Subsidence and relative sea-level rise due to glacio-isostasy in the Netherlands

Reconstruction of differential subsidence using 3D groundwater level interpolation

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Glacio-isostasy (GIA) in the Netherlands

In the Netherlands, several processes cause long-term natural subsidence. These "background" subsidence factors (Eq. 1) cause subsidence in the order of tenths of millimeters per year, due to which they are best distinguished on longer time scales. During the Holocene, the sea level of the North Sea was rising, and simultaneously the Netherlands was subiding because of glacio-isostatic movement of the Earth's mantle. The glacio-isostatic subsidence is stronger in the North, because it is closer to the former Fennoscandian ice sheet. As an example, the difference in glacio-isostatic subsidence between the German and Belgium coastline is approximately 7.5 m since 8000 yr BP (Vink et al. (2007).

Relative sea level rise

Different types of Holocene sediments were deposited under the influence of the rising sea level and the accompanying rising groundwater levels. These deposits now form an archive of the relative sea level rise along the Dutch coastline (Figure 1a). By comparing groundwater level rise reconstructions at different locations in the Netherlands, it is possible to identify patterns of long term subsidence (e.g. GIA), as long as local influences on groundwater levels are taken into account (Figure 1b&c).

3D groundwater interpolation

With a 3D interpolation of paleo-groundwater levels in the Dutch delta, it is possible to reconstruct the relative groundwater level rise of the past nine thousand years on a spatial scale (Figure 3).

References

a) Van 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). ORC.


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