

# Disentangling and parameterizing the total signal of subsidence

A data assimilation approach applied to various case studies

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## Purmerend – Deep and shallow subsidence

In progress

Problem:

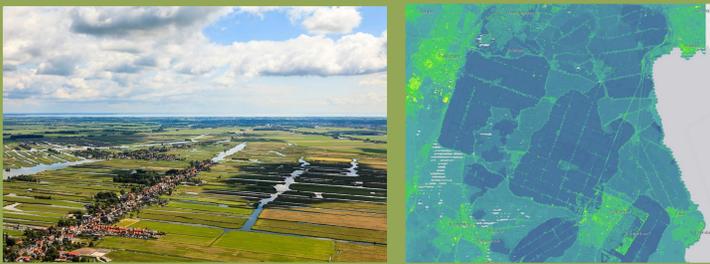
Complicated pattern of peat, reclaimed land and multiple gas fields at different reservoir depths

Action:

Model the subsidence by both shallow and deep processes and understand the relative contribution of each process

Result:

Disentangled deep and shallow step-wise, ...



On the method:



## Extensometer data analysis in Groningen, Friesland and Drenthe, and South-Holland (Rotterdam harbor)

Submitted

Problem:

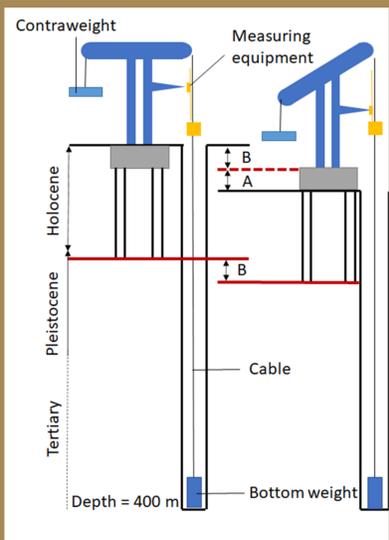
Barely any studies on subsidence at intermediate depth in NL

Action:

Use extensometer data in Rotterdam and Groningen to understand intermediate depth contribution

Result:

Consolidation by the overburden ~10% of total subsidence in these regions, strong seasonal effect



## Almere – unravelling shallow subsidence

Problem:

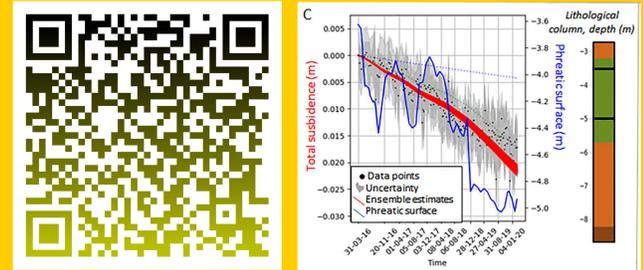
Spatially varying subsidence on city scale

Action:

Quantify causes of subsidence

Result:

Clay shrinkage is dominant, spatial pattern related to both phreatic surface and Holocene thickness. Effects of drought enhancing subsidence observed



## N31 – Loading of a highway structure on Holocene coastal plain deposits with large spatial variation

Problem:

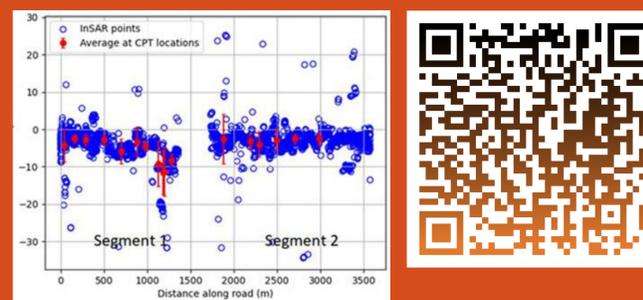
Differential subsidence along highway structure

Action:

Model subsidence along the highway on different scales, based on two types of subsurface data

Result:

Lithostratigraphy is leading. Short scale changes by high level data, lower level data for continuous image



## Ravenna region – disentangling deep and shallow subsidence

Problem:

Lagoon area with shallow subsidence by compaction, shrinkage, oxidation and loading of buildings, and impact of offshore gas field(s)

Action:

Fit the influence of the offshore gas field related subsidence and disentangle the age of buildings and their affect on subsidence by load in built-up areas. Quantify shallow subsidence in rural areas

Result:

Work in progress



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