Nearshore morphodynamics along the coastline of southern Sweden from detailed surficial mapping and hydrodynamic modelling

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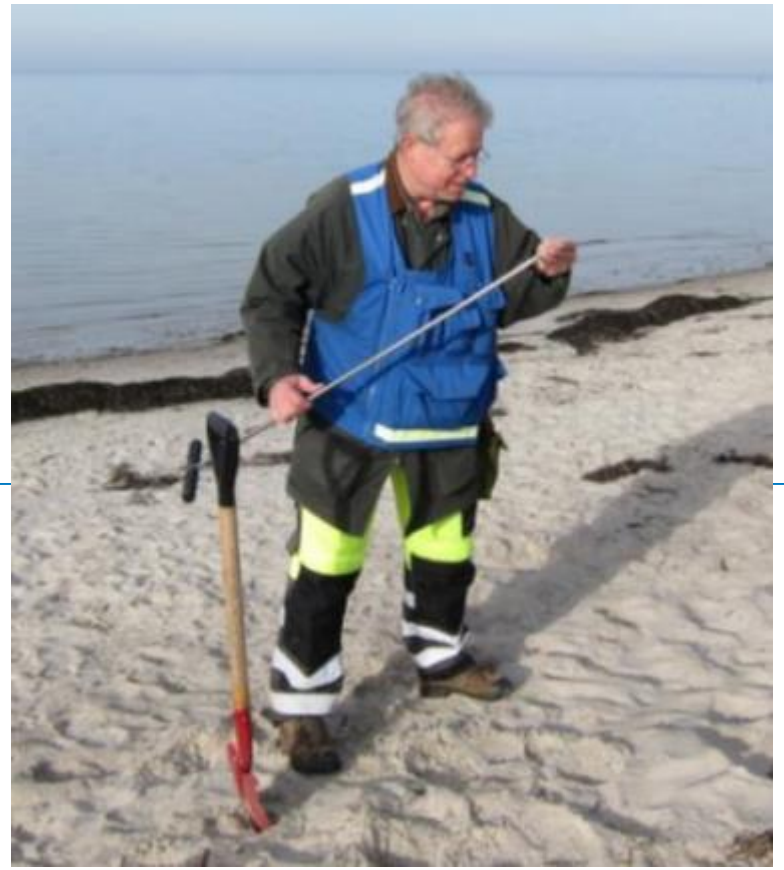
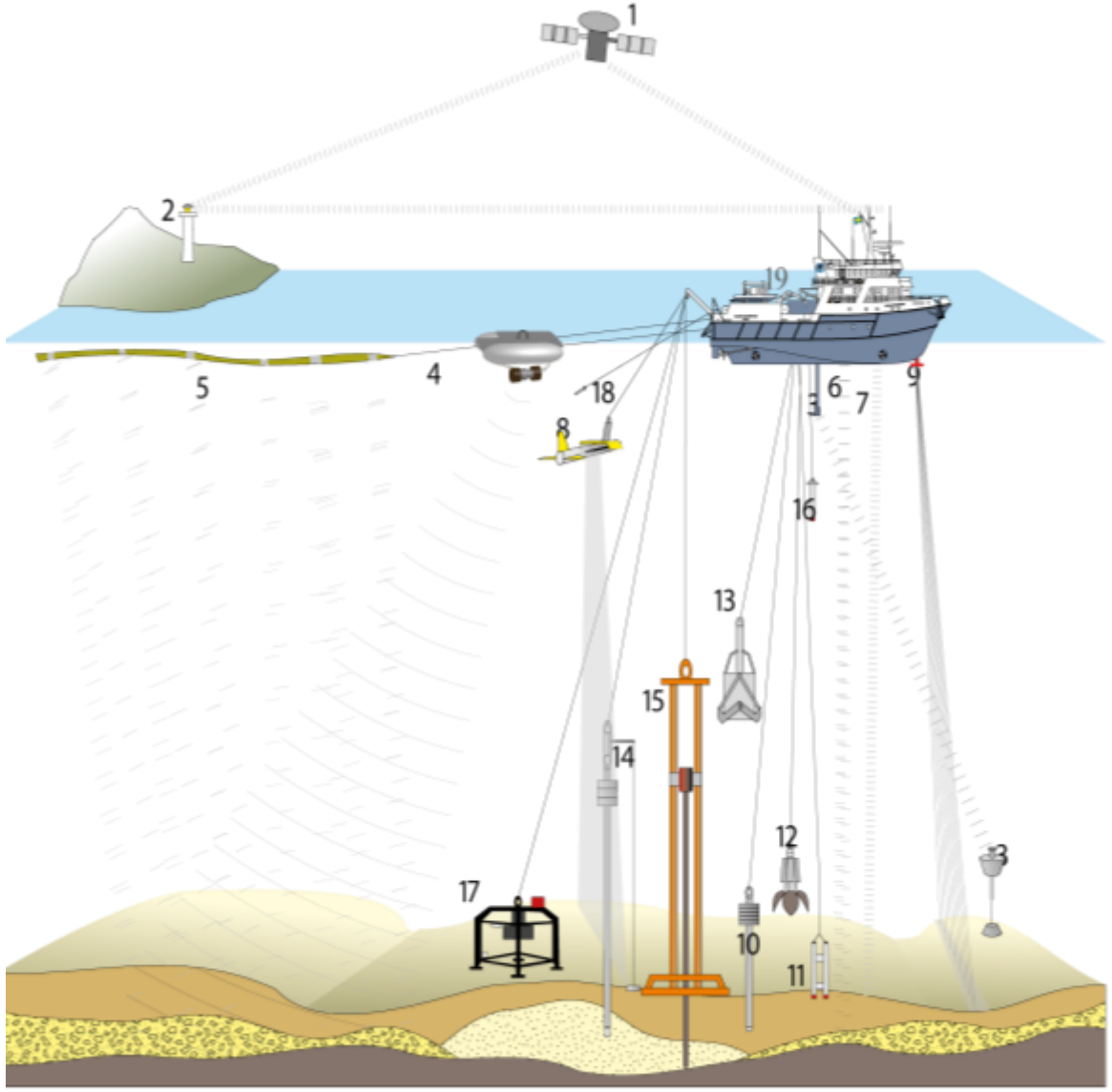
- **Seamless, full coverage land and seabed mapping from approximately 3 m above sea level to 1000 m offshore has been completed along 500 km of coastline of Skåne in southern Sweden.**

- **This coastline has a high population density, with low-lying urban areas developed in easily eroded Quaternary sediments. Land uplift following the last glaciation is now outpaced by sea-level rise and there is presently localized erosion and flooding that is anticipated to worsen under higher future sea levels.**



- **On land, mapping of surficial sediments was done using conventional field-based methods and a high-resolution LIDAR-based digital elevation model.**



Positioning systems
1. Satellite (GNSS)
2. RTK
3. HPR

Hydroacustic systems
4. Sleeve gun
5. Streamer
6. Sub-botton profiler
7. Echo sounder
8. Side-scanning sonar
9. Multibeam echo sounder

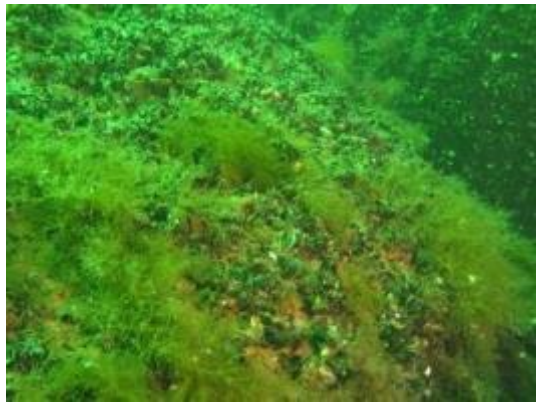
Sediment sampling sampler
10. Gravity corer (1 m)
11. Gemini corer
12. Orange peel bucket (OPB)
13. Box corer
14. Gravity corer (6 m)
15. Vibro corer

Hydrographic systems
16. CTD-probe
17. Underwater camera, Doppler current sounder, CTD-probe, Oxygen sensor
18. MVP

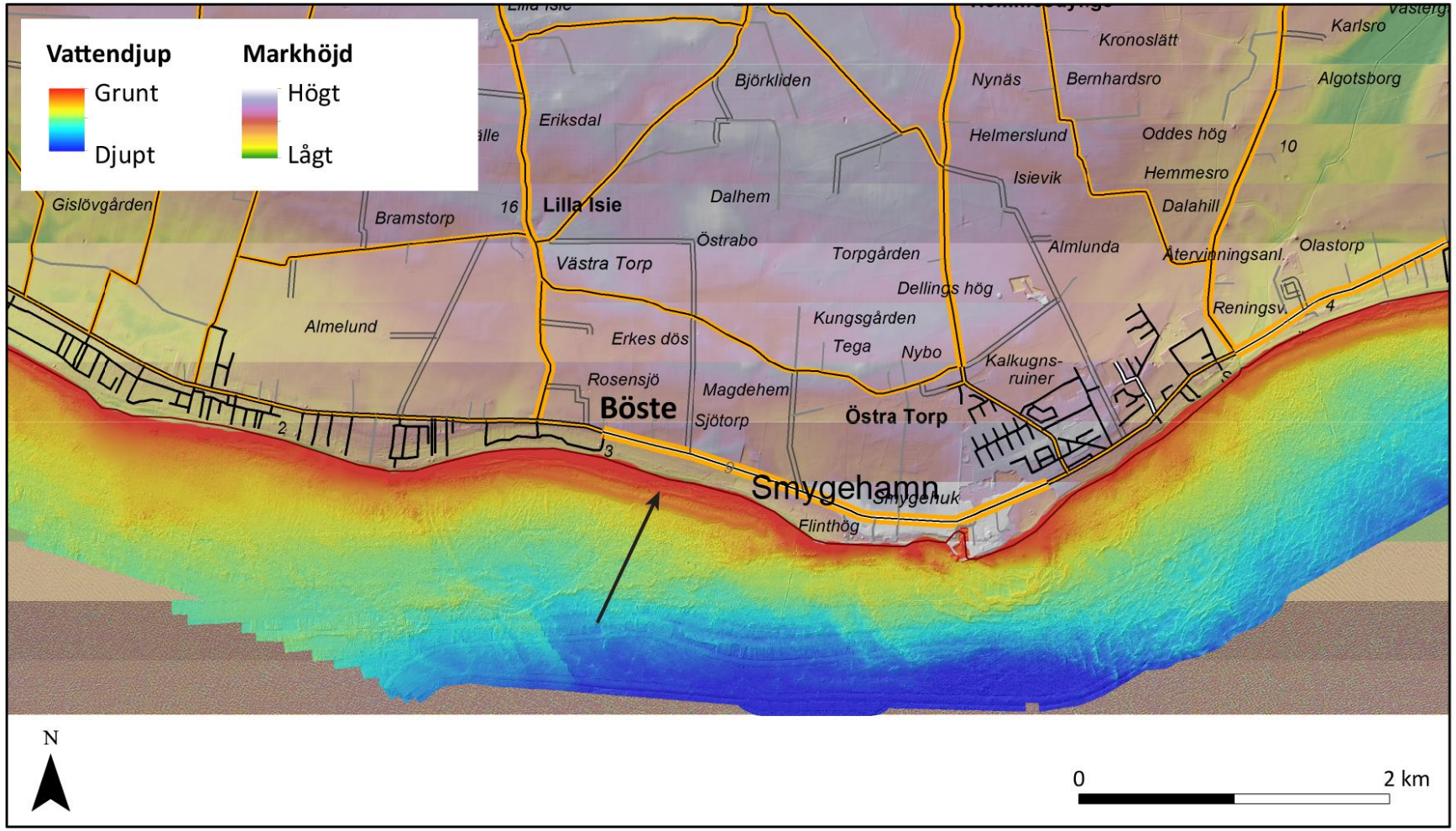
- **For the seabed, sediment and bathymetric mapping was based on ship-borne hydroacoustic surveying data, as shallow and close to shore as permitted by the ship draught, involving multibeam, swath-sonar, side-scanning sonar, sediment profiling and reflection seismics.**

- **For the white ribbon zone, i.e., the nearshore zone that is too shallow for the ships to enter, airplane-borne LIDAR and orthophoto-data were acquired.**

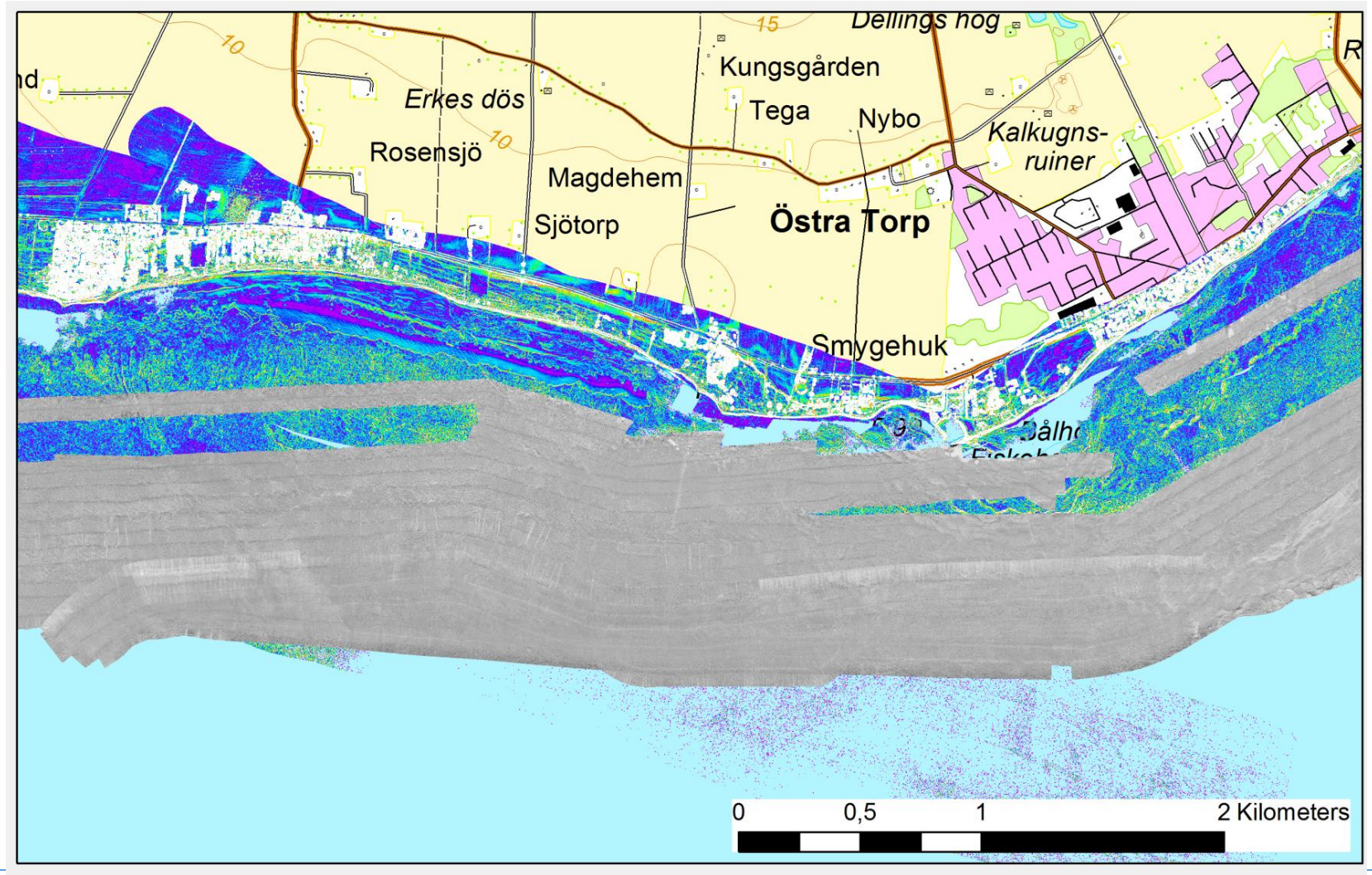
Ground-truthing in the form of sediment-sampling and visual observations was done to verify sediment interpretations, for instance, in the hydro-acoustical data.



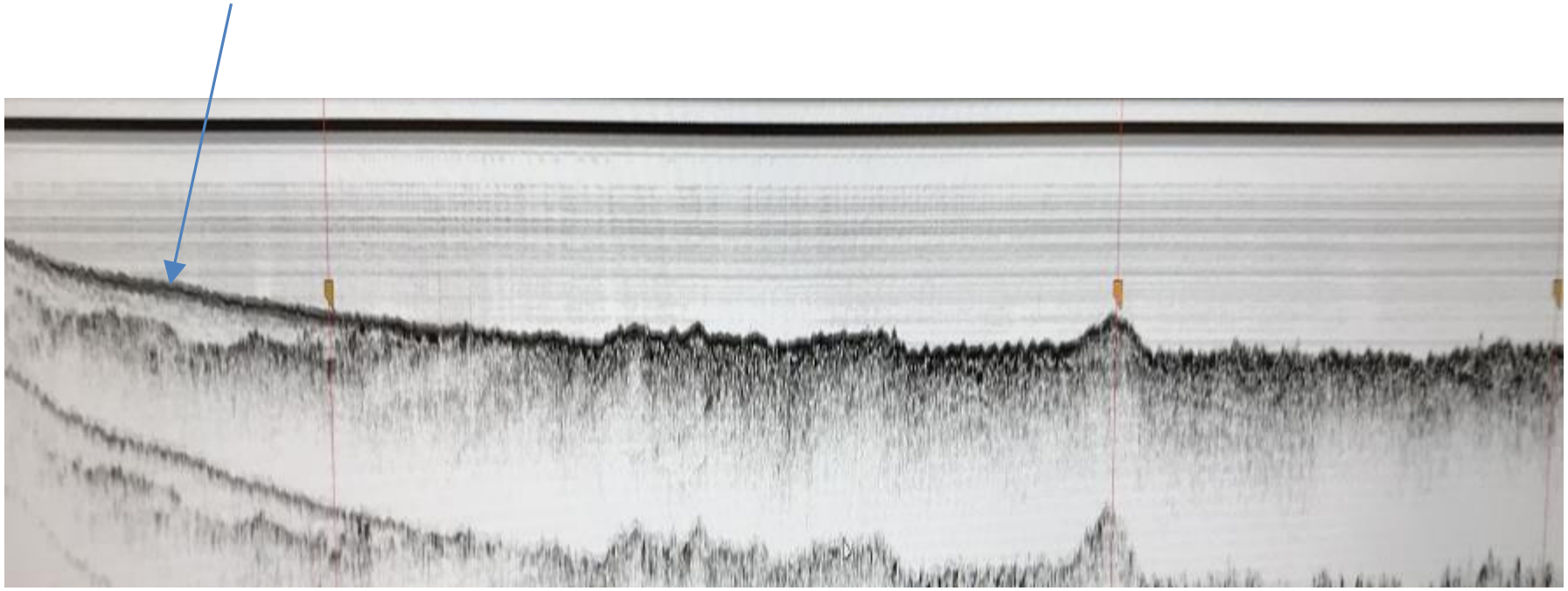
Example of seamless topographic and bathymetric data



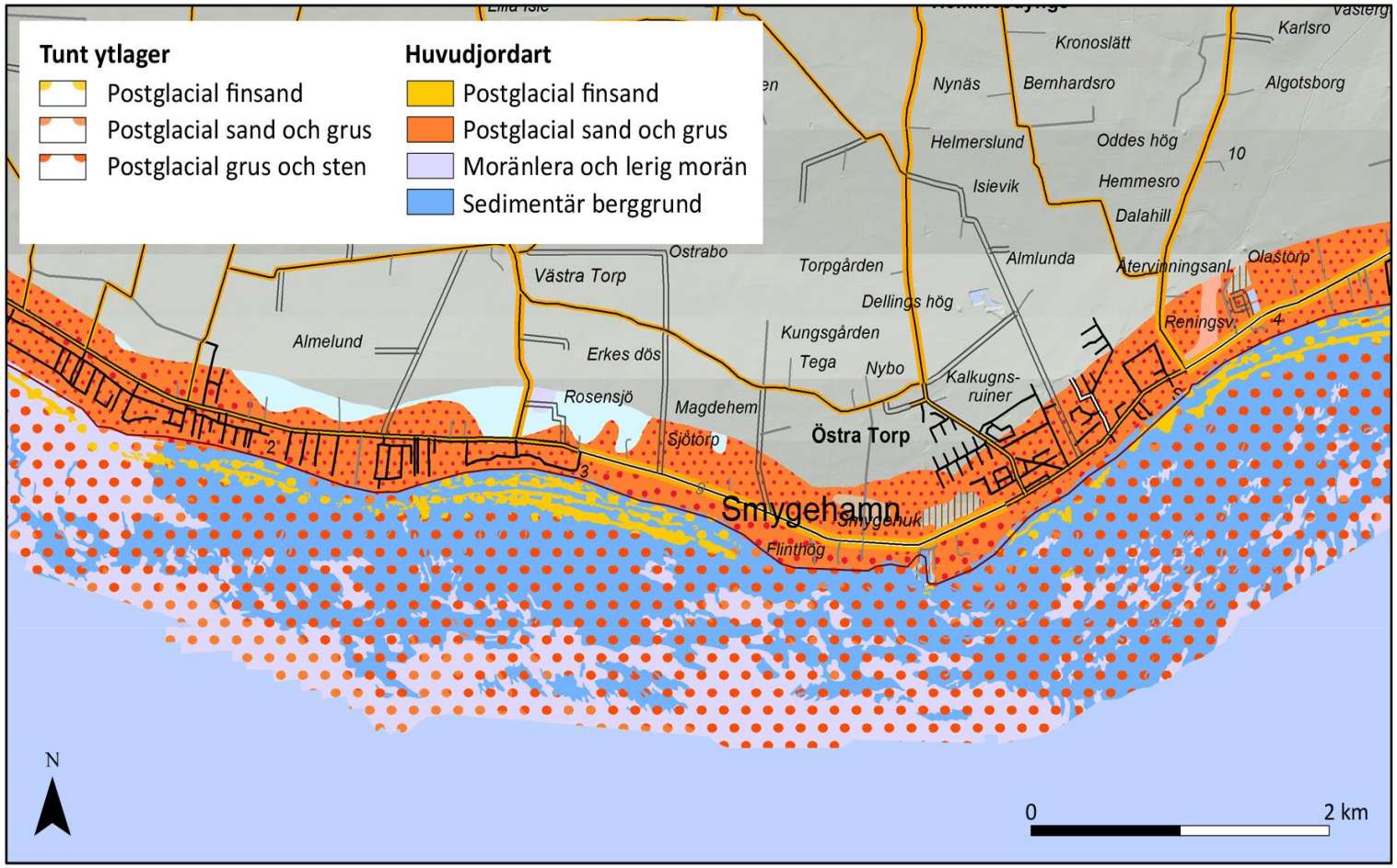
Example of backscatter and rugosity, which give information on the distribution of various sediments from the beach line and ca 1000 m off shore.

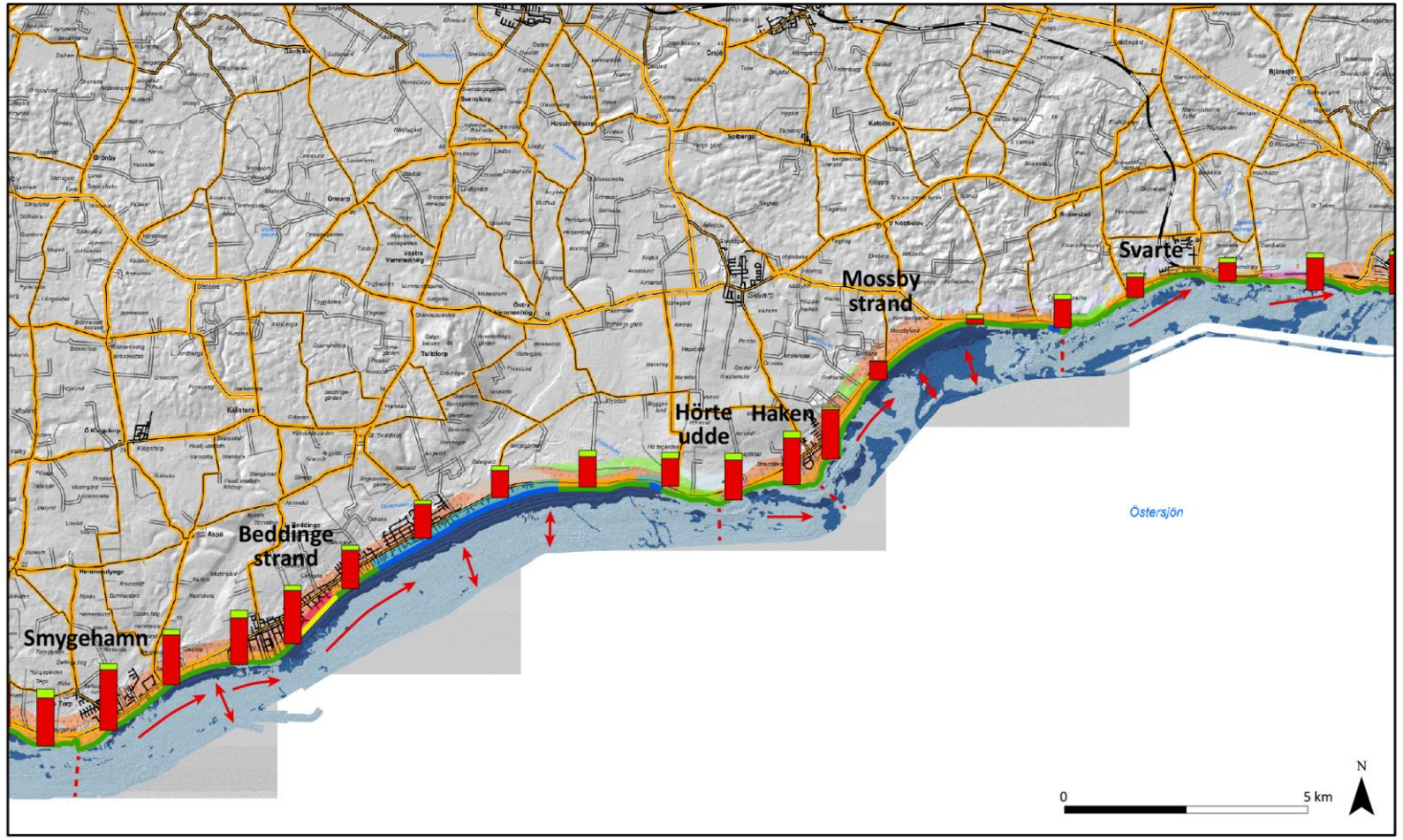


Example of sedimentprofiler data showing, i.e., thickness of mobile sand towards land.



Example of seamless surficial sediment map





Andel tid med kustparallell ström > 0,5 m/s åt öst respektive väst

- Åt väst
- Åt öst
- Sedimenttransport
- Gräns mellan sediment-dynamiksystem

Sedimentdynamik (erosions-, transport- och ackumulationsförhållanden), havsbotten

- Rörlig sand, lättmobiliserad och lättransporterad
- Grövre sand, kan röra sig tillfälligt och lokalt vid större vågor och starkare strömmar
- Grövre sediment med svårmobiliserade partiklar av grus, sten och block, rör sig sällan

Strandlinjens förändring från 1940 till 2010

- Ackumulation: 15–30 m
- Erosion: 15–30 m
- Ingen eller liten förändring

Erosionsförhållanden för kustlinjen

- Strand med tillväxt
- I huvudsak stabil strand; ingen eller obetydlig erosion
- Strand med växelvis erosion/ackumulation men i huvudsak balans
- Strand med långsam erosion
- Strand med betydande erosion
- Ej bedömd

Jordart på land

- Organisk jordart
- Lera
- Silt
- Sand
- Grus
- Sten-block
- Isälvssediment, sand-block
- Moränlera
- Morän
- Berg
- Fyllning

Waves and currents were modelled from several decades of historical wind data.

All data combined to analyze spatial patterns of sediment erosion, transport and deposition.

The results are compiled into maps showing the location and distribution of mobile sediments, their transport pathways and storage compartments in the nearshore and deeper offshore zones, and, whether compartments are closed or leaky, and their onshore-offshore exchange, including long-term trends in coastline accretion and erosion.

Key findings

- Limited sand volumes generally located on the east sides of bays along the southern coast of Skåne.
- Eastwards directed longshore sediment transport over recent decades.
- Embayments pinned between deposits of glacial boulders, which inhibit longshore sediment transport, causing long-term net erosion of some embayments.
- Erosion is a localized problem at present, but concern for future sea level rise.