Holocene water-level indicator database for the Dutch coastal plain

K. de Wit[1], R. S. W. van de Wal[1,2], K. M. Cohen[1]

1: Department of Physical Geography, Utrecht University, 2: Institute for Marine and Atmospheric research Utrecht (IMAU), Utrecht University

Kim de Wit, MSc - k.dewit@uu.nl

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Data collection

Introduction

Holocene coastal plain evolution in the Netherlands is strongly influenced by **relative sea-level rise (RSLR)** caused by two components:

Relative SLR → Sea-level rise components + Background subsidence components

The background subsidence components consist mainly of **glacio-isostatic adjustment (GIA)** and **tectono-sedimentary basin loading and sinking** [1,2].

Isolating these subsidence components in the Netherlands is difficult because:

- Both processes act on a similar temporal and spatial scale
- Their rates are of a similar order of magnitude
- Their relative contribution is not well constrained

HOLSEA-NL water-level indicator dataset

Geological water-level indicators are used to assess **local and regional variabilities in RSLR.** In the Netherlands, these are mainly:

- Basal peat layers (Figure 1)
- Which are gradual drowning surfaces
- Forming terrestrial upper limiting data
- And indirect sea-level markers

~710 indicators in HOLSEA format were added to the **HOLSEA-NL database**:
a uniform data set of water-level indicators on a national scale.

Documenting all vertical correction options:
- ✓Anthropogenic subsidence
- ✓(paleo) tidal correction
- ✓Tectonic subsidence

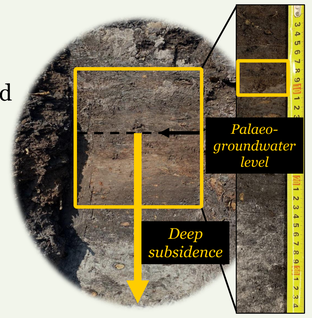


Figure 1
Basal peat as water level indicator

SLIP data per region

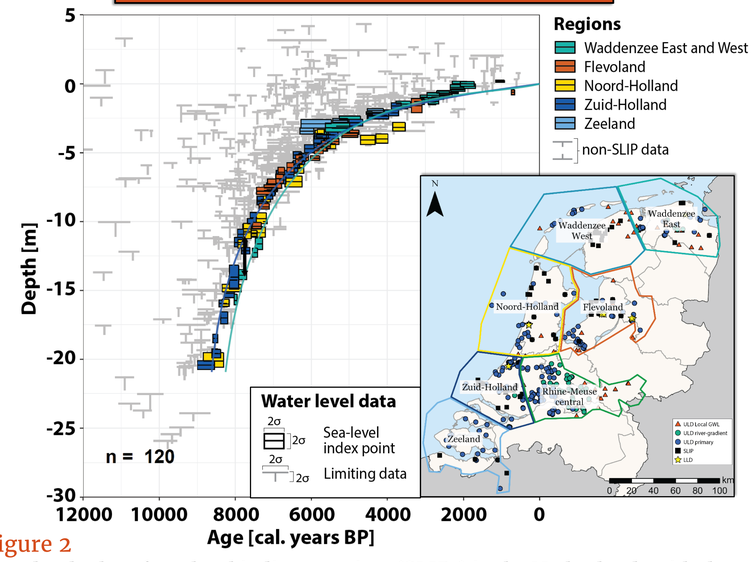
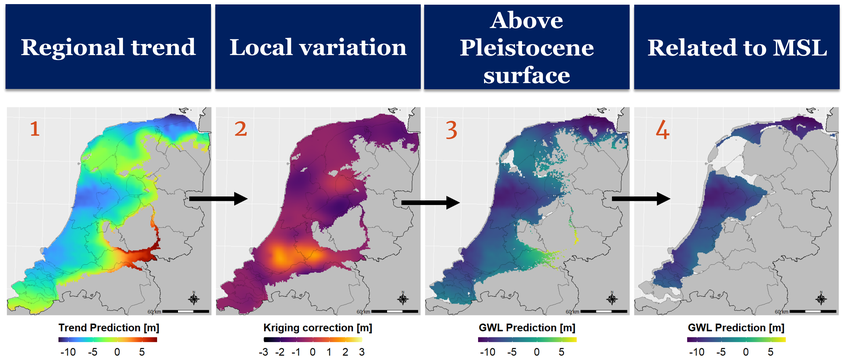


Figure 2
Age-depth plot of sea-level indicator points (SLIPs) in the Netherlands with the **tectono-sedimentary subsidence signal removed**.

Modelling

Spatio-temporal interpolation

Interpolation of SLIP data resulting in a reconstruction of Holocene RSLR, with **continuous coverage** of the Dutch coastal plain.



1) Fit spatio-temporal trend to the data

2) 3D block kriging of residuals

3) Select water levels above Pleistocene surface

4) Filter sea-level related water levels based on slope and max elevation

Figure 3
Example output spatio-temporal interpolation steps for timestep 6000 cal. years BP.

Untangling long term subsidence in NL

- **Tectono-sedimentary subsidence signal removed**
- Regional differential subsidence: more RSLR in N-NL vs SW-NL
- **Decrease of GIA signal** in the Late Holocene (2-4 ka)

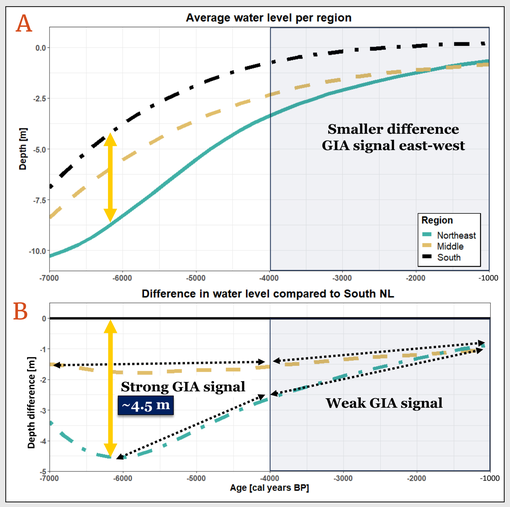


Figure 4
A) Reconstructed and filtered Holocene water level rise averaged for three regions; B) Difference in reconstructed average water level for the northeast and middle compared to the southwest of the Netherlands

Take-Home messages

- **HOLSEA-NL**: uniform dataset on national scale.
- Reconstruction **independent** from global sea-level analysis, basin-geological subsidence reconstructions and geophysical GIA-modelling output.
- **Disentangling** of RSLR signal, next step:
  - › Combining with GIA-modelling output.

References

1) *Vink, A., et al. (2007). Holocene relative sea-level change, isostatic subsidence and the radial viscosity structure of the mantle of northwest Europe (Belgium, the Netherlands, Germany, southern North Sea). QSR .*
2) *Kooi, H., Johnston, P., Lambeck, K., Smither, C., & Molendijk, R. (1998). Geological causes of recent (~100 yr) vertical land movement in the Netherlands. Tectonophysics, 299(4), 297-316.*

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