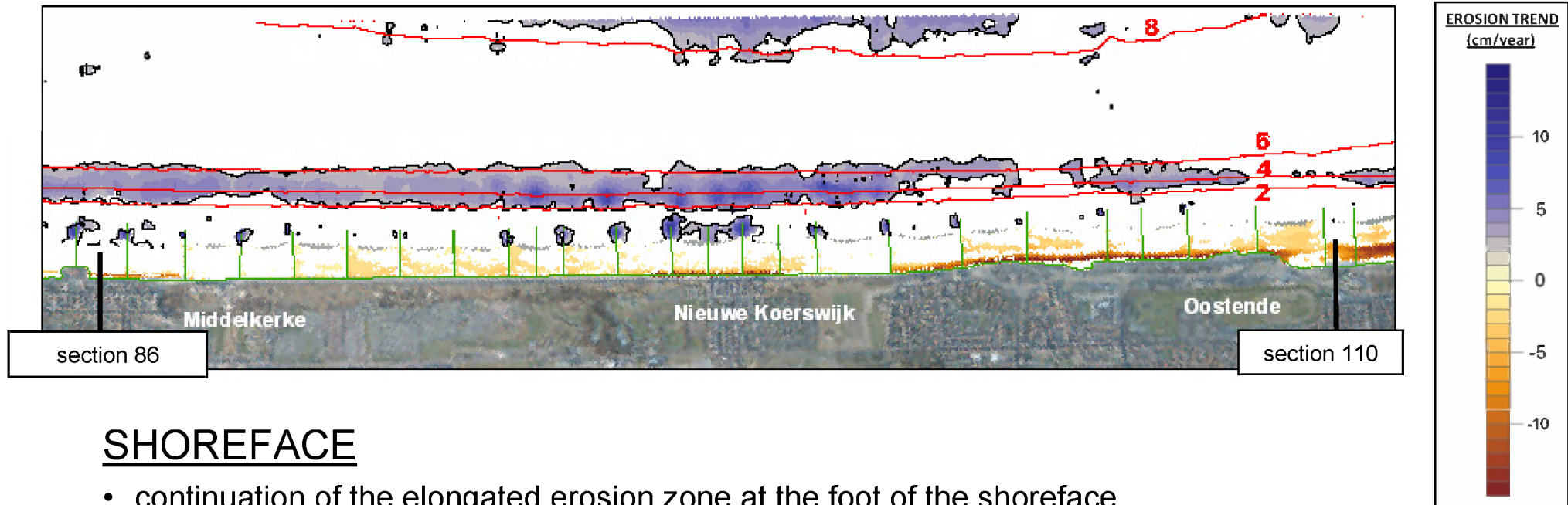
- sections 65-74: strong sedimentation of the foot of the dunes
- sections 75-85: sedimentation of dry beach close to dike



morphological trend analysis: beach and shoreface: sections 86-110



morphological trend analysis: beach and shoreface: sections 86-110



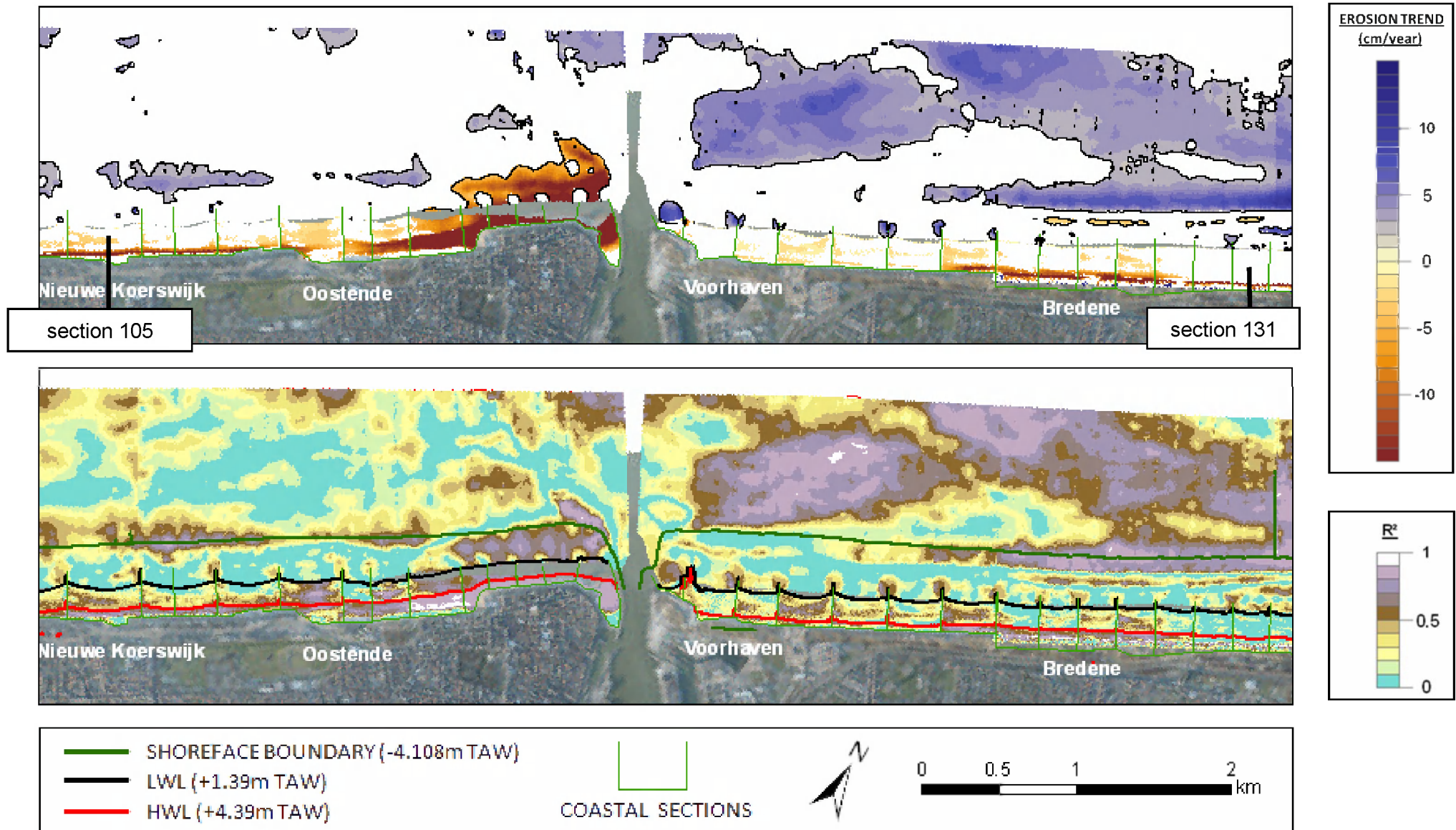
SHOREFACE

- continuation of the elongated erosion zone at the foot of the shoreface

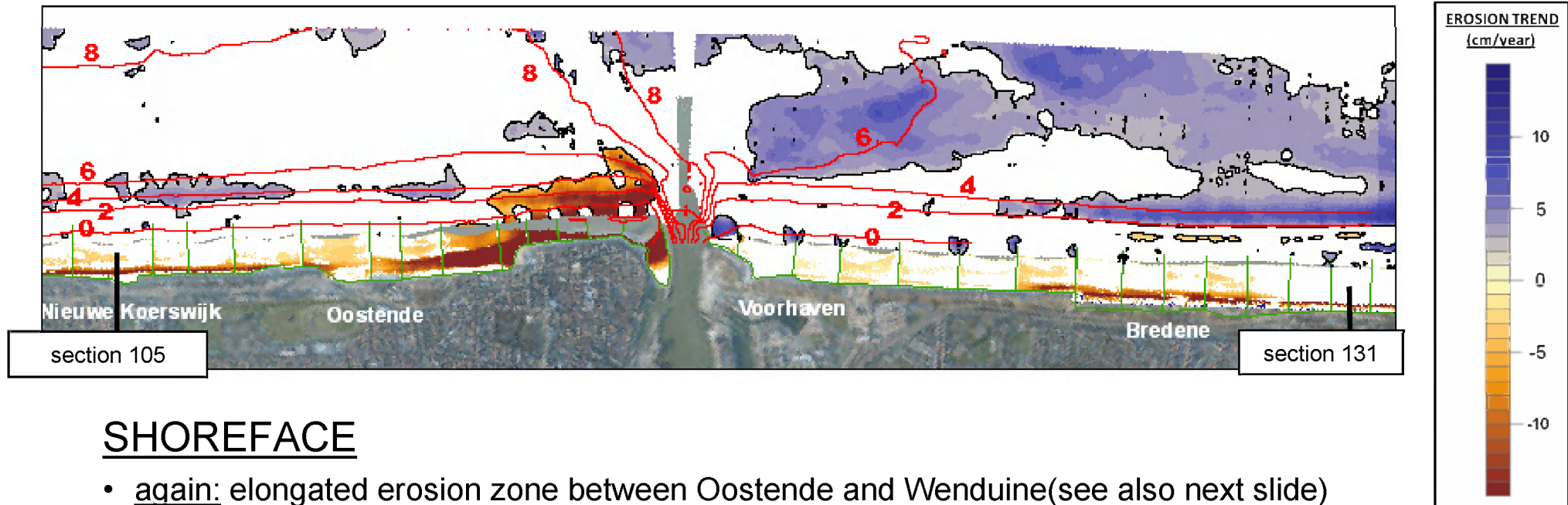
BEACH

- dike present along entire depicted zone
- strongest “sedimentation” trend due to suppletions (sections 97-99, sections 103 and further)
- but also naturally occurring sedimentation of wet beach
- note: local erosion at the head of the small groynes (scouring)

morphological trend analysis: beach and shoreface: sections 105-131



morphological trend analysis: beach and shoreface: sections 105-131



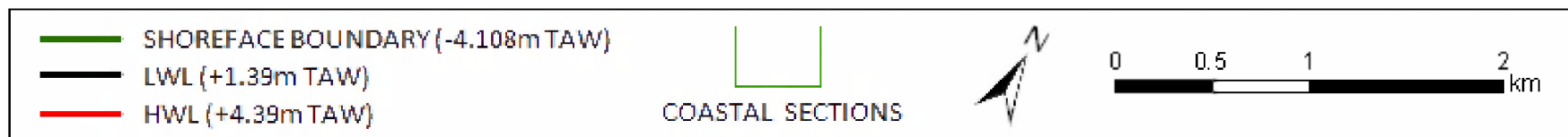
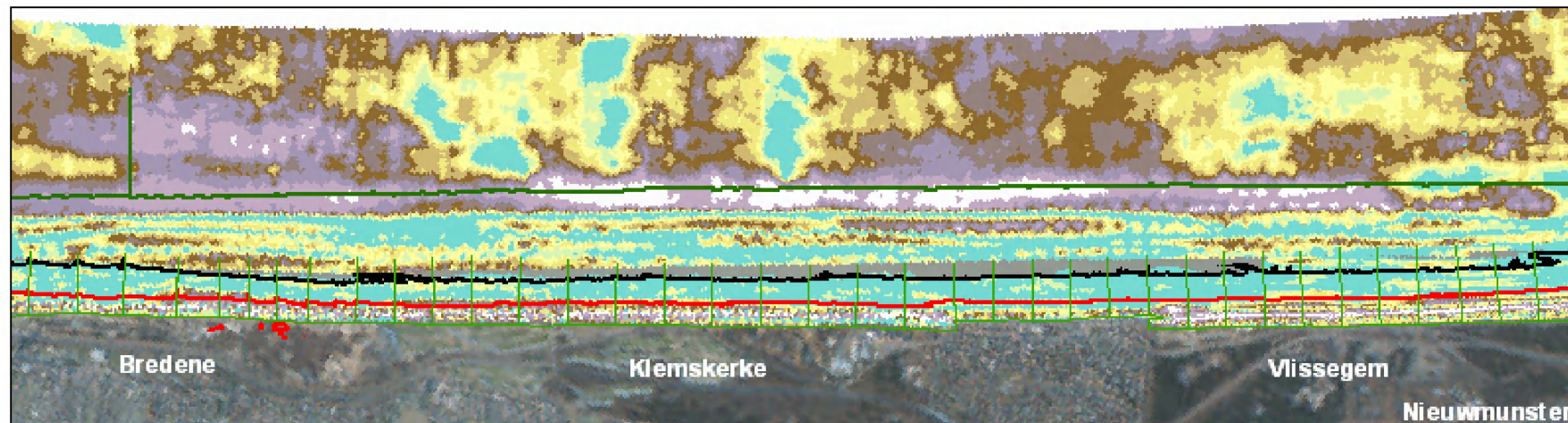
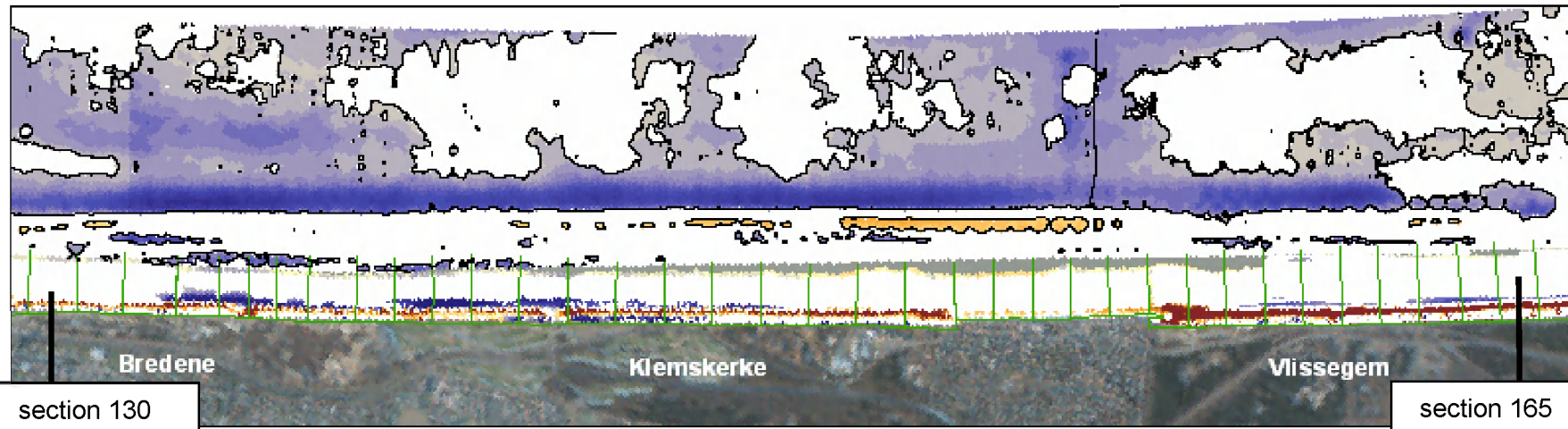
SHOREFACE

- again: elongated erosion zone between Oostende and Wenduine(see also next slide)
 - erosion of the foot of the shoreface
 - but also of the neighbouring seafloor: erosion of “Grote Rede” gully

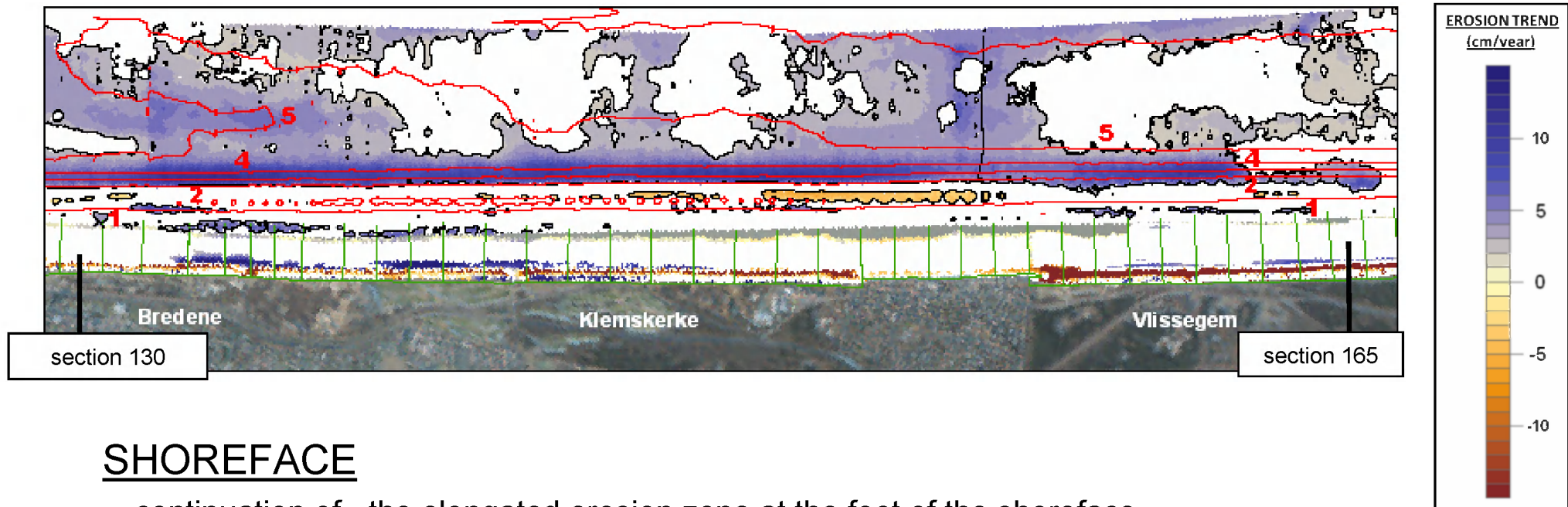
BEACH

- sections 109-117: “sedimentation” due to large suppletion works in 2004 (noodstrand Oostende, sections 112-117, 460 000m³)
- sections 124-131: sedimentation at the foot of the dunes (west of 124: all dike, no dune)

morphological trend analysis: beach and shoreface: sections 130-165



morphological trend analysis: beach and shoreface: sections 130-165



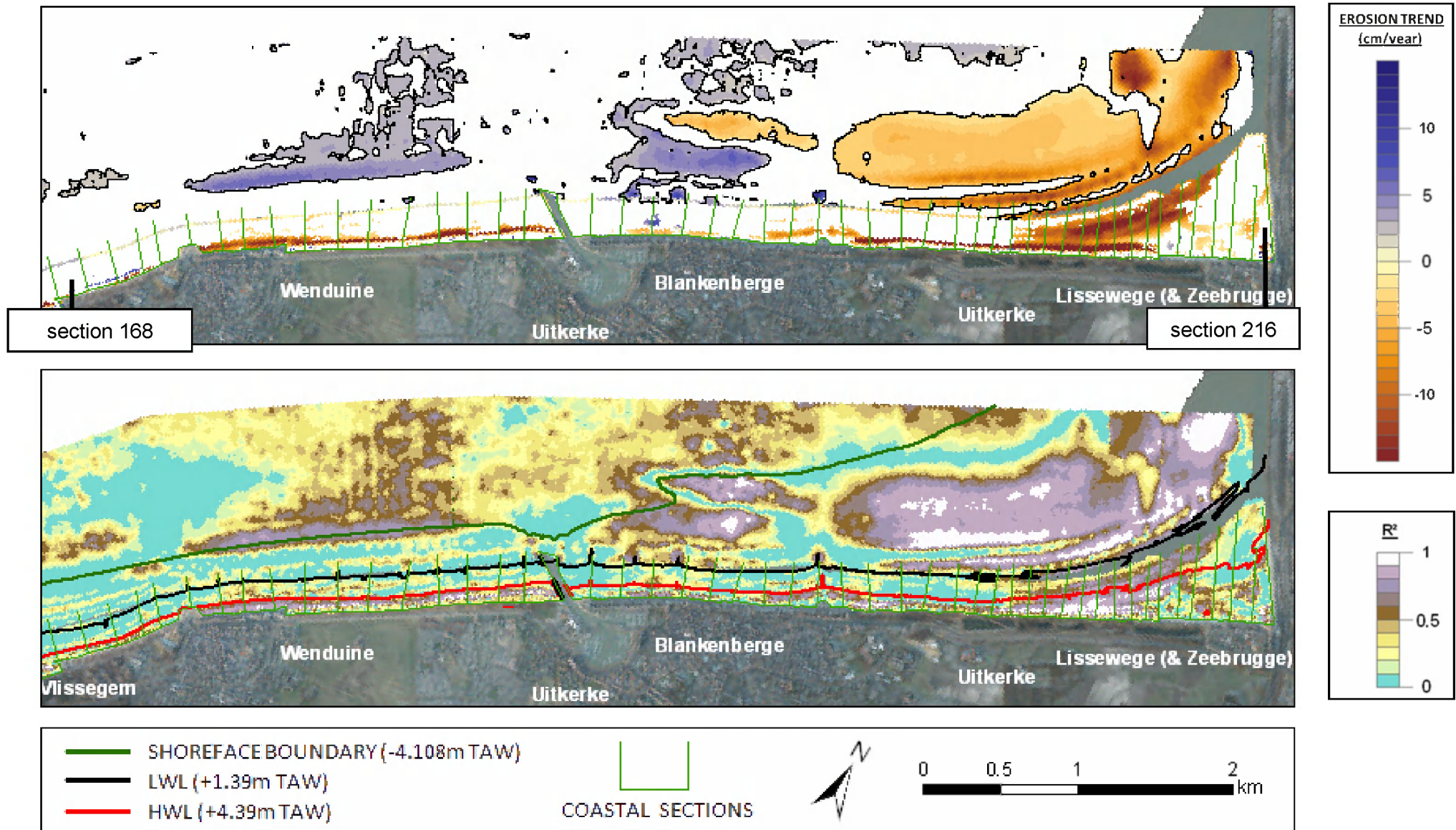
SHOREFACE

- continuation of -the elongated erosion zone at the foot of the shoreface
-erosion of the “Grote Rede” gully
- feeder berm: from 1991, 800 000m³ below low water line, along sections 132-169

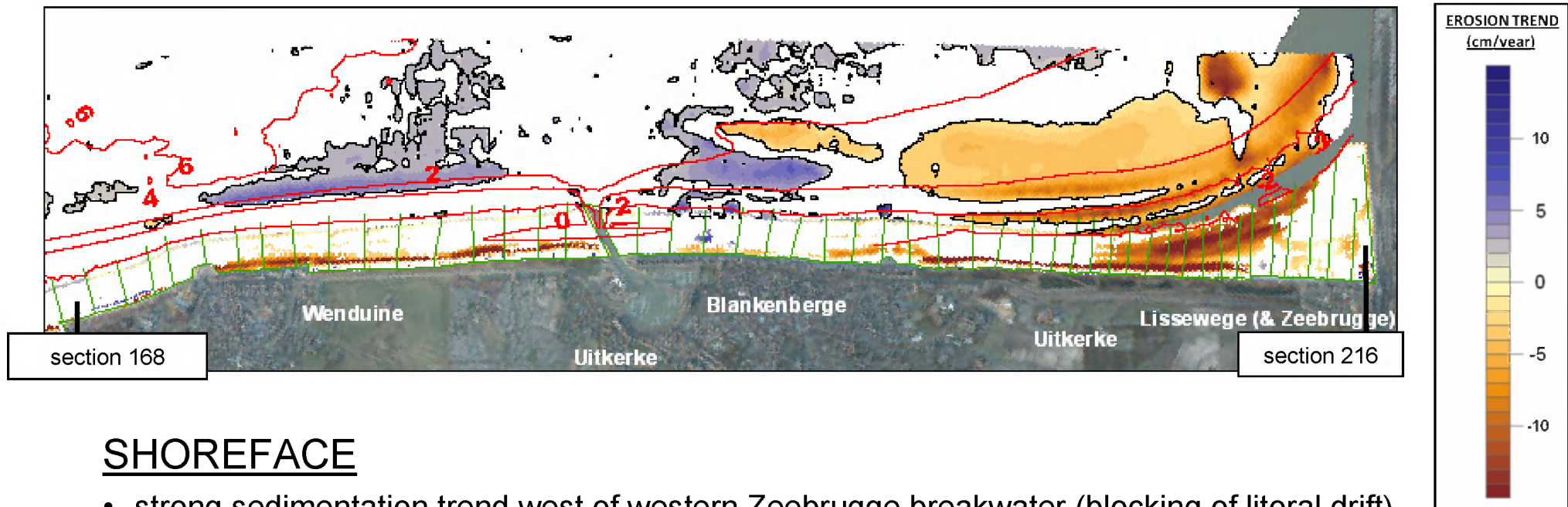
BEACH

- if dunes are present (130-150 en 156-165): sedimentation at the foot of the dunes
- also strong sedimentation trends where artificial hedges are present
- sections 133-146: wet beach with erosive characteristics

morphological trend analysis: beach and shoreface: sections 168-216



morphological trend analysis: beach and shoreface: sections 168-216



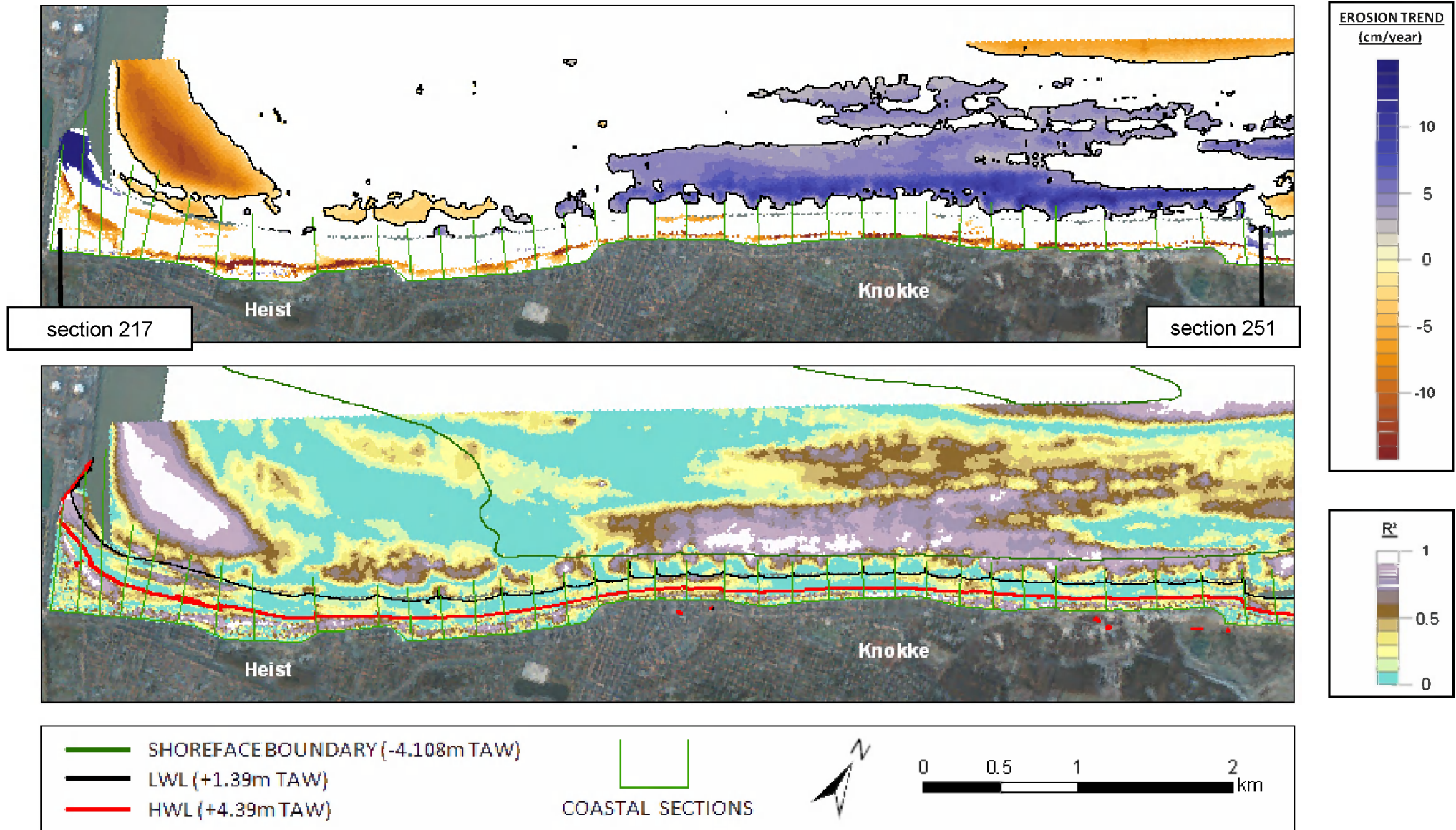
SHOREFACE

- strong sedimentation trend west of western Zeebrugge breakwater (blocking of litoral drift)
- erosion at the foot of the shoreface
but locally interrupted by Blankenberge harbour

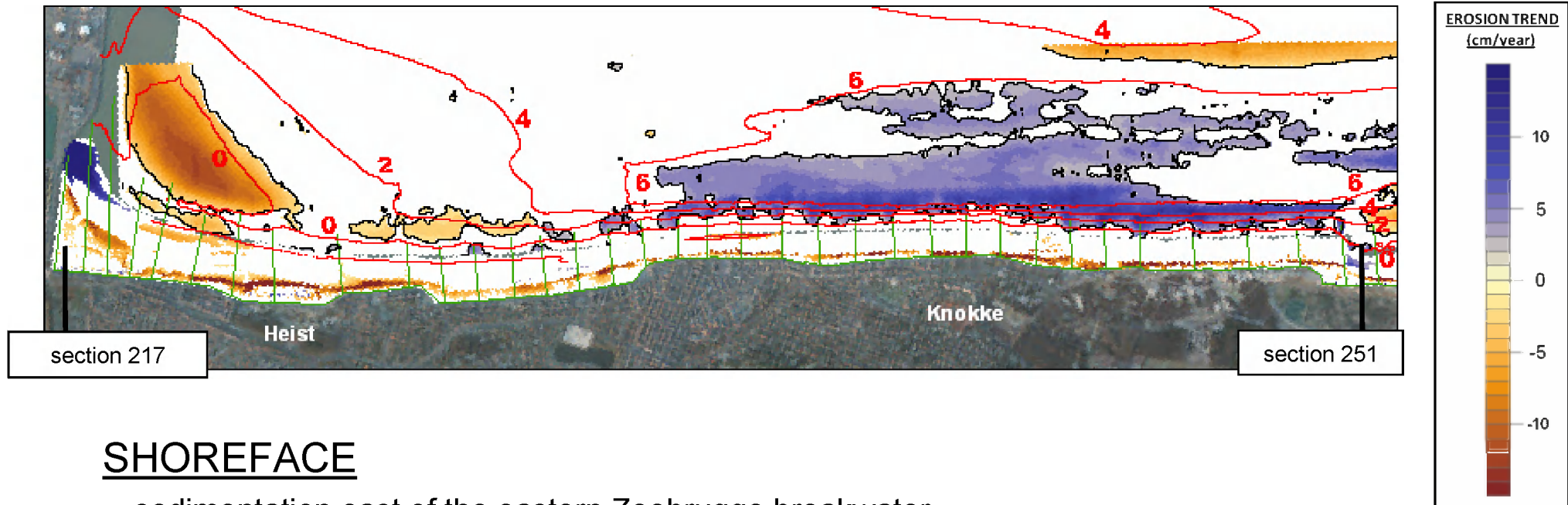
BEACH

- sedimentation at the foot of the dunes

morphological trend analysis: beach and shoreface: sections 217-251



morphological trend analysis: beach and shoreface: sections 217-251



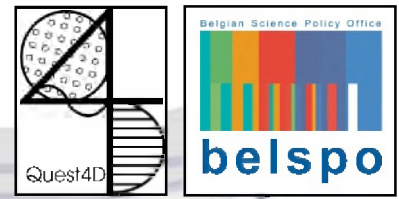
SHOREFACE

- sedimentation east of the eastern Zeebrugge breakwater
→ further growth of sand bank in the Bay of Heist
- erosion of the “Appelzak” gully (Westerschelde ebb gully)

BEACH

- sedimentation dry beach / dune foot





morphological trend analysis:

beach and shoreface: conclusions

- shoreface has erosive behavior
erosion situated in transition zone between shoreface and seafloor
→ narrowing of the shoreface?
→ steepening of the shoreface?
- almost no significant trends on wet beach
(! evolution disturbed by human interaction: suppletions,...)
- dry beach (at foot of dike or at foot of dune) exhibits often sedimentation
note: vegetation ("rijshouthagen") appear very effective sand traps
- large scale infrastructure works have great influence on morphological evolution
→ sedimentation near Zeebrugge breakwaters
→ sedimentatie around Koksijde groynes

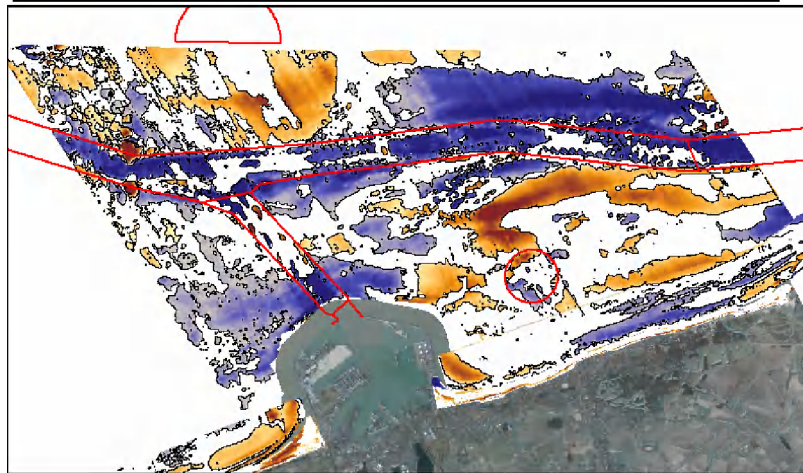
An aerial photograph of a coastal area during sunset. A curved breakwater or pier extends from the left side into the water, enclosing a small harbor. The water is calm with gentle ripples. The sky is a mix of orange, yellow, and blue, with the sun's glow visible on the left. The overall scene is serene and scenic.

Thank you for your attention!

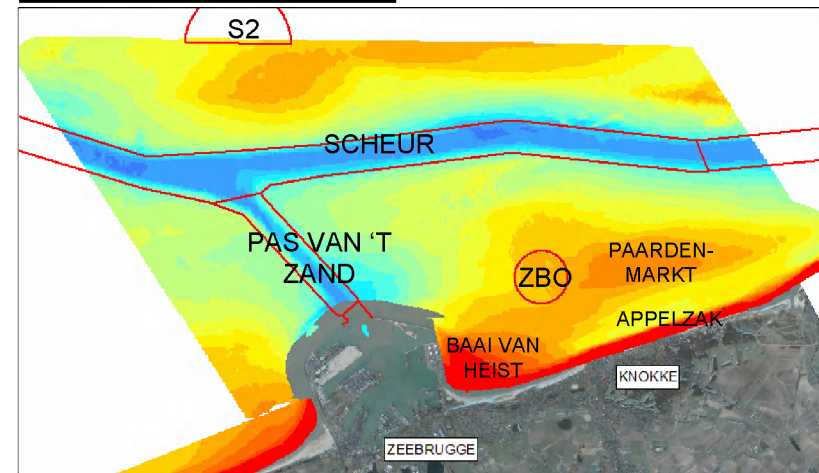
morfologische evolutie

kustnabije zone: Wielingen-Scheur

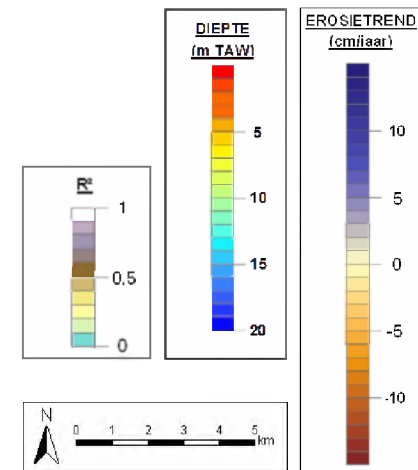
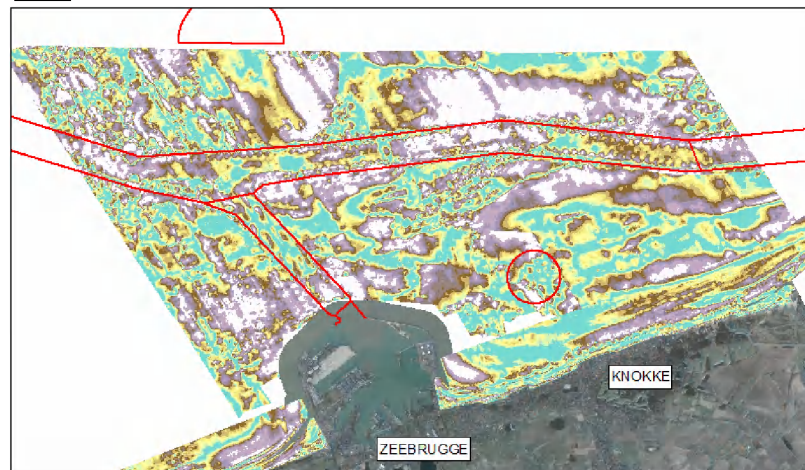
EROSIETREND



BATHYMETRIE



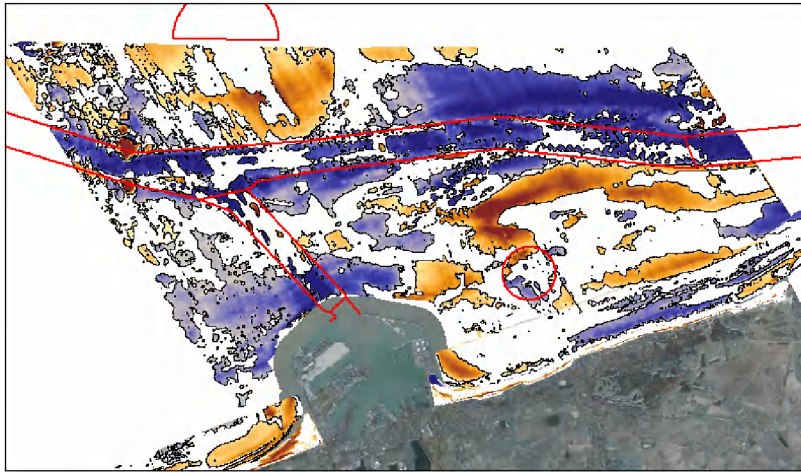
R²



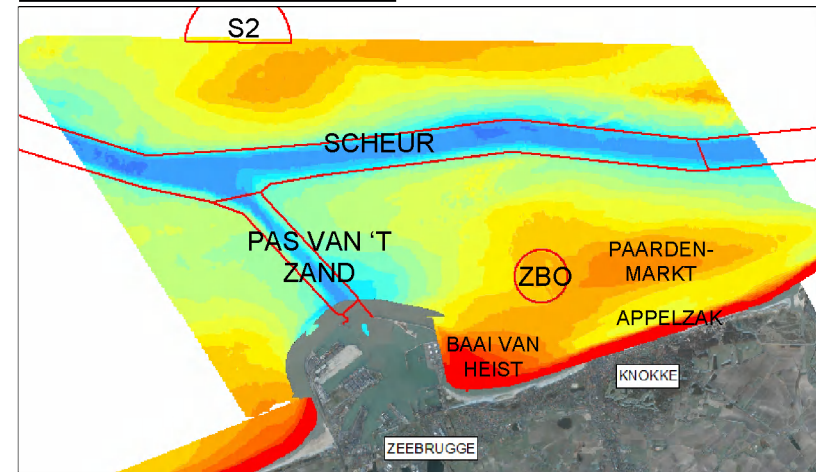
morfologische evolutie

kustnabije zone: Wielingen-Scheur

SIGNIFICANTE EROSIETREND

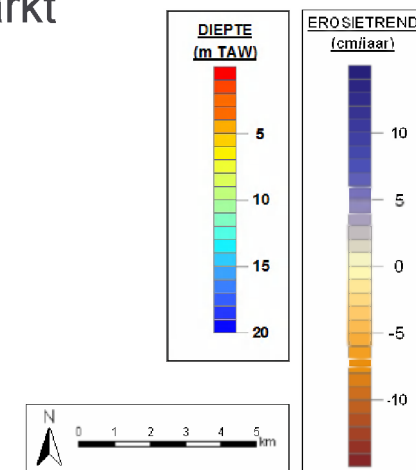


BATHYMETRIE



- verdere sedimentatie van (kustwaartse zijde van) Paardenmarkt
- erosie aan haveningang Zeebrugge (contractie stroomlijnen)
- eroderende invloed van vaargeul op omgeving
- Maar wel sterke sedimentatietrend in gebied noordoosten haven van Zeebrugge

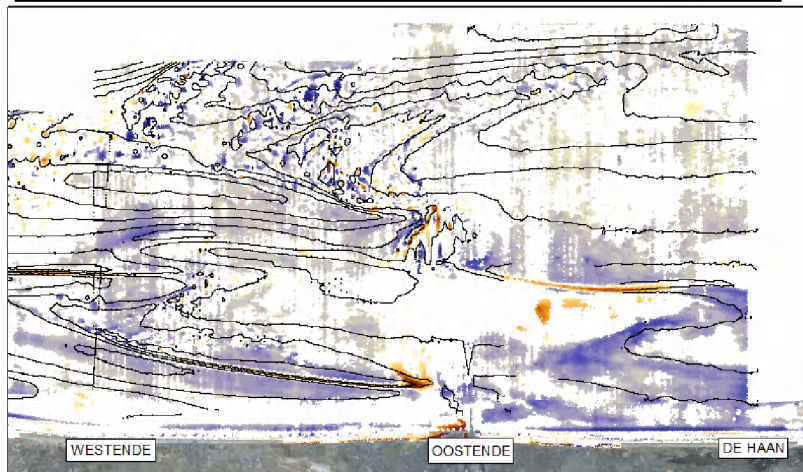
NB: beperkte tijdreeks van dieptegegevens!



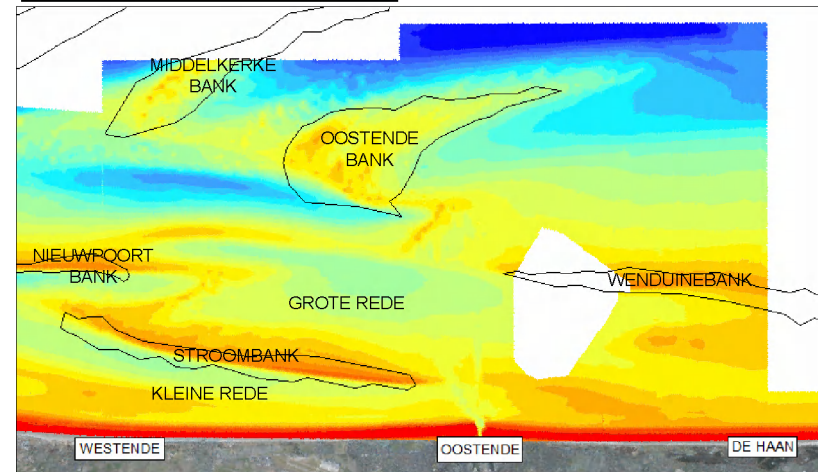
morfologische evolutie

kustnabije zone: Westende-De Haan

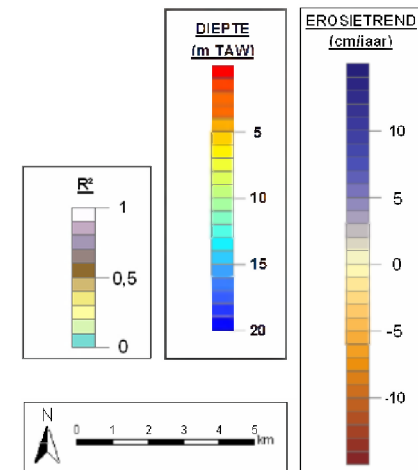
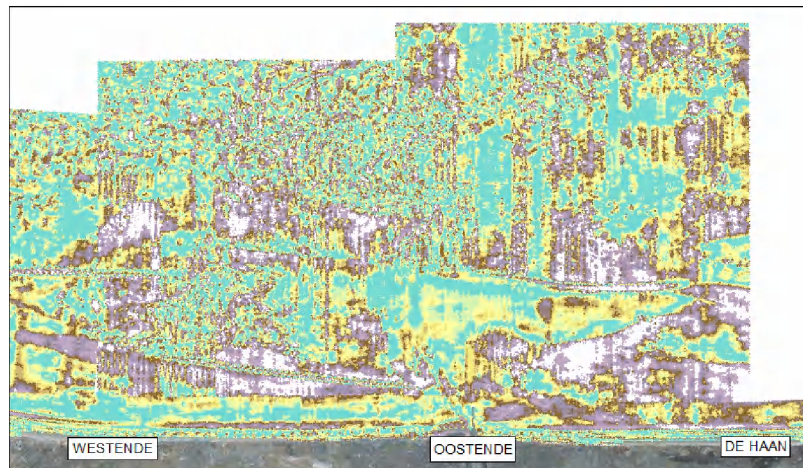
EROSIETREND



BATHYMETRIE



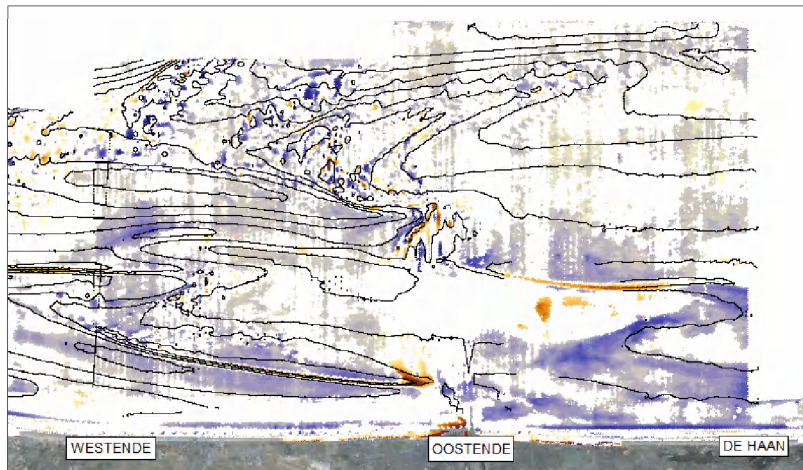
R²



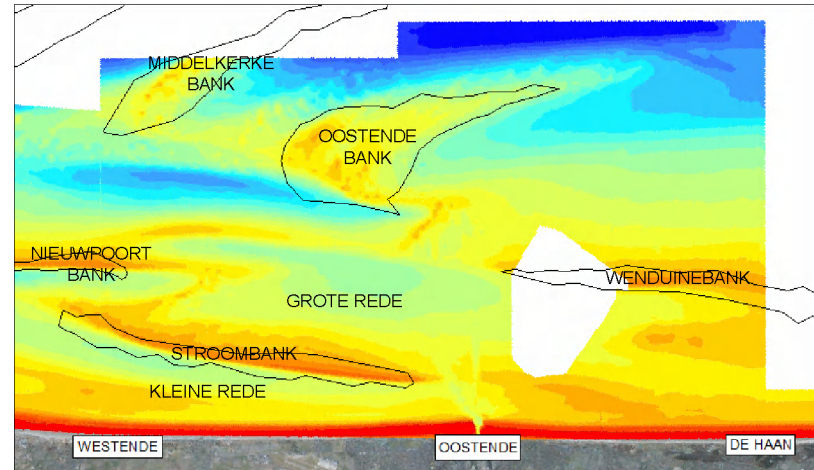
morfologische evolutie

kustnabije zone: Westende-De Haan

SIGNIFICANTE EROSIETREND

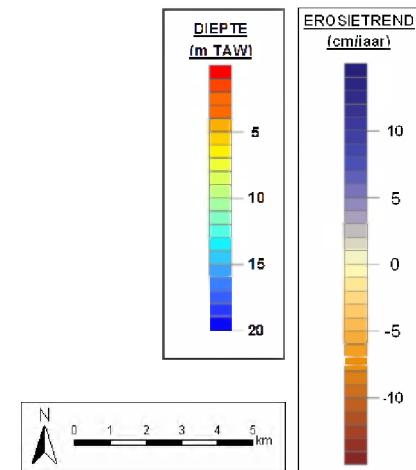


BATHYMETRIE



- overwegend erosietrends
- enkele sedimentatietrends op kruinen van enkele banken (Stroombank, Wenduinebank, Nieuwpoortbank)
- erosietrends voornamelijk in geulen: Kleine Rede, oostelijk deel Grote Rede

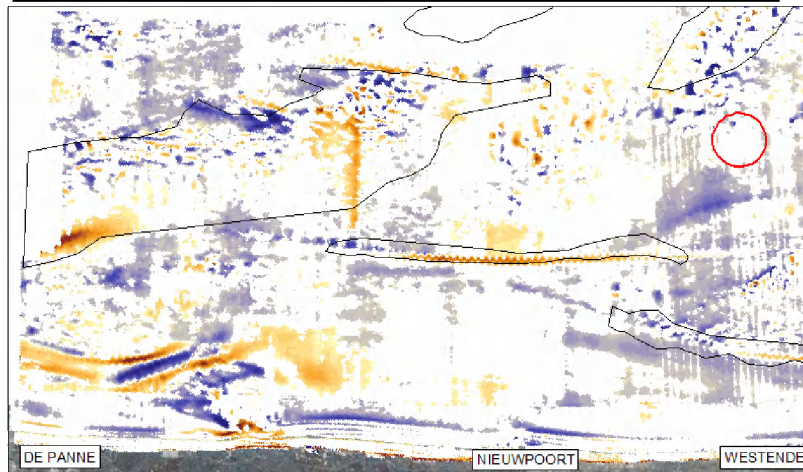
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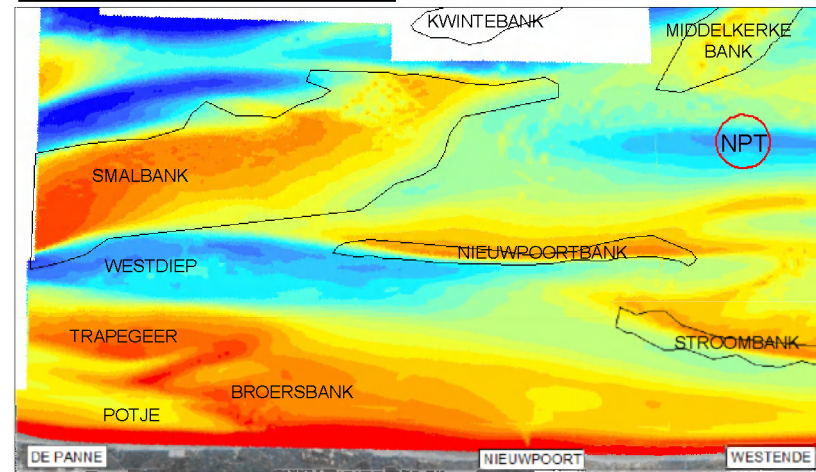
morfologische evolutie

kustnabije zone: Zuydcoote-Westende

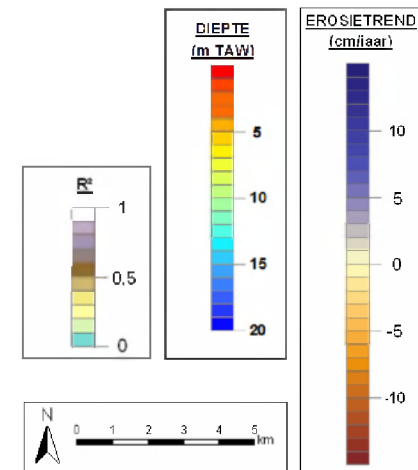
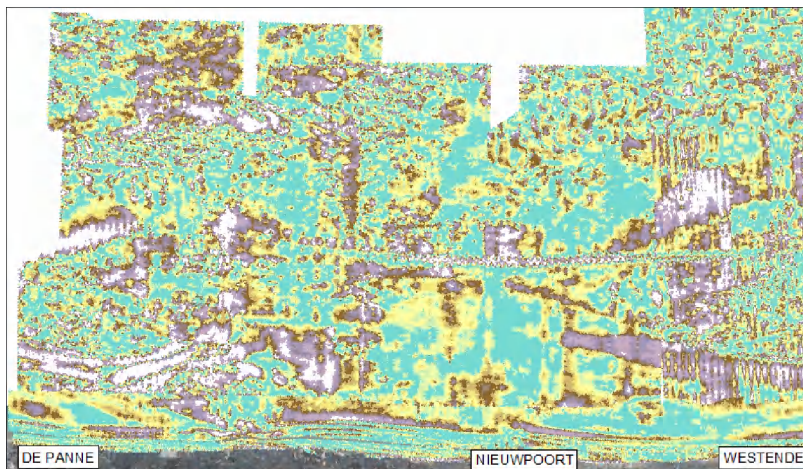
EROSIETREND



BATHYMETRIE



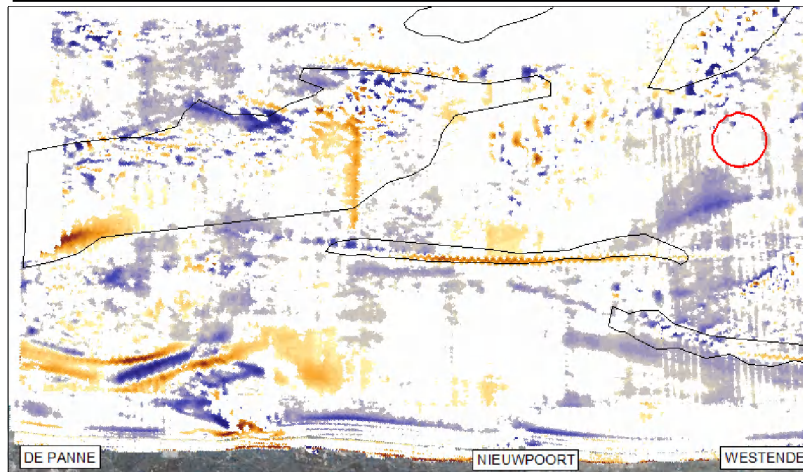
R²



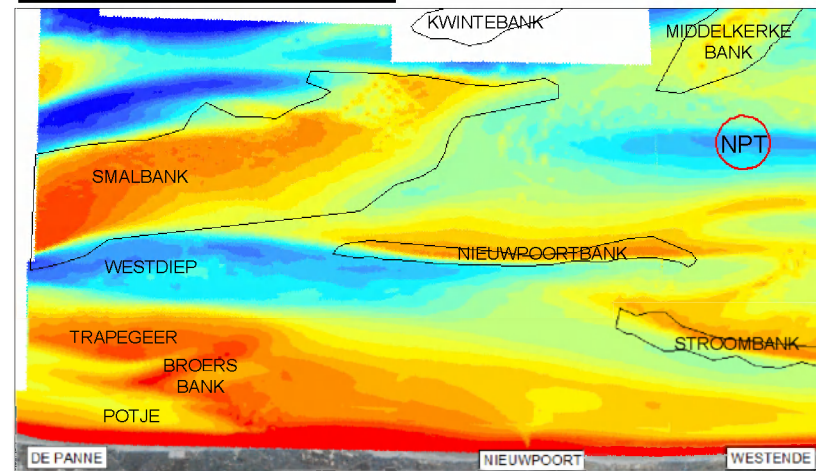
morfologische evolutie

kustnabije zone: Zuydcoote-Westende

SIGNIFICANTE EROSIETREND



BATHYMETRIE



- weinig significante trends
- sedimentatietrend op kruin Nieuwpoortbank
- meest dynamische zone rond Potje / Trapegeer / Broersbank:
sedimentatie geul zuiden van Trapegeer
erosie Broersbank / verplaatsen Broersbank ?

NB: beperkte tijdreeks van dieptegegevens!

