


Cultural Heritage Agency  
Ministry of Education, Culture and  
Science

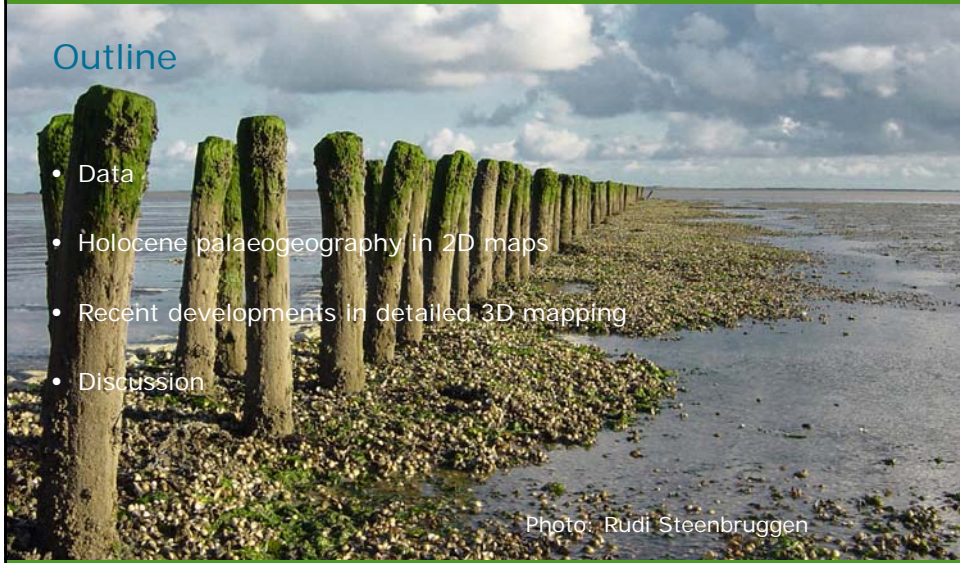

Lower Saxony Institute  
for Historical Coastal Research



## Indicative mapping of the Wadden Sea area - A geological perspective

Henk Weerts  
[h.weerts@cultureelerfgoed.nl](mailto:h.weerts@cultureelerfgoed.nl)

Martina Karle  
[karle@nihk.de](mailto:karle@nihk.de)



### Outline

- Data
- Holocene palaeogeography in 2D maps
- Recent developments in detailed 3D mapping
- Discussion

Photo: Rudi Steenbruggen

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Husum, 24-26 September 2012



## Data categories

- Borehole data
- Archaeological data
- Historical data
- Remote sensing data
- Expert knowledge

Photo: Henk Weerts

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## DINOLoket



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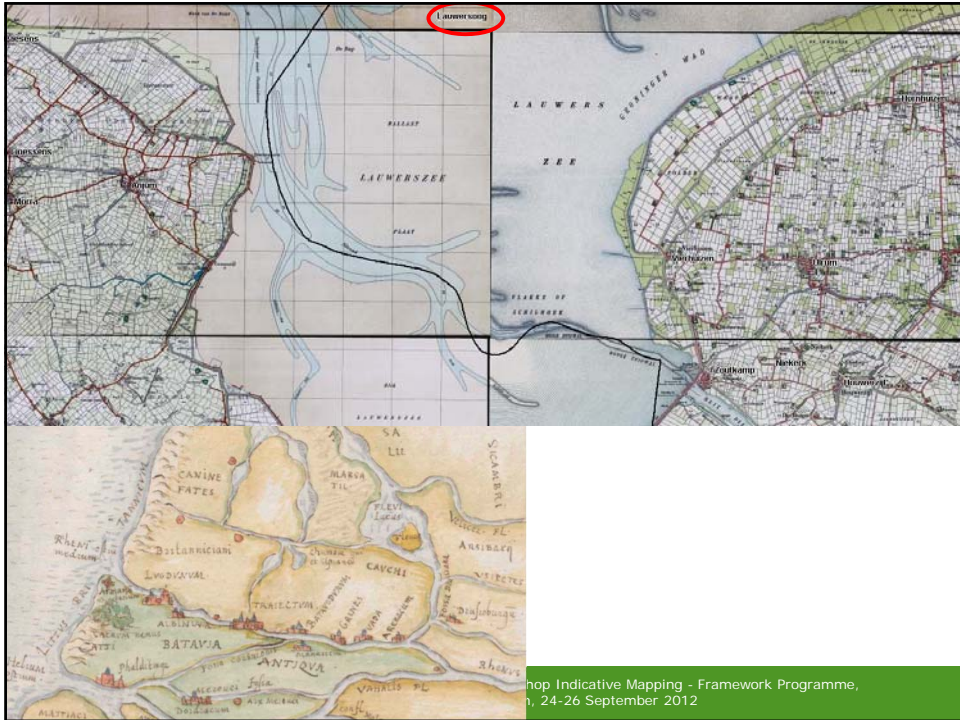
**NIBIS®** **KARTENSERVER**

Main source for geological data  
 Archive of core data, maps  
 „free access“ BUT...

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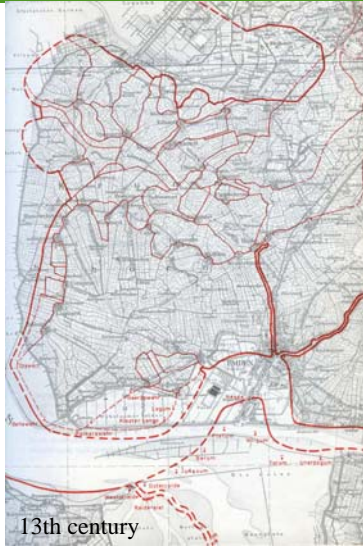
**Archaeological data**

- ARCHIS II, Cultural Heritage Agency of the Netherlands  
<http://archis2.archis.nl/archisii/html/index>

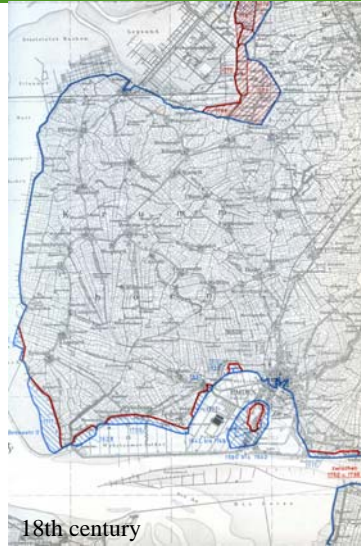


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Some work is already done:  
 Historical maps of medieval coastal evolution by Homeier 1969



13th century



18th century

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## Remote sensing data

- Laser altimetry (land surface)
- Shallow seismics (water)
- Deep 3D seismics from oil companies (water and land)

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## Laser altimetry

- Nationwide, m-scale (horizontal), cm- scale (vertical).
- Generation 2 available in 2012

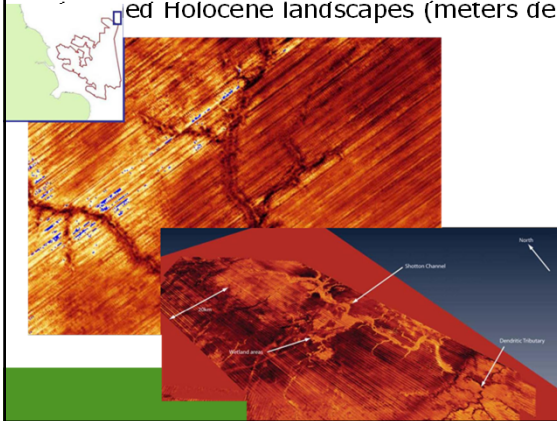






## Deep 3D seismics from oil companies

- Originally aimed at oil and gas exploration at great depths (kms!)
- University of Birmingham researched possible use for mapping of old Holocene landscapes (meters depth)

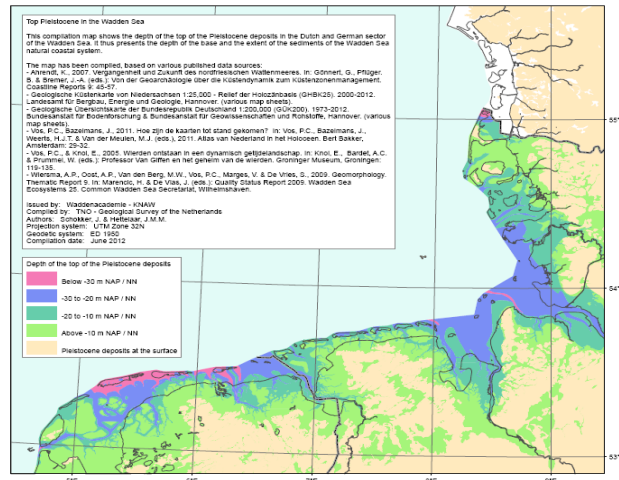


UNIVERSITY OF  
BIRMINGHAM  
PCS Petroleum Geo-Services

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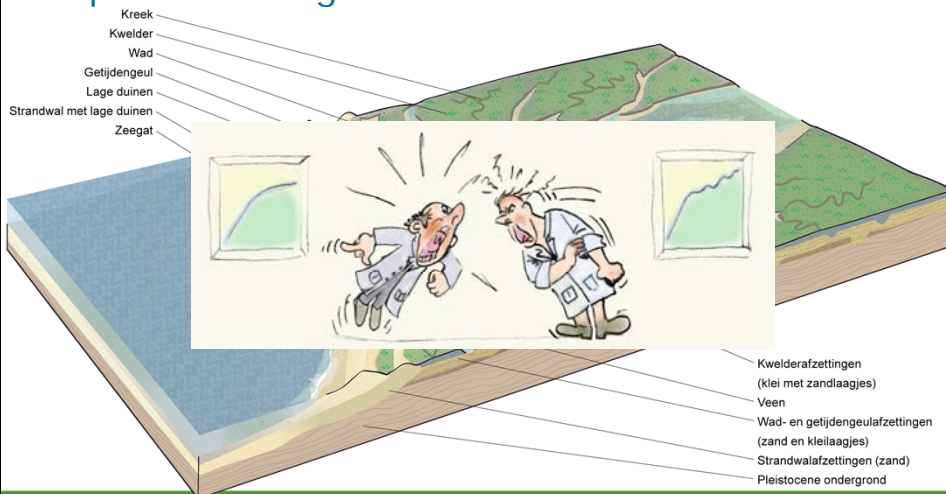
## Indicative Map top Pleistocene deposits



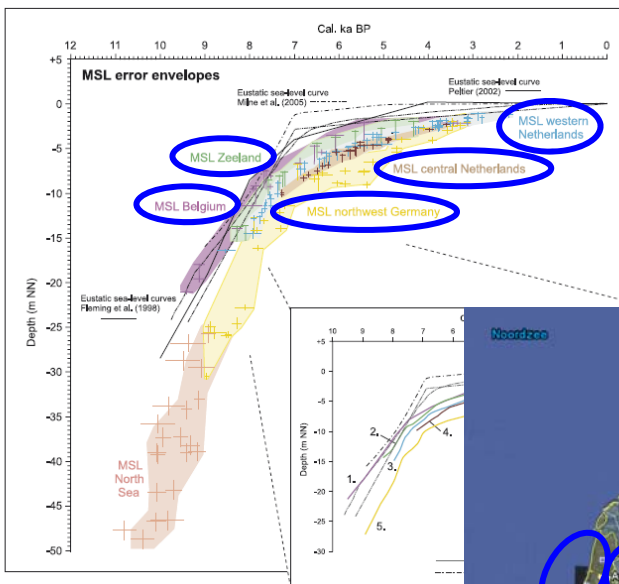
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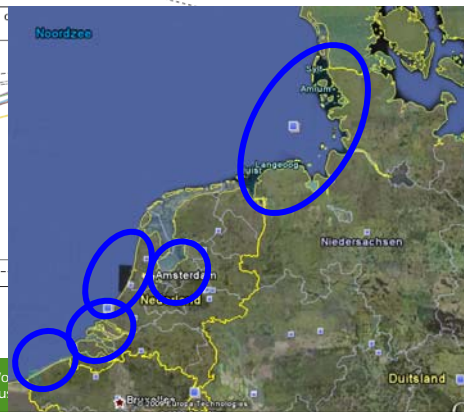
## Expert knowledge



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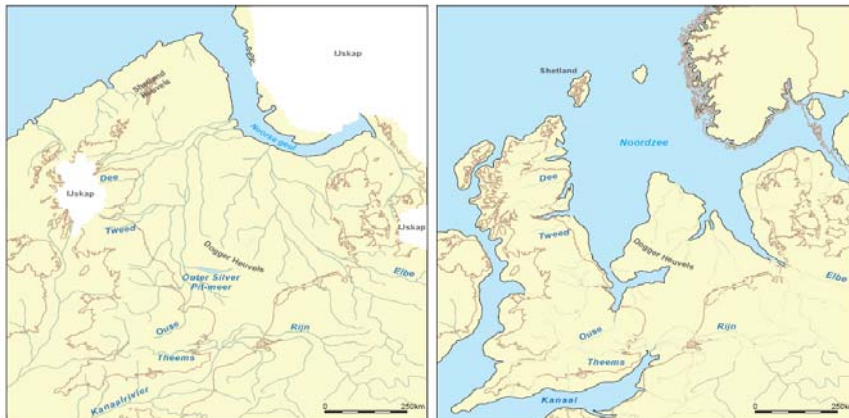
Up to 5 m difference between the regions







## The end of the last ice age

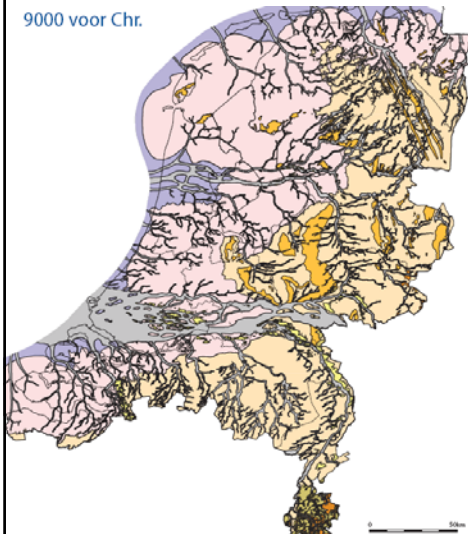


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## The Netherlands in the Holocene

9000 voor Chr.



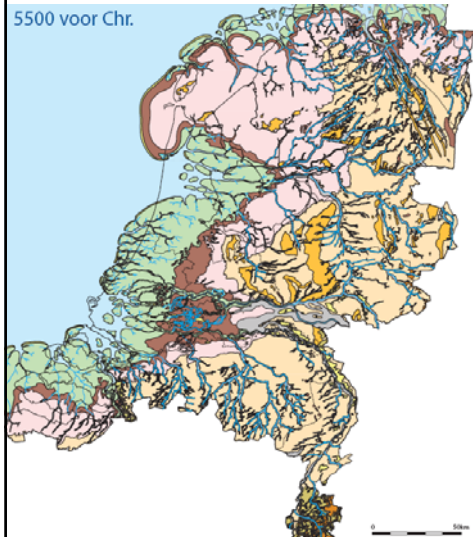
Palaeogeographical maps:  
Peter Vos, Deltares





## The Netherlands in the Holocene

5500 voor Chr.



## The Netherlands in the Holocene

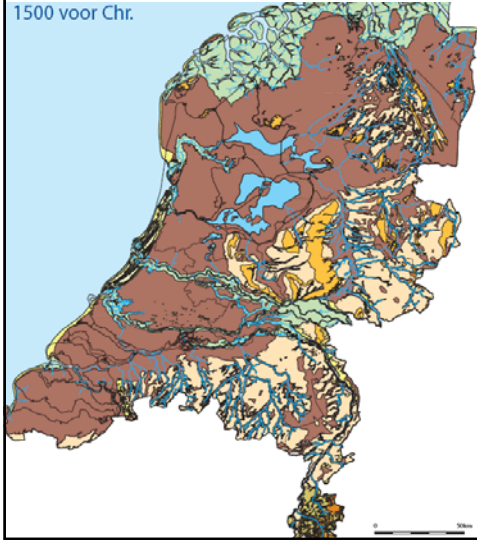
2750 voor Chr.





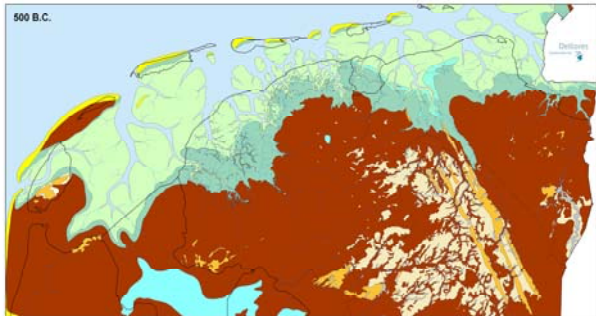
## The Netherlands in the Holocene

1500 voor Chr.



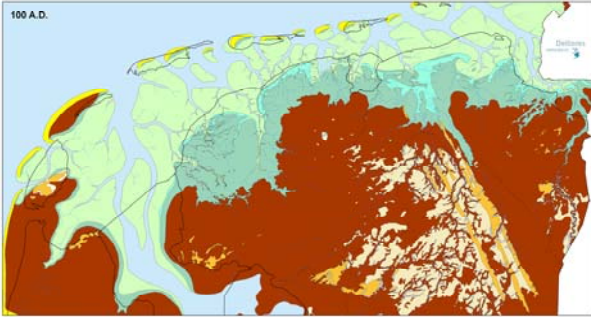
## The Netherlands in the Holocene

500 B.C.

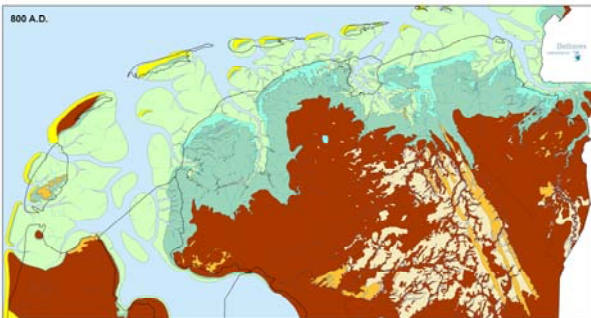




## The Netherlands in the Holocene



## The Netherlands in the Holocene





## The Netherlands in the Holocene

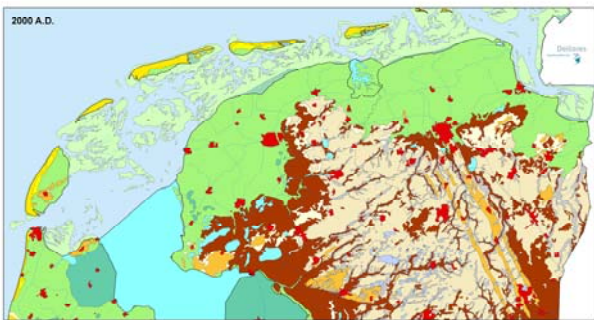


## The Netherlands in the Holocene





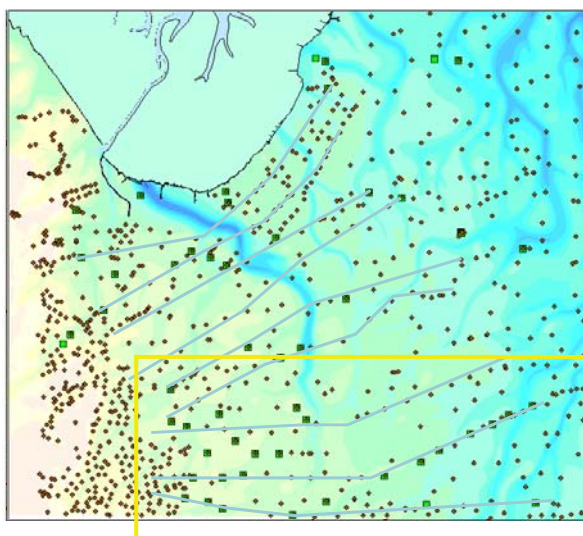
## The Netherlands in the Holocene



## Case study from Jade Bay Project

### Database

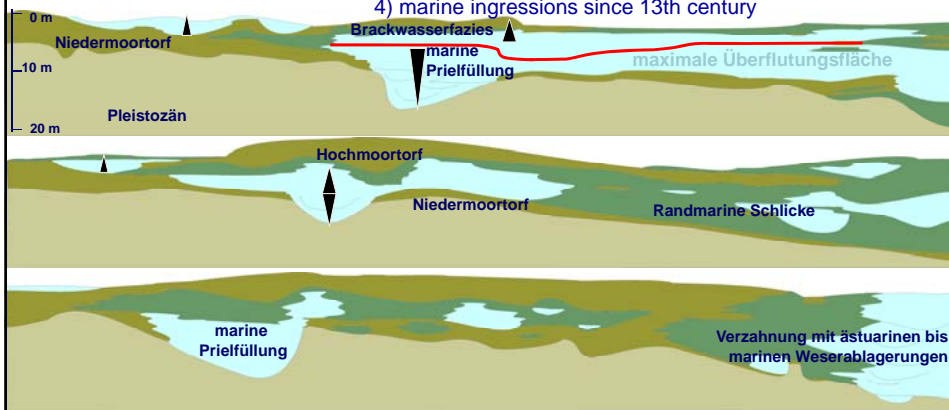
- 6573 corings
- 1031 geological corings
- 822 corings reaching to the pleistocene surface
- 59 radiocarbon datings in 24 corings



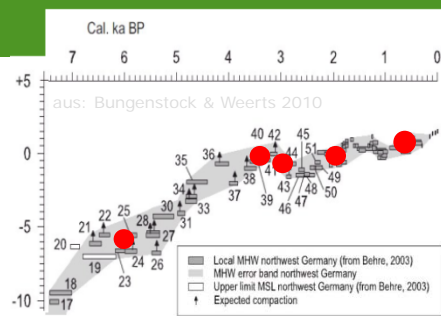


**Sedimentary development:**

- 1) transgressive contact on top of pleistocene basement or basal peat with brackish or marine sediments
- 2) regressive sequence with growing influence of terrestrial facies
- 3) silting-up and growth of fen peat and raised bog peat
- 4) marine incursions since 13th century

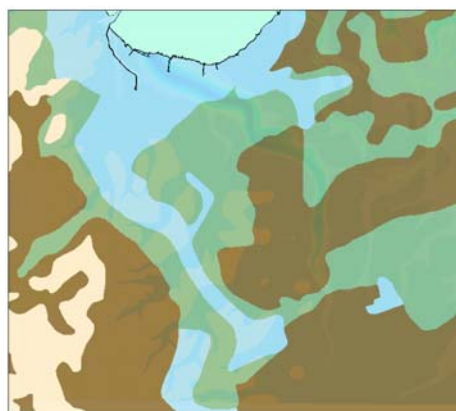


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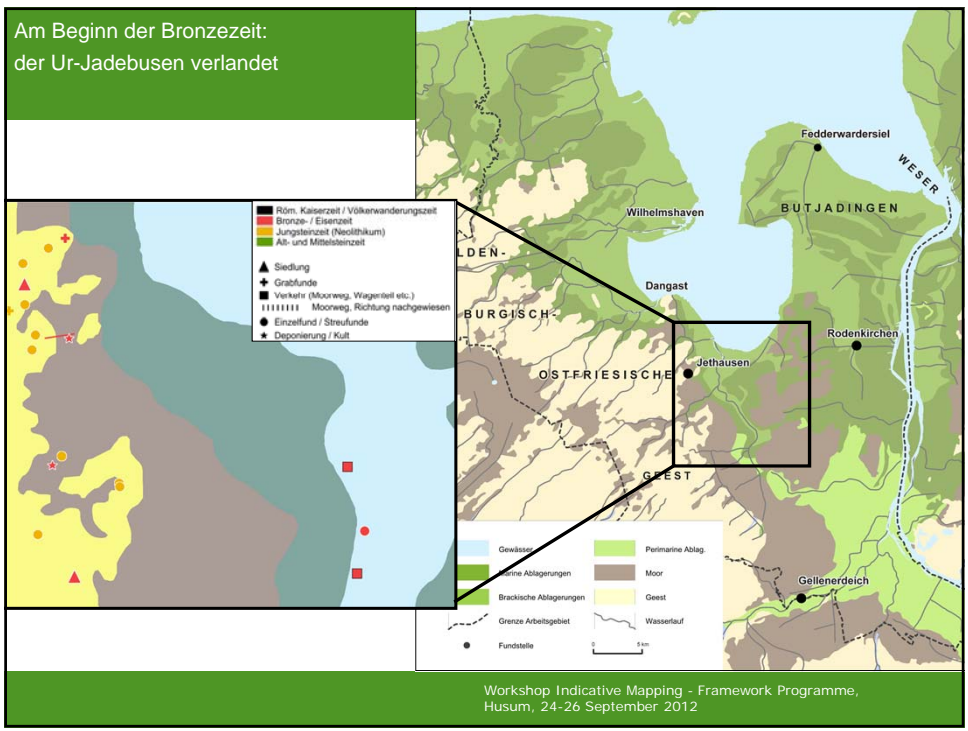
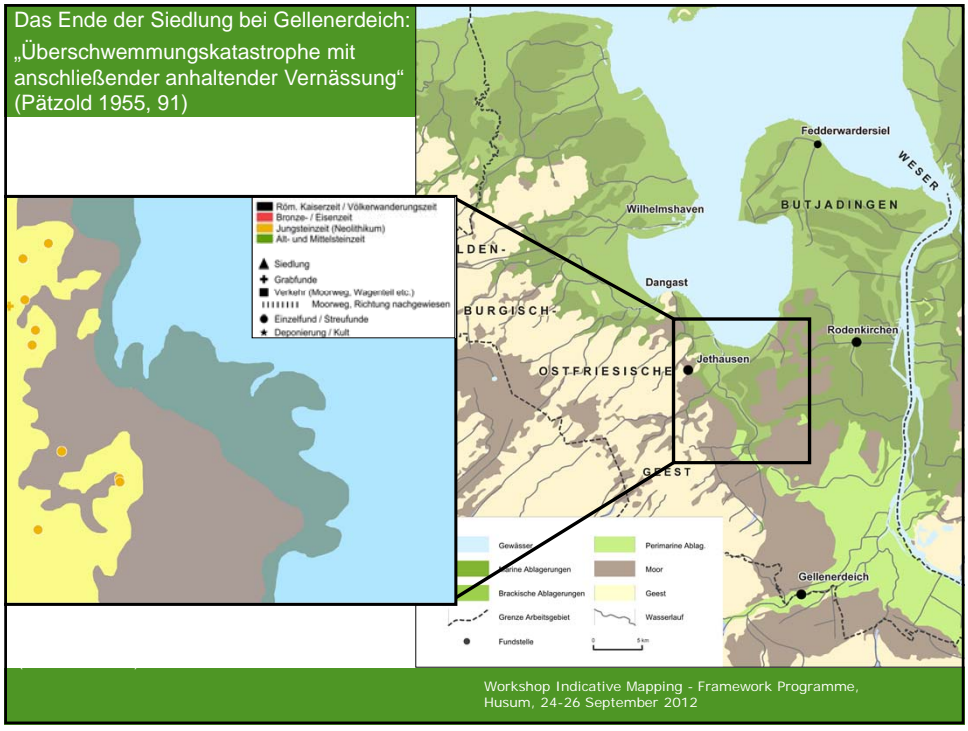


Facies shift during rising sea level

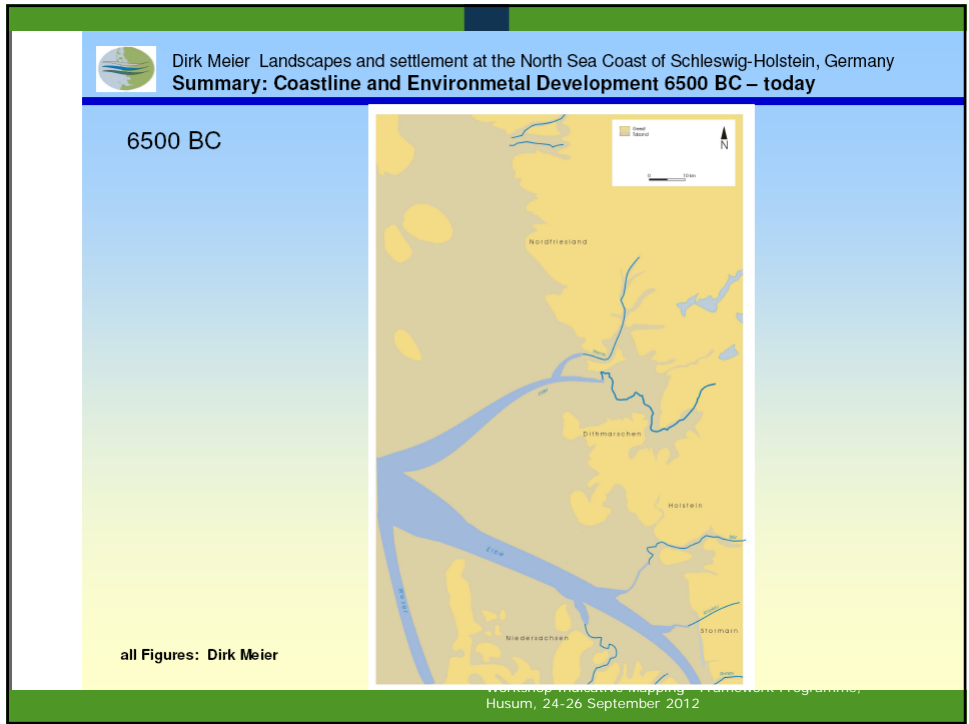
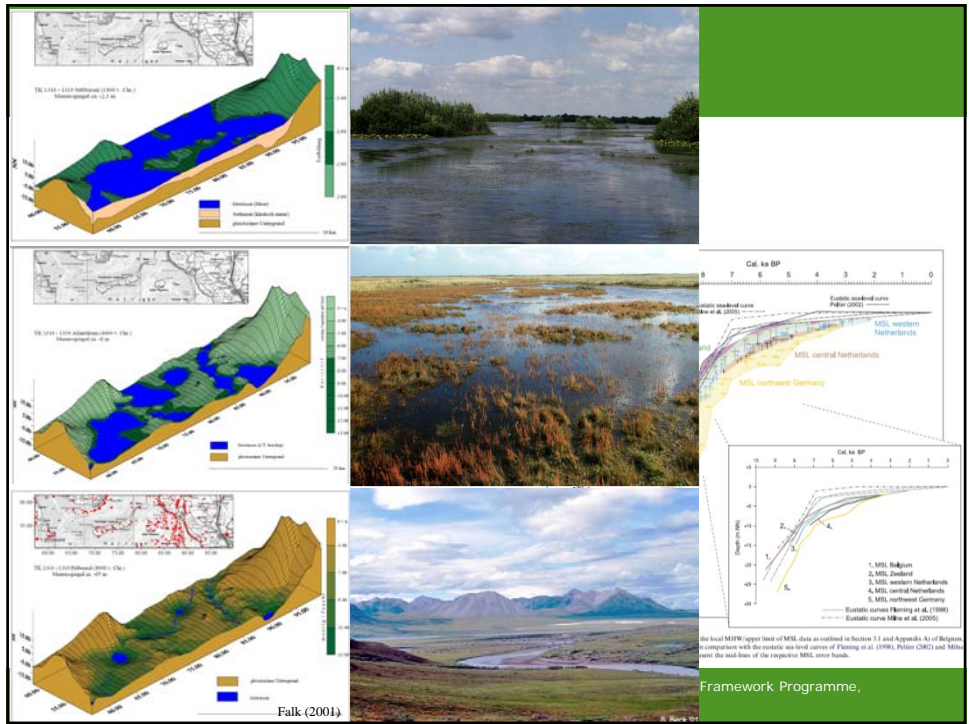
- 5500 cal BC: first marine incursions into pleistocene channel structures
- 4000 cal BC: basal peat
- 1500 cal BC: maximum flooding surface, so called „Urdjadebusen“
- 1000 cal BC: Prograding coastline,
- 200 cal BC: continuing silting-up process



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### Early Medieval time AD 700 – 1000



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### Polders – 1362



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### Polders –1500



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### Polders –1634



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### Polders –1825



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### Polders –1955



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## Polders –2000



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## Recent developments in detailed 3D mapping

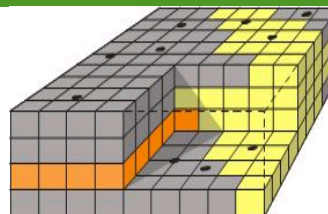
- TNO | Geological Survey of the Netherlands
- Geological mapping of the Netherlands – funding by several ministries, Research program for several years
- 3D-top; detailed 3d-lithological model of the upper 30 m
- Voxel size 100 \* 100 \* 0.5 m
- Geostatistical model, including uncertainties of the model



## 3D-top

### 3D sub-surface model of the Netherlands

- Nationwide (> 40,000 km<sup>2</sup>)
- Upper 30 m
- Voxels of 100 \* 100 \* 0,5 m
  - > Each voxel: lithostratigraphical unit + uncertainty
  - > Lithology (gravel, sand, loam, clay, peat) + uncertainty
  - > Geohydrological, geophysical and geochemical properties
  - > *Future: Archaeological expectation, Age*
    - » 2012: Joint pilot-project by TNO and RCE



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## 3D-top South-Holland

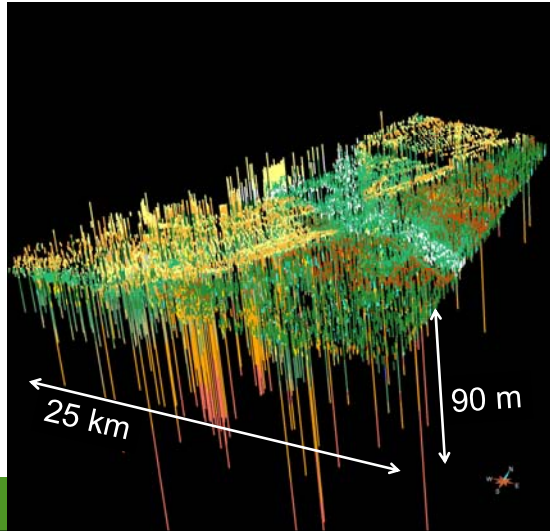


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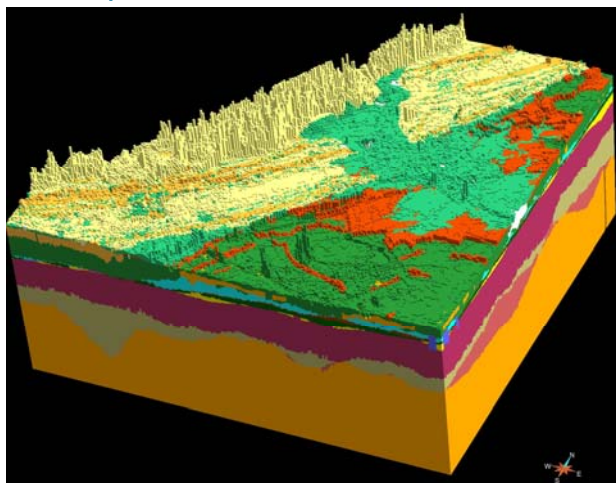
## 3D-top South-Holland; corings lithostratigraphy



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## 3D-top South-Holland; 3D lithostratigraphy



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Thank you !

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