15/07/2015

A Voxel Model for Mineral Resources: Loess Deposits in Flanders

8th EUREGEO – Barcelona

Flemish Knowledge Centre of the Subsurface (VLAKO), part of VITO

Flemish Government (LNE-ALBON)

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Outline

- Introduction
- Objectives
- Methodology
- Results
- the ‘Mineral Resource Explorer’
- Next steps

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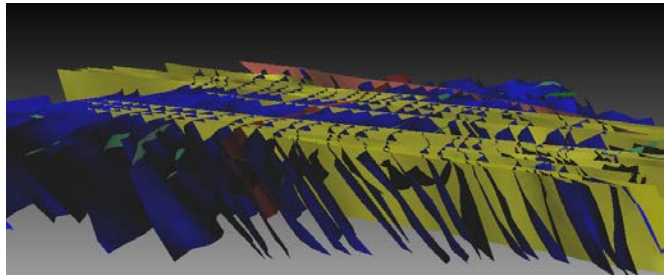
Introduction

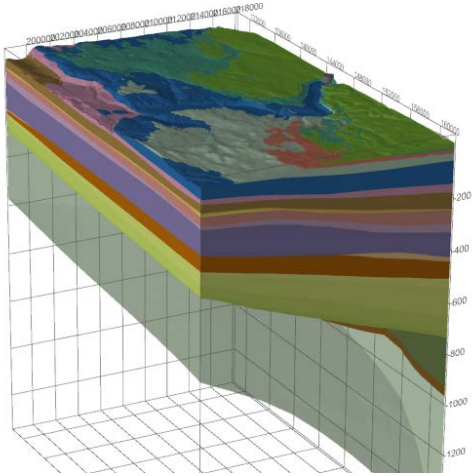
- Flemish government: Natural Resources Service

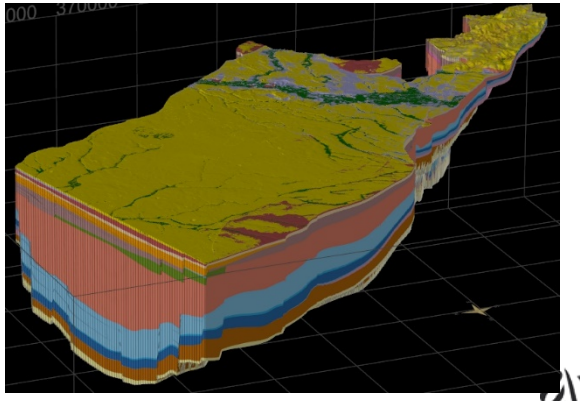
  Competences

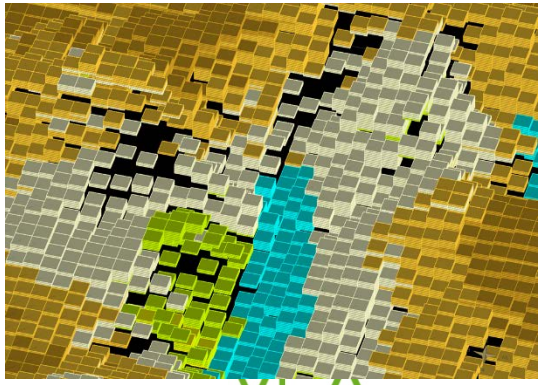
  1. Raw Materials Policy
  2. Sustainable management of the deep subsoil
  3. Geological knowledge: policy-supporting research & data sharing



- VITO (VLAKO-group)







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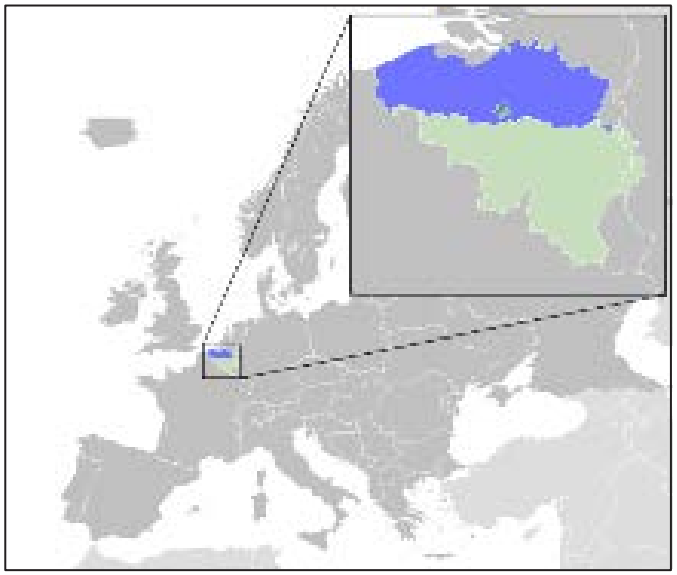
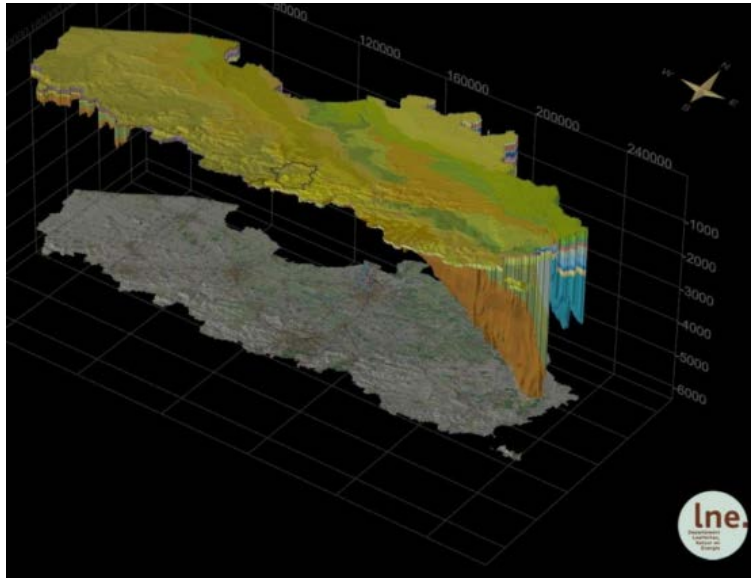
Introduction

- Voxel model part of geological 3D (layer) model of Flanders, Belgium
  - Area: Flanders and Brussels Capital Region
  - Free accessible @ http://dov.vlaanderen.be





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Introduction

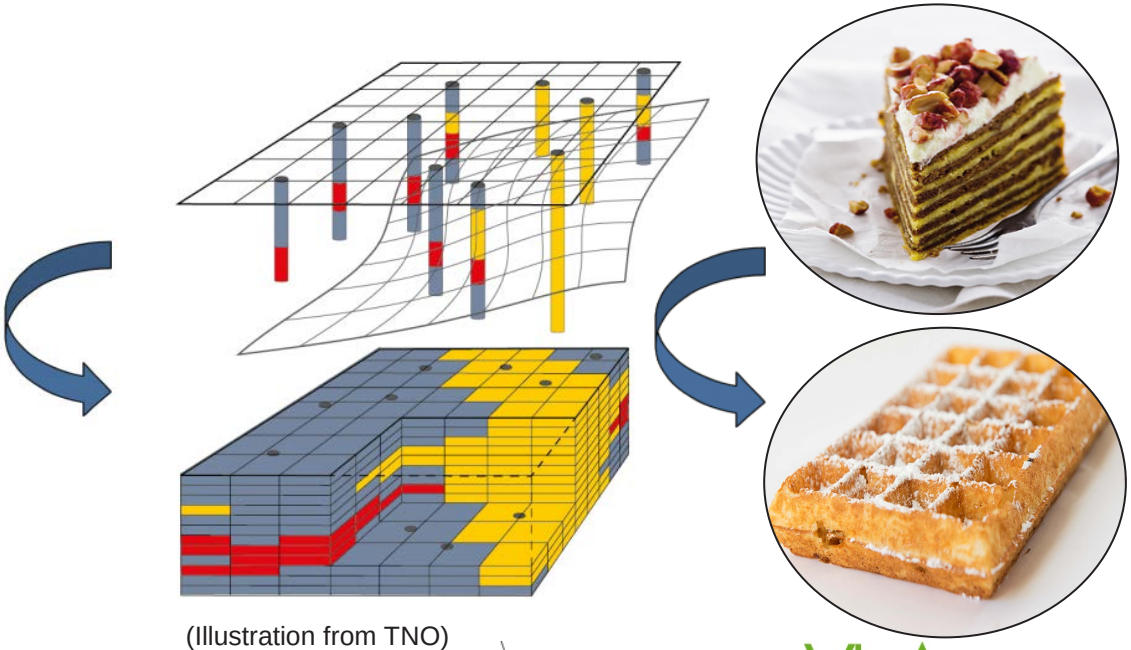
2006:
start

2011:
"first results"

2013:
"1st complete layer model"

next

- Next:
  - Refining layer model
  - creating first voxel model



(Illustration from TNO)

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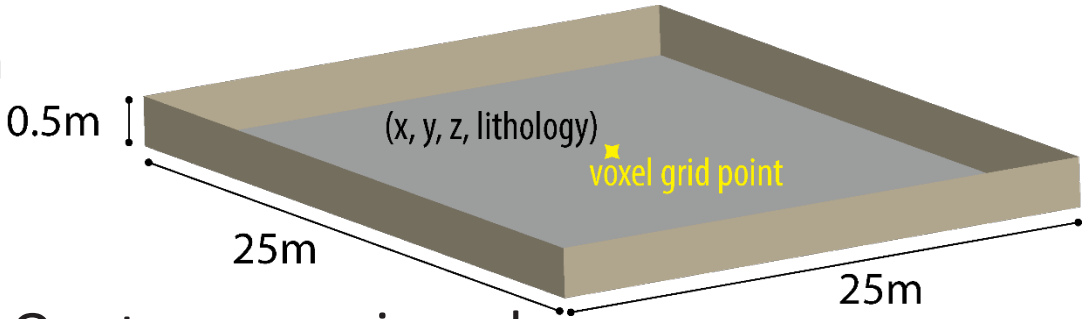
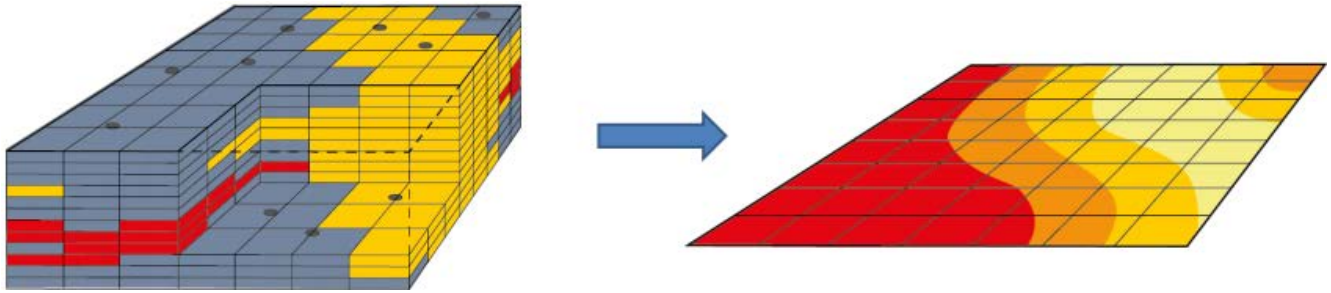
Objectives voxel model

- Combining layer model + borehole information
  - 3D Grid: 25 x 25 x 0.5 m



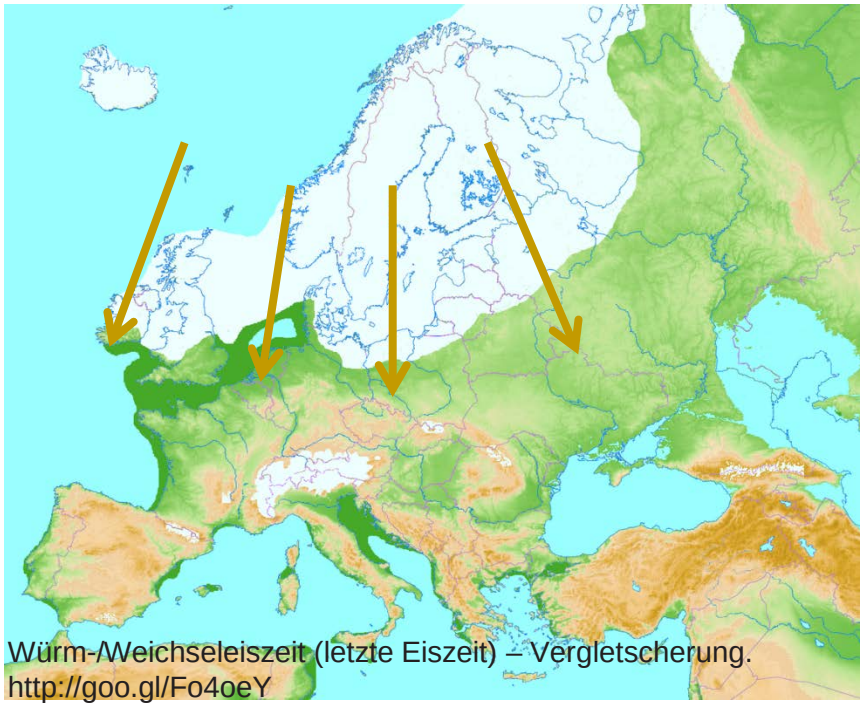
- Priority areas: significant Quaternary mineral resources
- Offering external users an online viewer for mineral resources



(Illustration from TNO)

Objectives voxel model

- First focus area: Loess deposits in Flanders
  - ! Still of importance for brick and ceramic industries in Belgium
  - Part of Middle to Late Pleistocene aeolian deposits



Würm-/Weichseleiszeit (letzte Eiszeit) – Vergletscherung.
http://goo.gl/Fo4oeY

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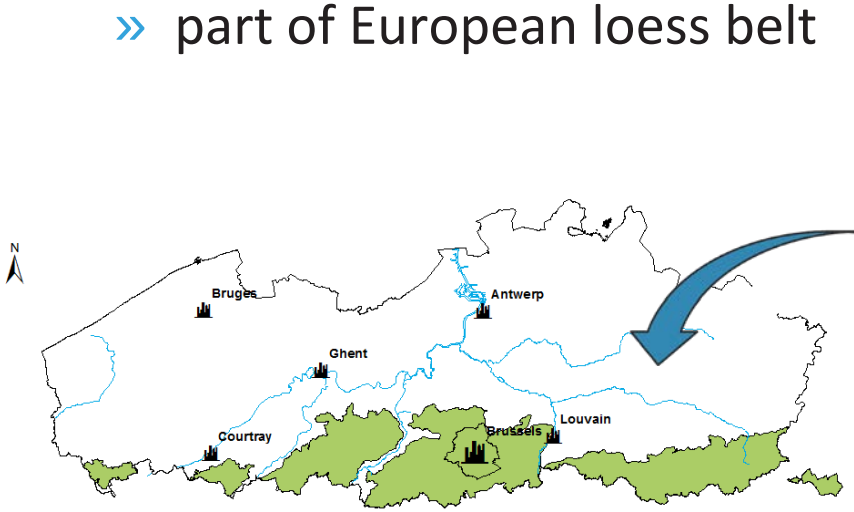
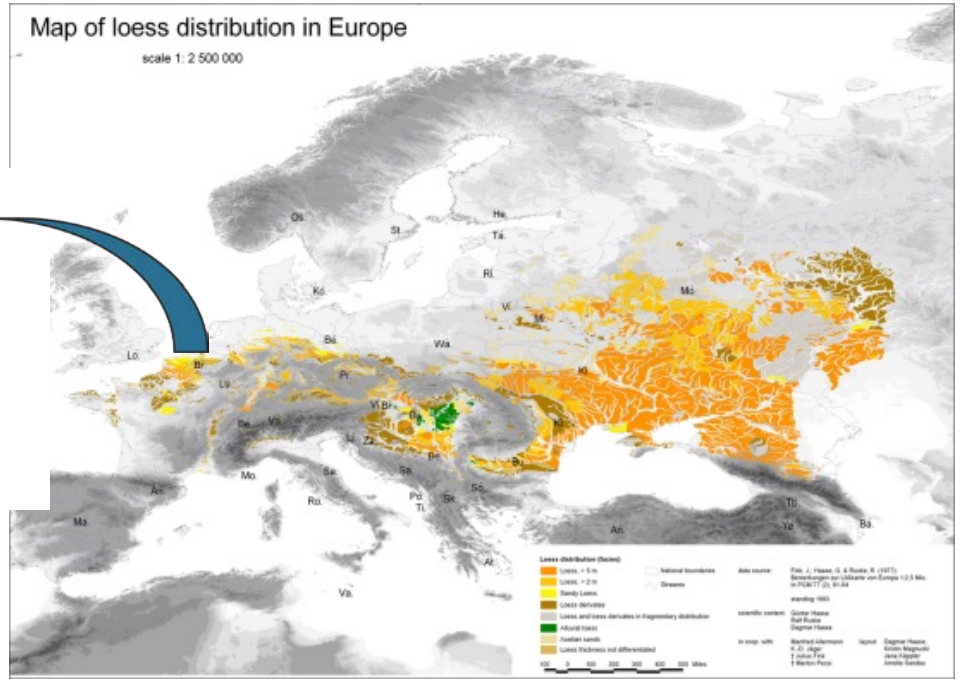
Objectives voxel model

- First focus area: Loess deposits in Flanders
  - ! Still of importance for brick and ceramic industries in Belgium
  - part of European loess belt





Haase et al., 2007. Loess in Europe - its spatial distribution based on a European Loess Map, scale 1:2,500,000. Quat.Sci.Rev. 26 (9-10), 1301-1312

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Methodology

1) Selection of area, layers & boreholes

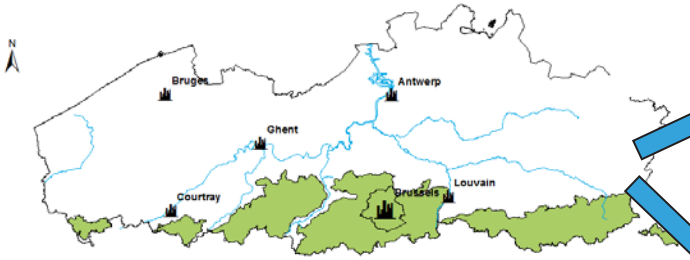
2) Translation & conversion boreholes → datapoints

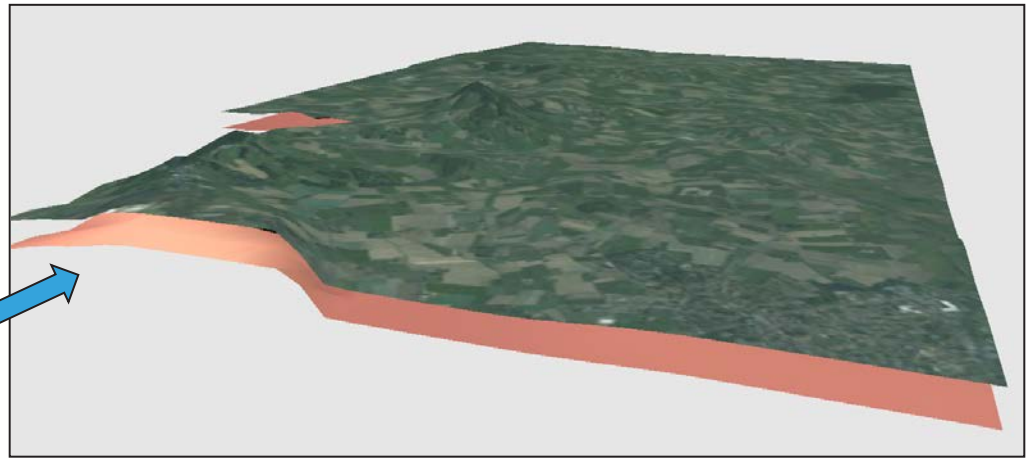
3) Interpolation datapoints

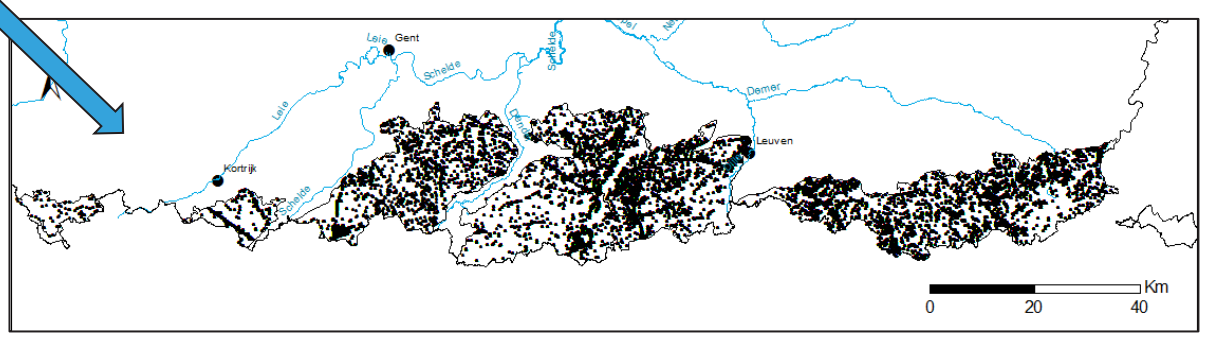
Software: ArcGIS, AutoCAD, Surfer, Voxler

Methodology - 1

1) Selection set: area, layer model and boreholes







~ 8.000 boreholes

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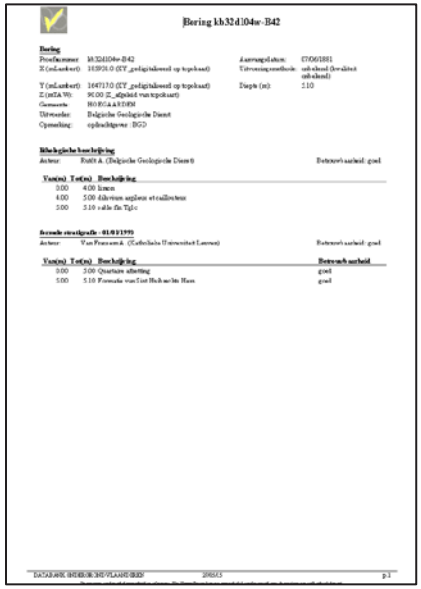
Methodology - 2

2) Translation & conversion boreholes → data points

- Translation: lithological descriptions → categories
- Conversion: categorised descriptions → datapoints

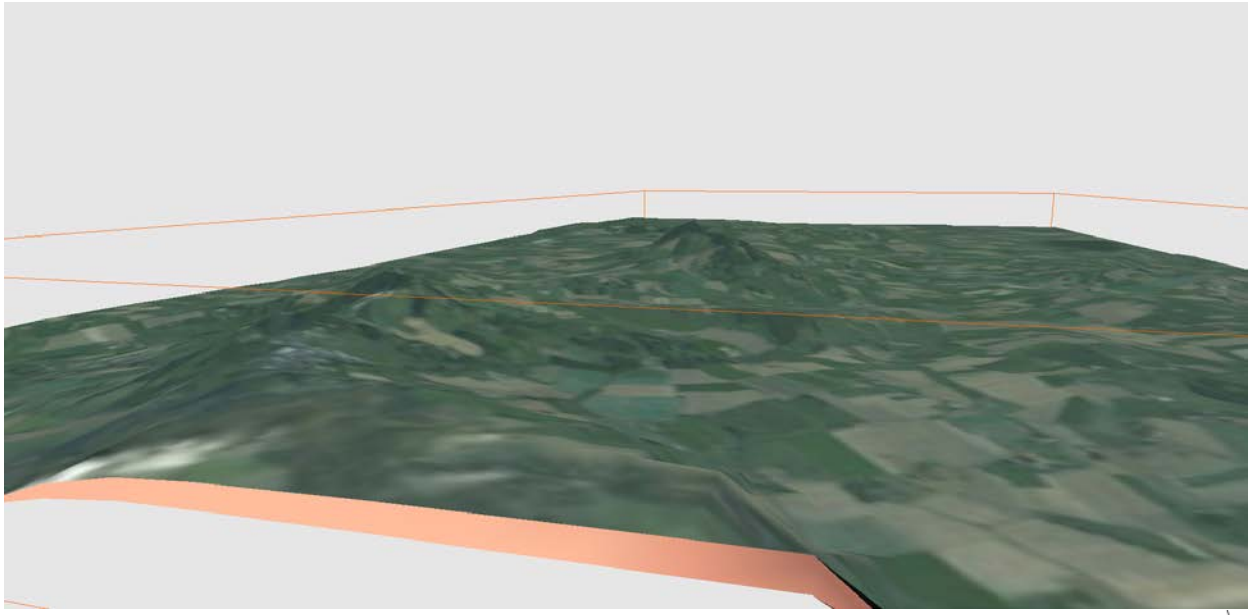


0 – 0.5 m: clay
0.5 – 2 m: loam
2 – 2.5 m: sandy loam
2.5 – 3 m: loamy sand

Methodology - 3

3) Interpolation data points

- Two step process
  - First: 2D interpolation along top + base Quarternary

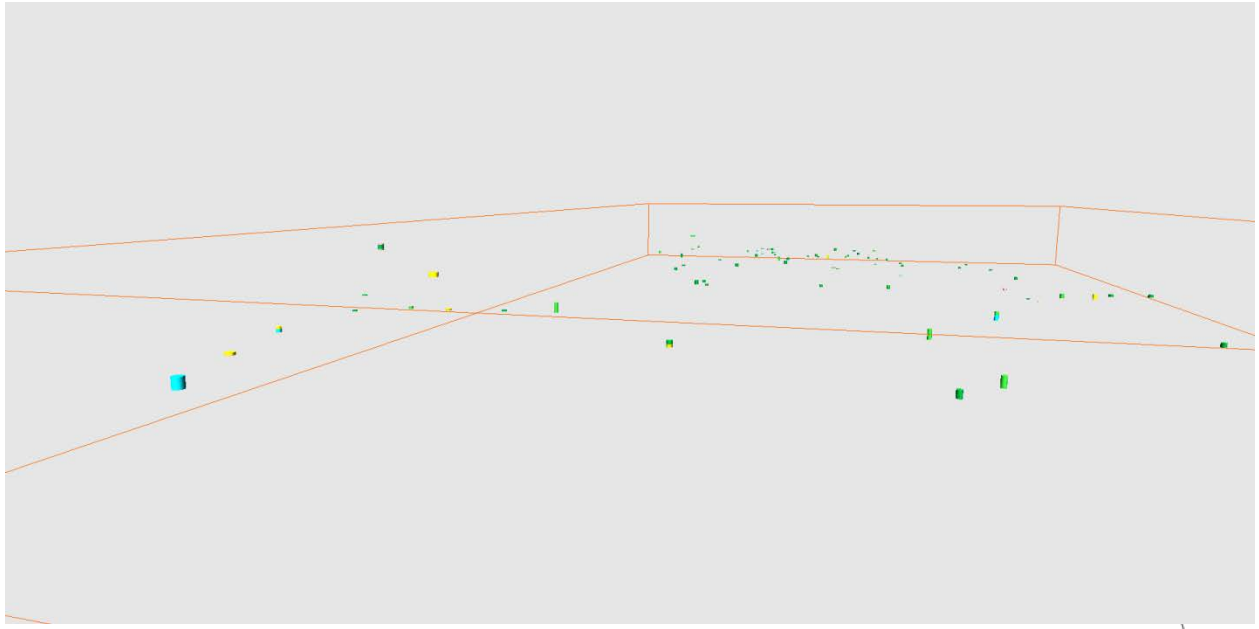


Methodology - 3

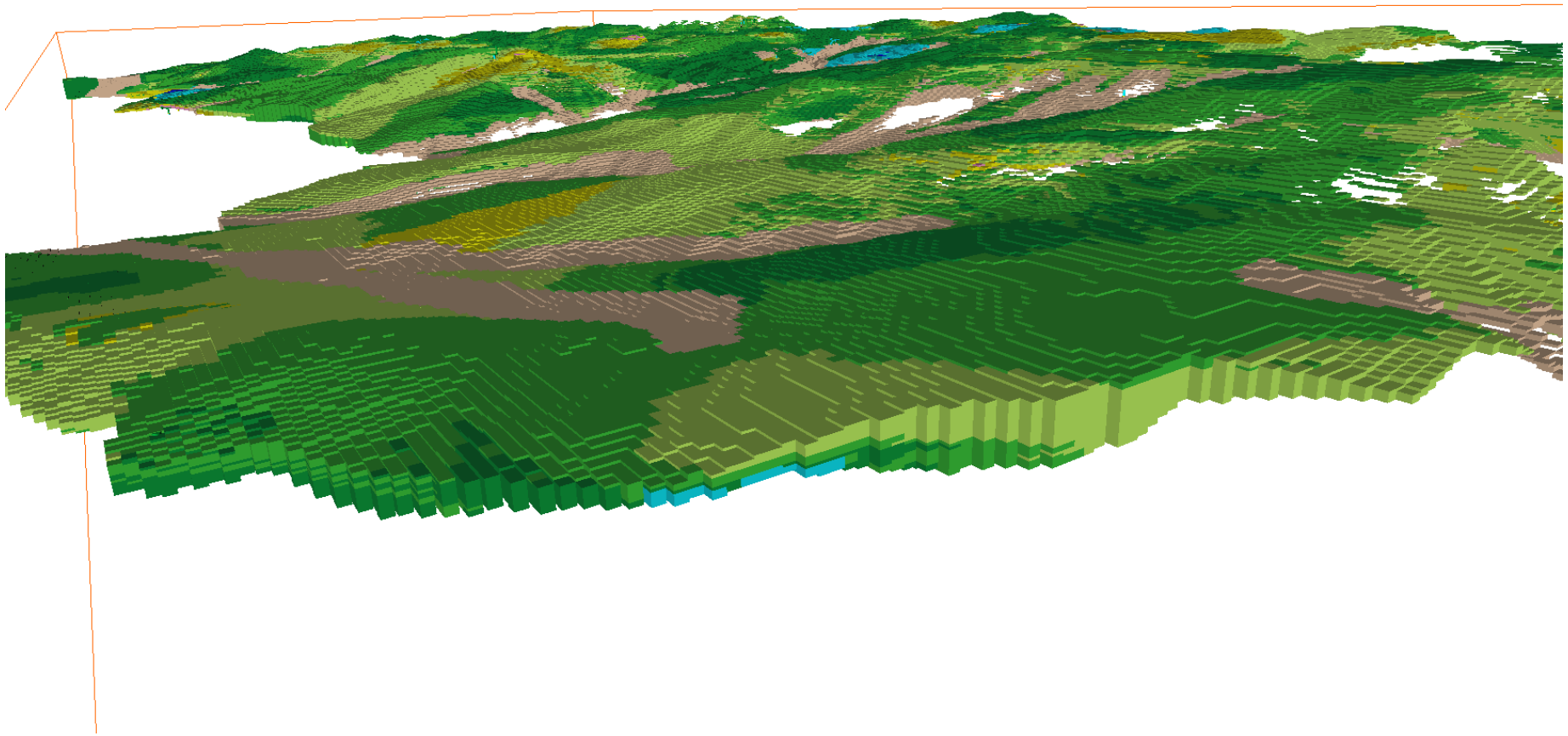
3) Interpolation data points

- Two step:
  - Second: 3D interpolation

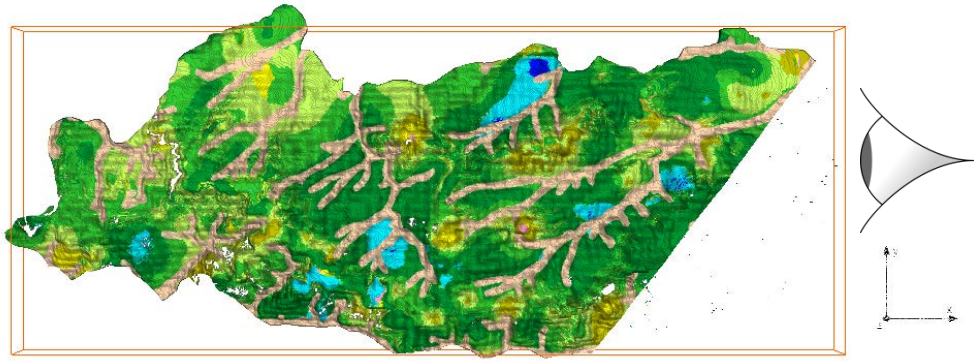
    combining 2D grids + datapoints boreholes

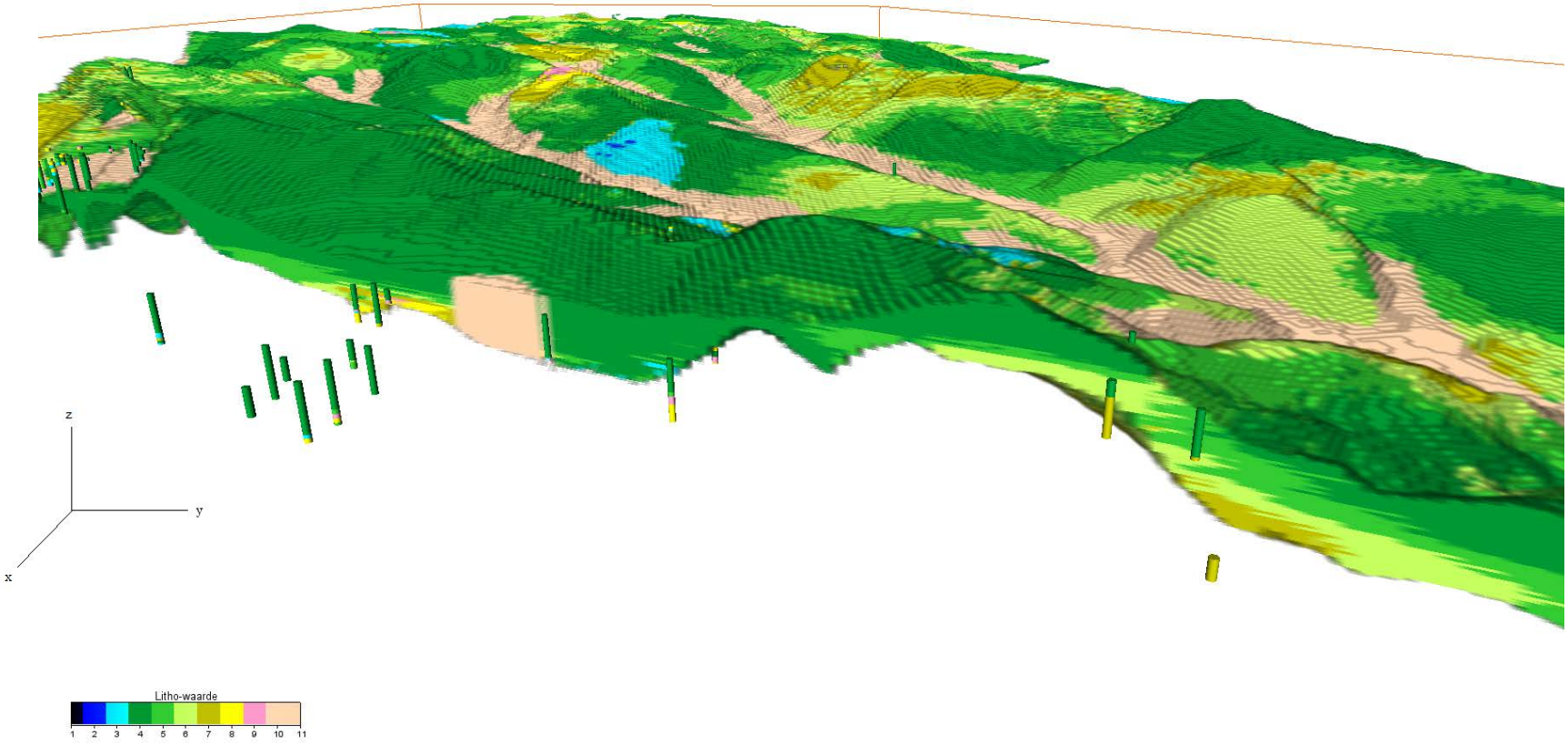


Results - *Example*



Results - *Example*





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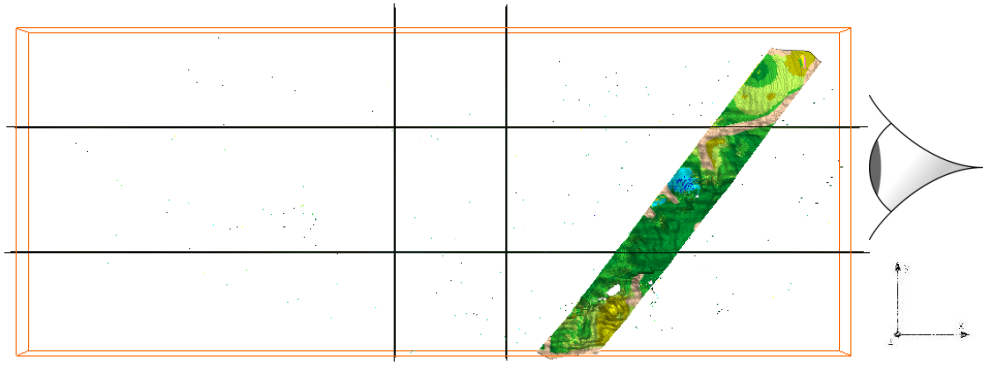
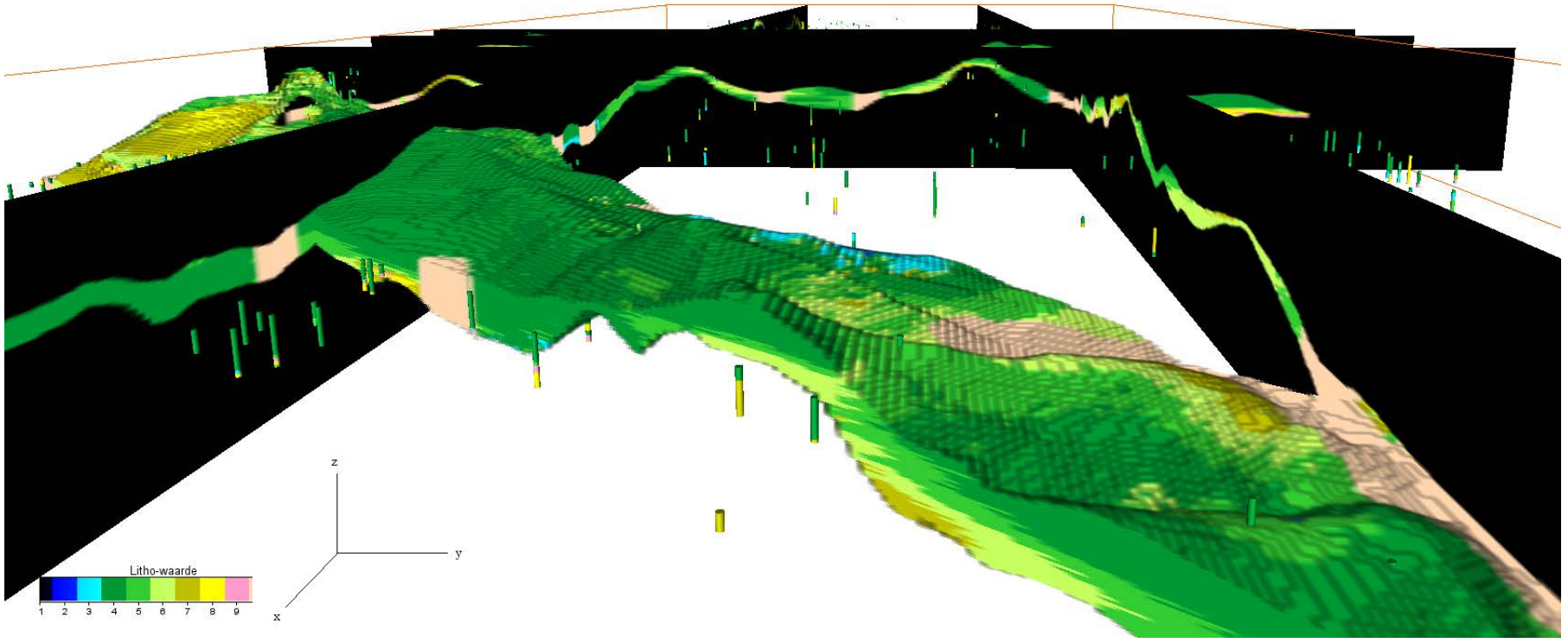
Results - *Example*





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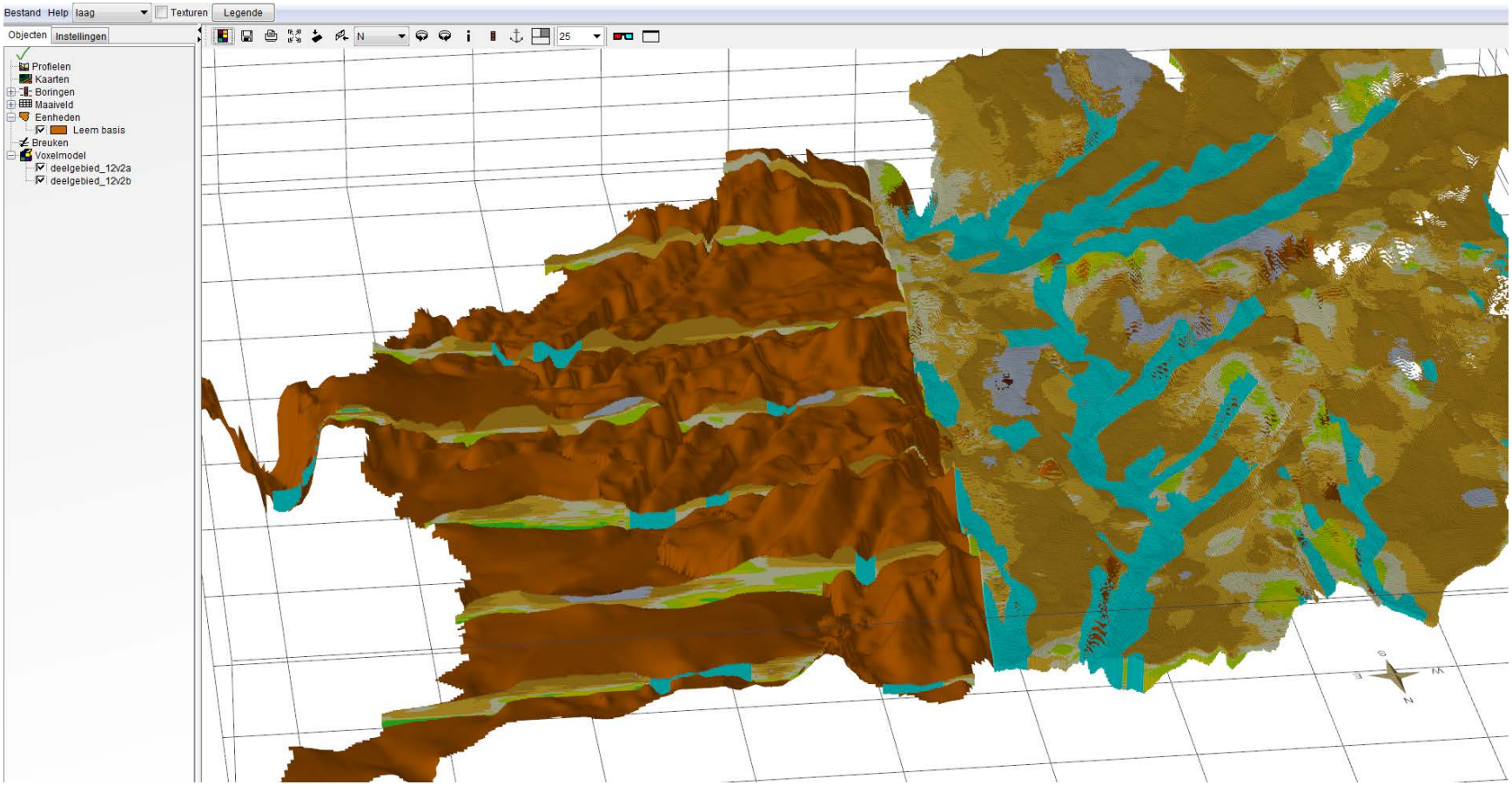
Results – 3D Subsurface Viewer®

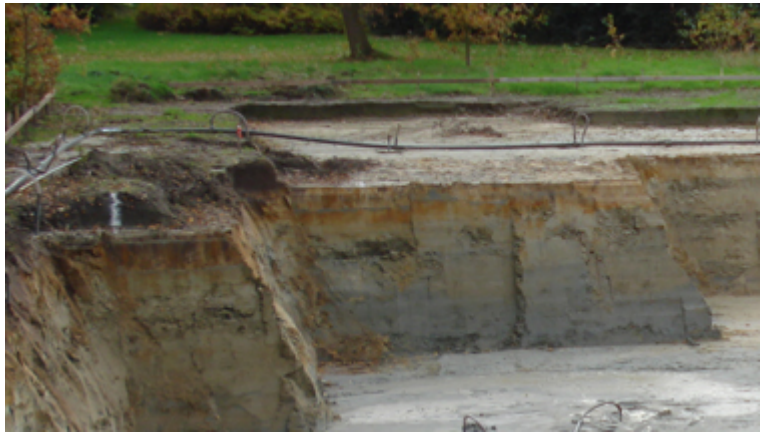


‘Mineral Resource Explorer’

- Why a ‘Mineral Resource Explorer’?
  - user friendly
  - mineral resources policy
  - opportunities
  - mineral extraction industry

- Result

allows users to view 3D data, to do calculations and to combine it with other models and geographical information.



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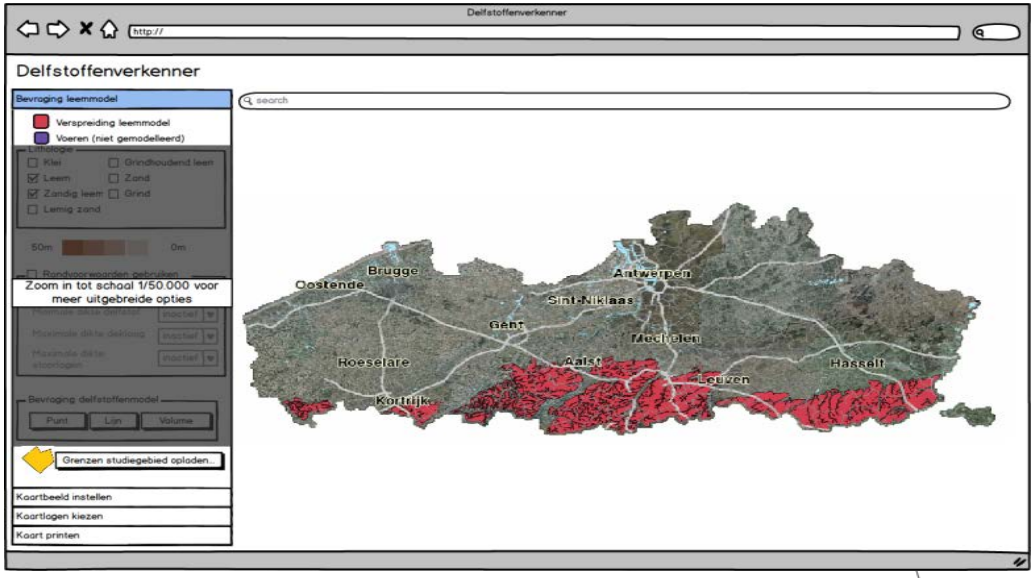
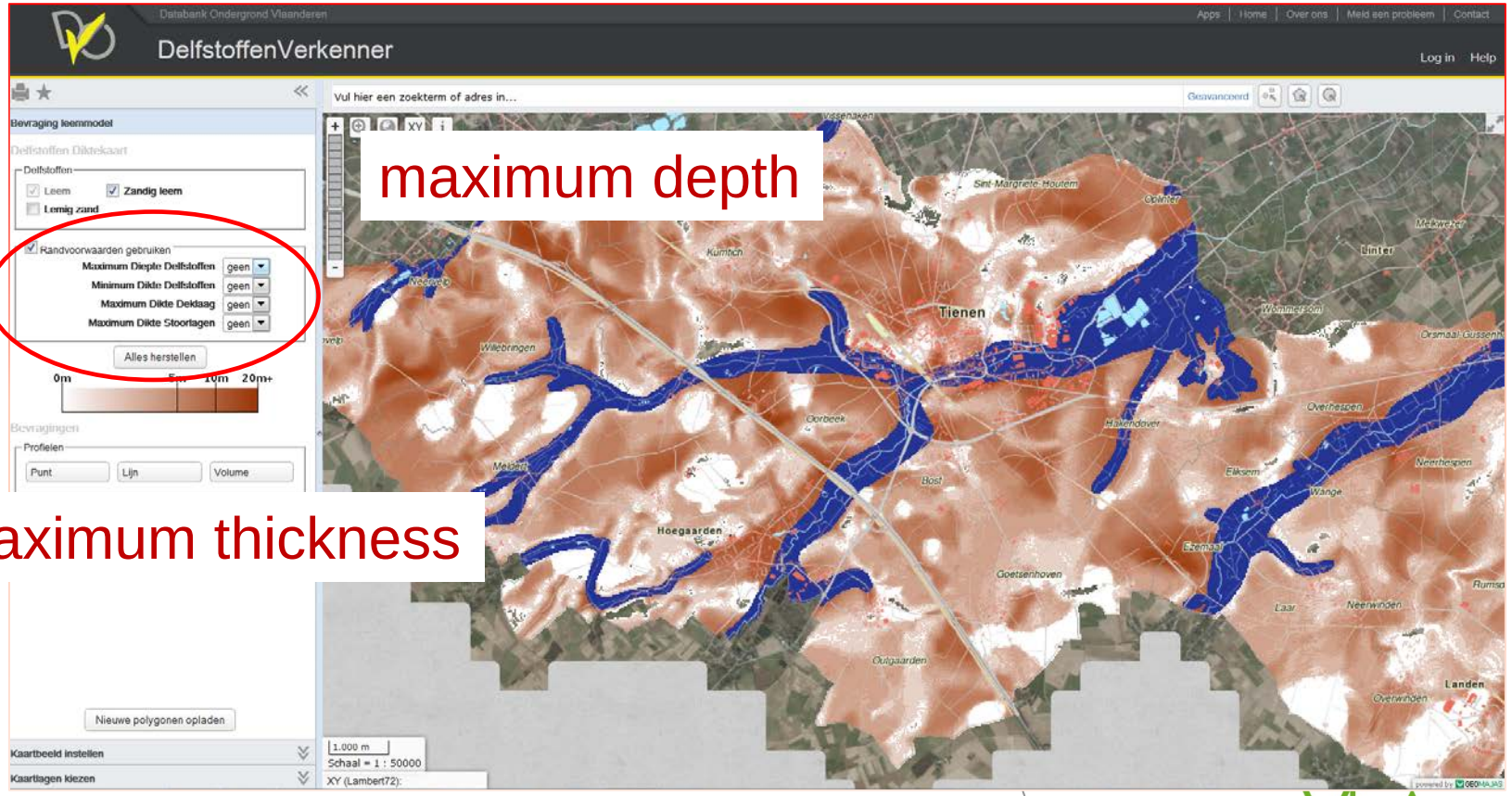
the ‘Mineral Resource Explorer’

- **First** voxel model: Loess deposits
- In the **future** also other voxel models:
  - clay, industrial sand, gravel, …
- Visualizing appearance of the Quaternary loess deposits



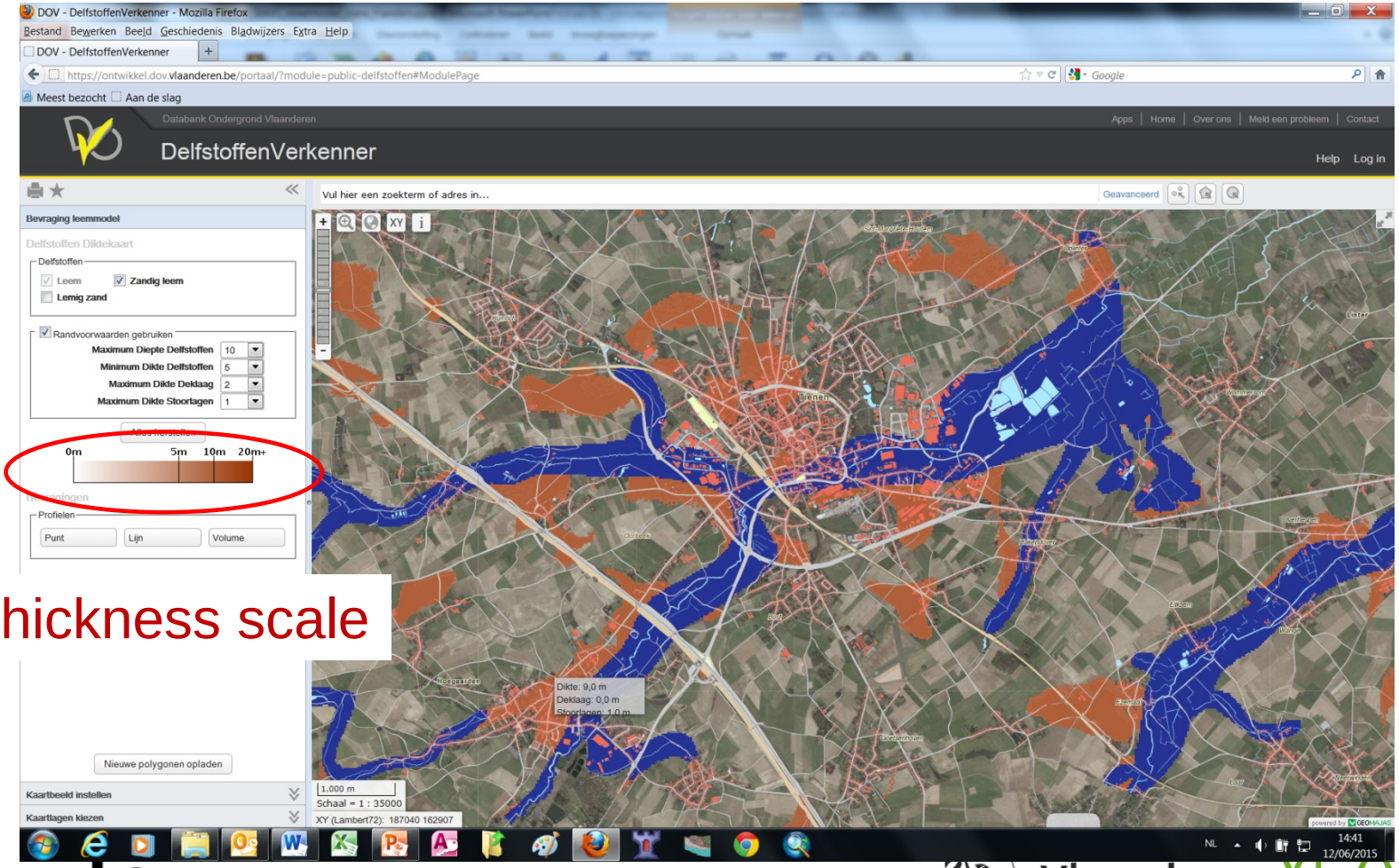
the ‘Mineral Resource Explorer’

» possible to determine the extractable mineral resources based on certain preconditions



the ‘Mineral Resource Explorer’

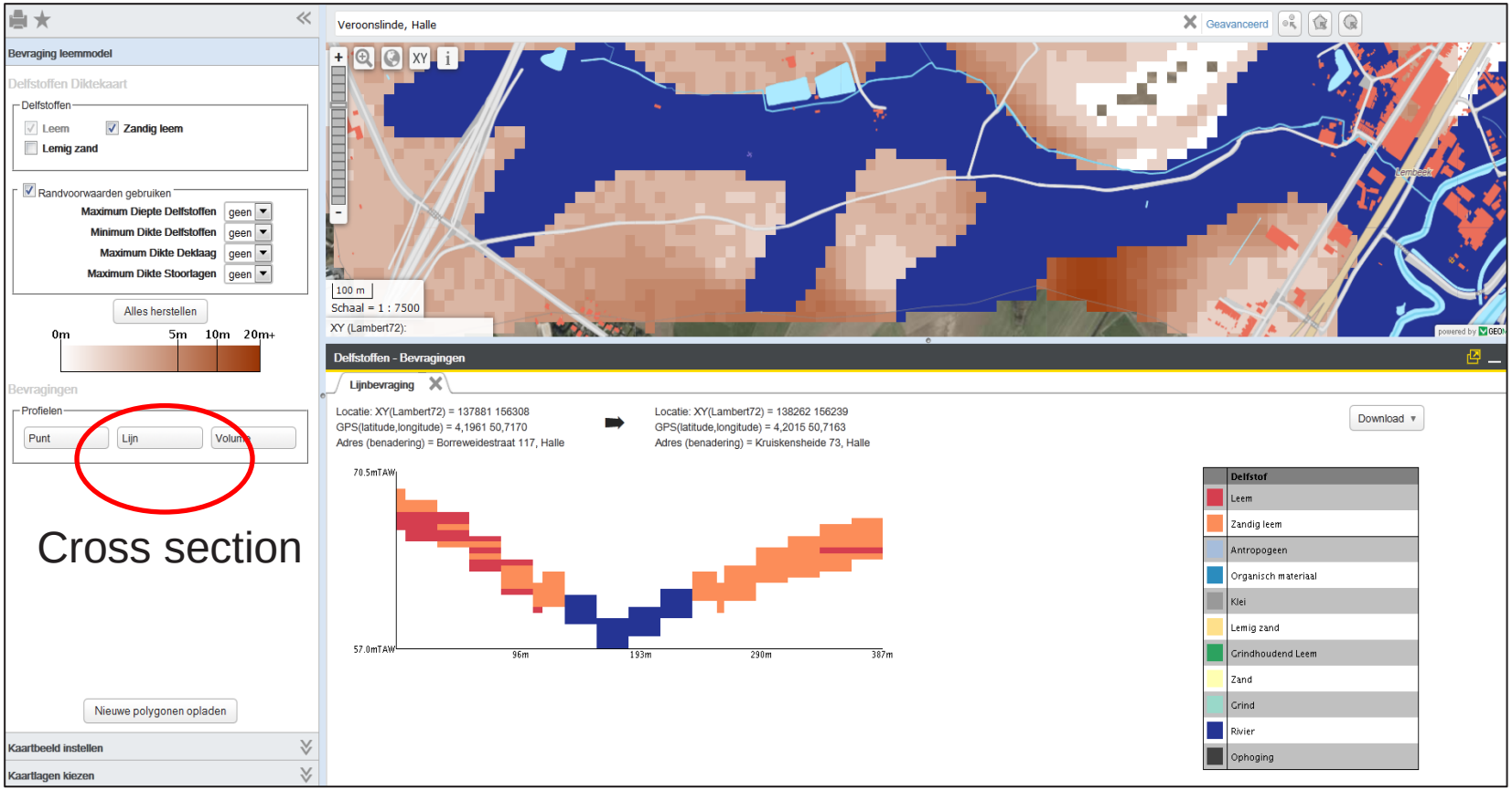
» New ‘extractable’ mineral resource map



Thickness scale

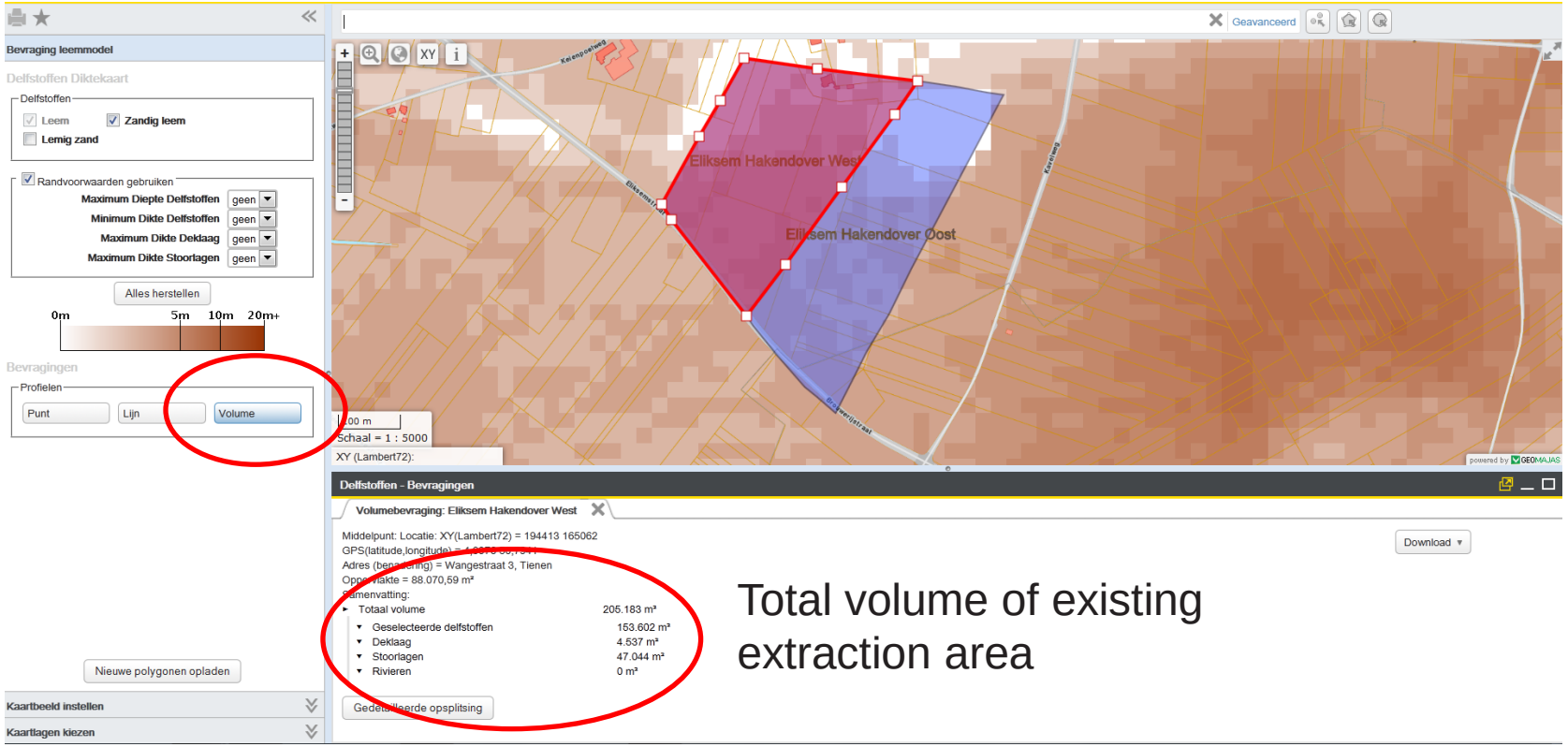
the ‘Mineral Resource Explorer’

» More specific interactions:



the ‘Mineral Resource Explorer’

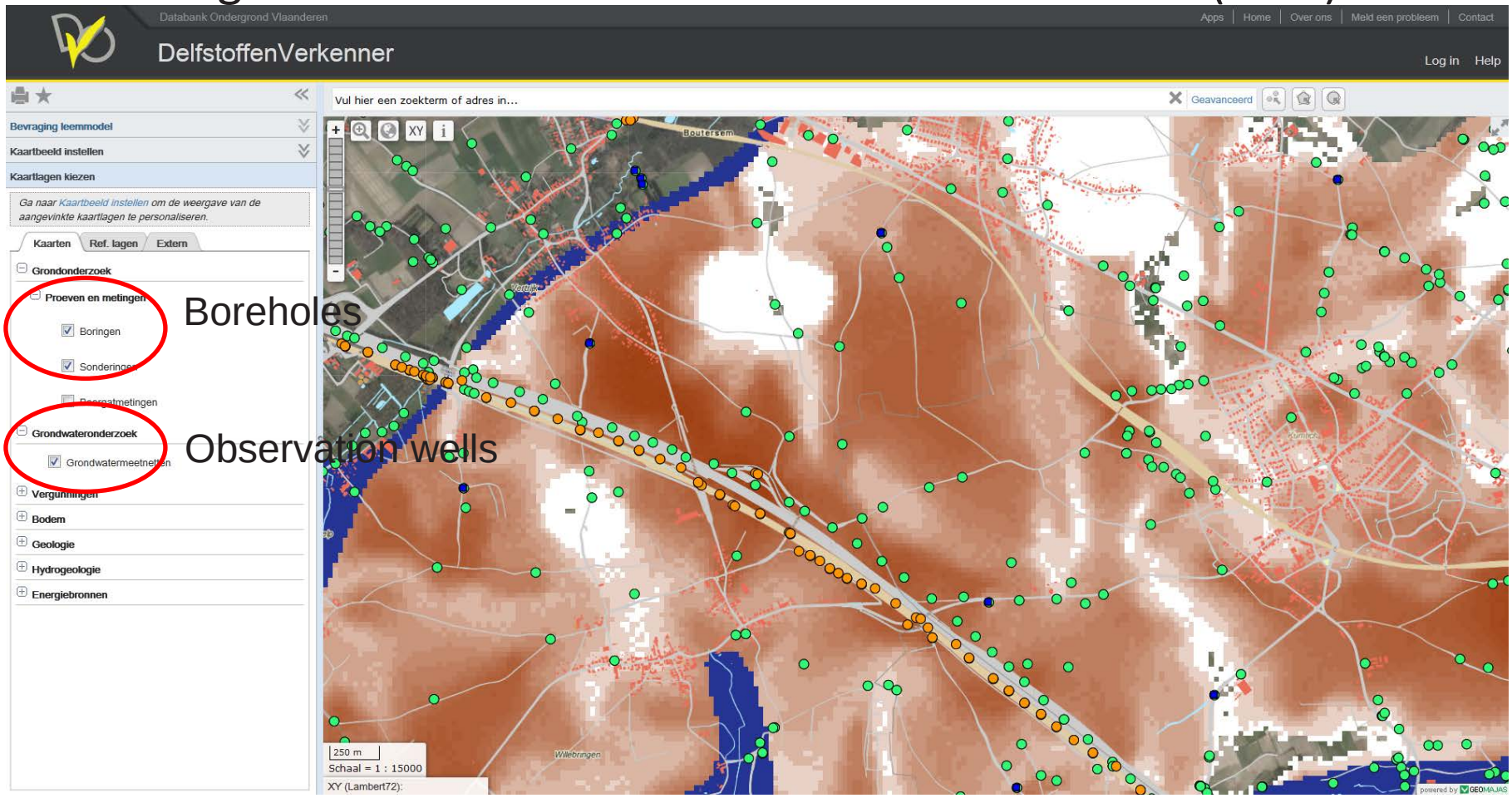
- More functionalities:
  - GIS functionalities and volume calculation



Total volume of existing extraction area

the ‘Mineral Resource Explorer’

» Integration in Flanders´ Soil and Subsoil Database (DOV)



Next steps

- 2016: 2nd voxel model: Sand + Gravel deposits
- Development modelling techniques (different deposits need different approaches)
- Other voxel parameters + combining them?: granular size, stratigraphical information, …
- Dealing with big data volumes!
- Online explorer: dynamic evolution

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Thank you for your attention

Gràcies per la vostra atenció

Gracias por su atención

¿Any questions?

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