Coastal plain dynamics: GIS-solutions to map and catalogue coastal marine architectural elements

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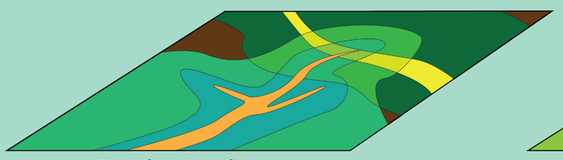
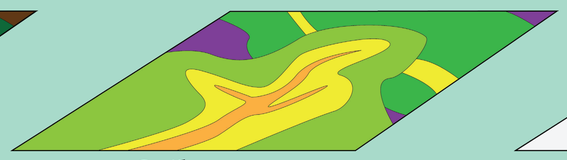
The Dutch coast consists of beach barriers and tidal inlet systems which dynamically developed during the Holocene. The resulting coastal plain geology has been studied extensively since the beginning of the 20th century, in various ways and from different backgrounds. Today, a large amount of heterogeneous data and many regional studies are available. However, the overwhelming quantities make that knowledge tends to stay fragmented. To analyze coastal system dynamics at millennial time scales, an overview and integration of knowledge on coastal development is required. Therefore, a GIS-system has been developed, expanding on methods for mapping the Rhine-Meuse delta. The new GIS-system documents the accumulated knowledge on individual geological-geomorphological elements and allows to map coastal evolution from past to present. The system links digital base maps (extent of geological-geomorphological elements) and database tables (dating, lines of reasoning, references to sources), which both are dynamically updatable. The system combines this data in scripts to produce palaeogeographical maps for times of choice, as far as data allows. It enables supraregional comparison of coastal plain development, along the entire Dutch coast, and its local and regional forcings by quantitatively analyzing sea ingression dynamics. Both academic and applied research can benefit from this integrated reconstruction.

Input

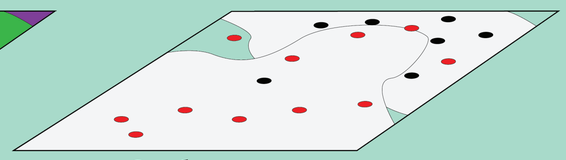
Heterogeneous data from different regions, environments and institutes



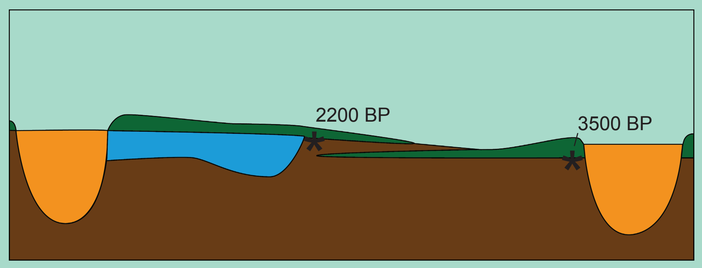
Geological map



Soil map



Settlements



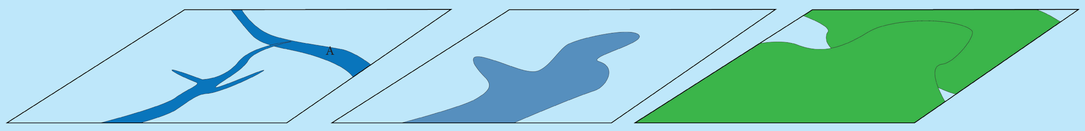
Cross-sections, absolute dates

and more...

GIS

I: Base maps

Manually edited extension of geological-geomorphological units



All channels **All intratidal flats** **All supratidal flats**

II: Database

1) Ages of the geological-geomorphological units
2) Other metadata: e.g. references

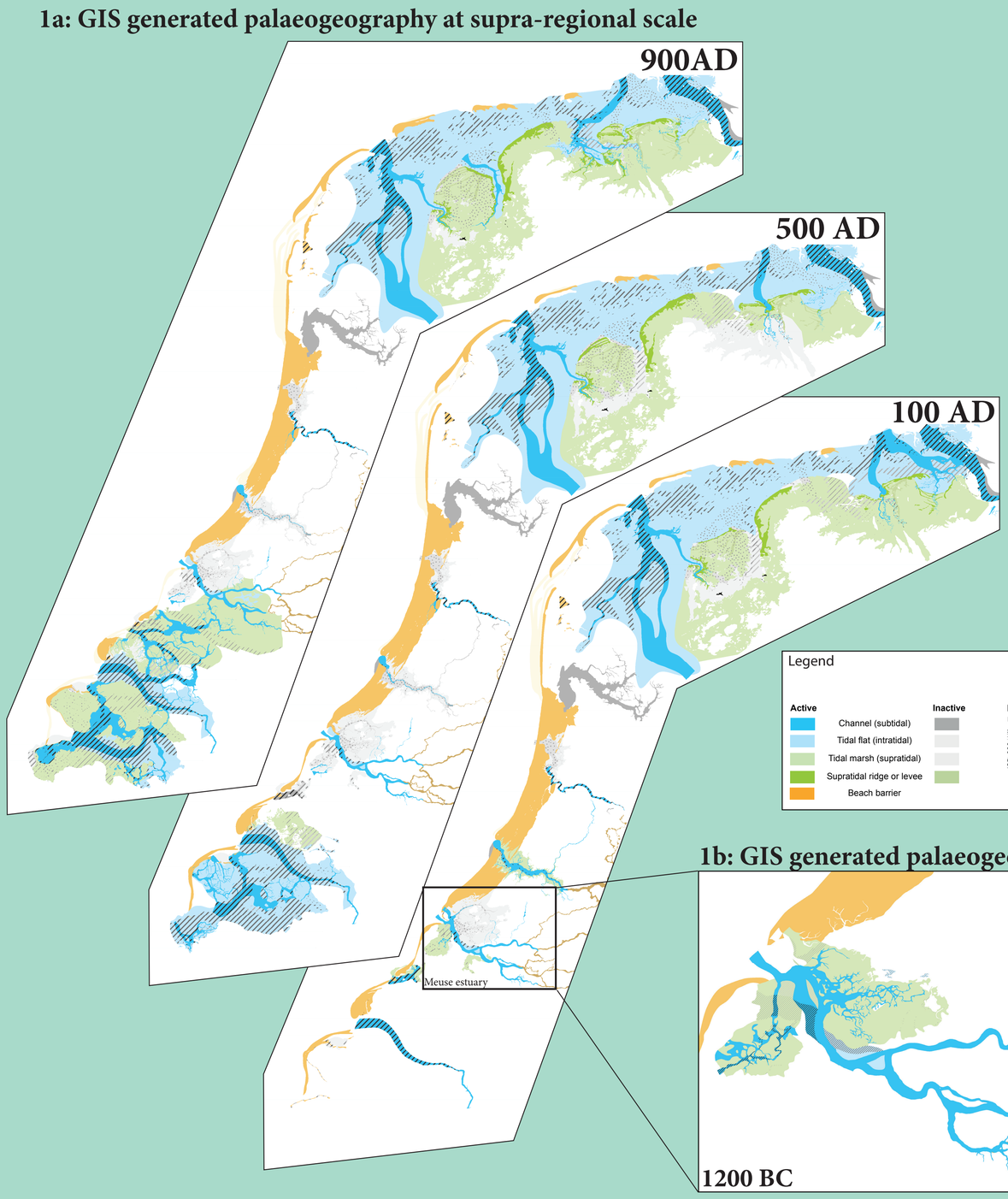
System	Begin	End
A	3000	2000
B	2000	1000

Script

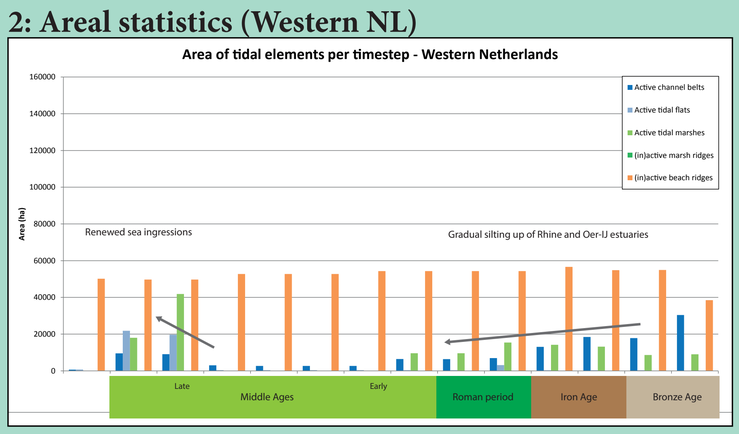
1) Connects age to geological-geomorphological units
2) Calculates geological relations (cross-cut and depositional relations)

Results / Output

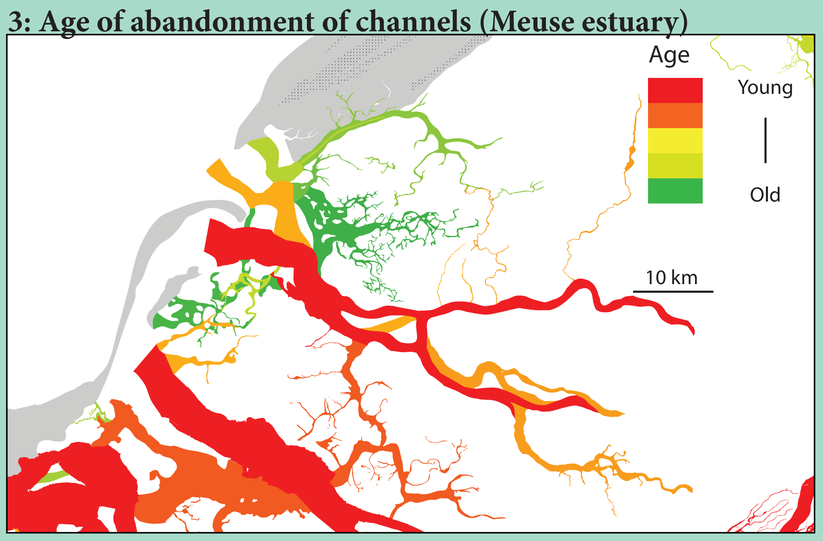
1a: GIS generated palaeogeography at supra-regional scale



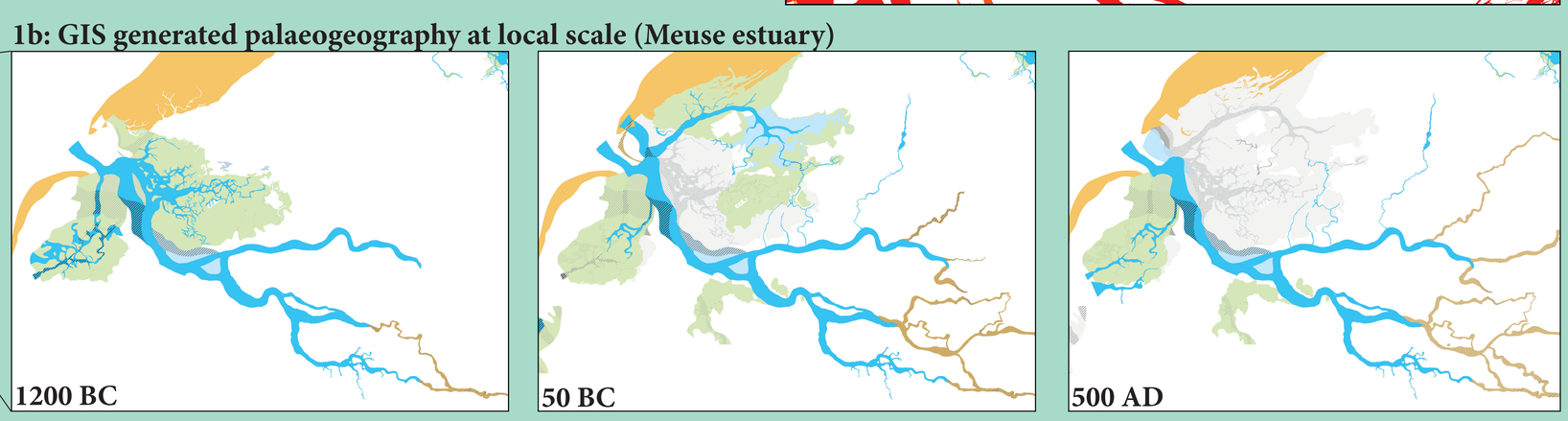
2: Areal statistics (Western NL)



3: Age of abandonment of channels (Meuse estuary)



1b: GIS generated palaeogeography at local scale (Meuse estuary)



Conclusions

GIS:
- Input: geological base maps and tables
- Combines various input using scripts
- Output: map series, area statistics, catalogue

Allows to:
- Study coastal development at supra-regional and local scale
- Split natural and human forcings in coastal development
- Determine push and pull factors on human migration (see other Pierik et al. poster!)

Additional information

Project website

Poster pdf

References

Universiteit Utrecht

NWO Netherlands Organisation for Scientific Research

Cultural Heritage Agency of the Netherlands
Ministry of Education, Culture and Science

rijksuniversiteit groningen