Status update on GeoTOP, a 3D voxel model of the Netherlands

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3rd European Meeting on 3D Geological Modelling
Wiesbaden - Germany

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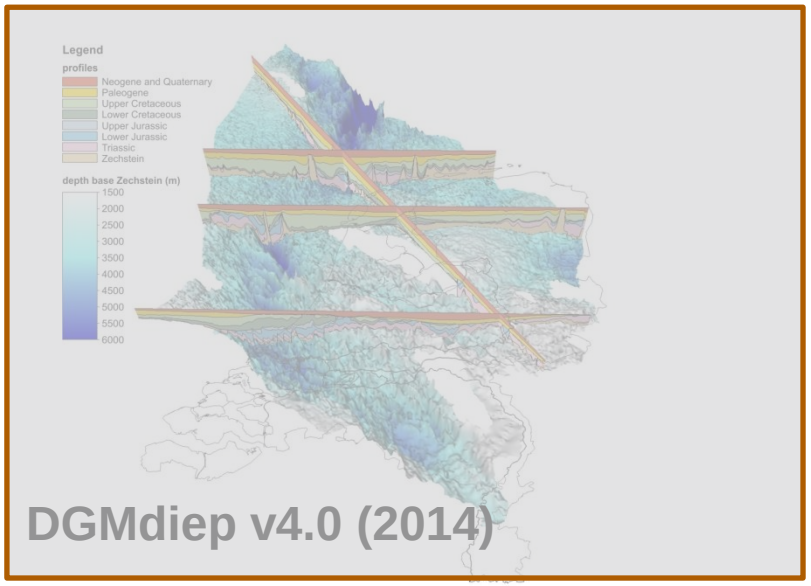
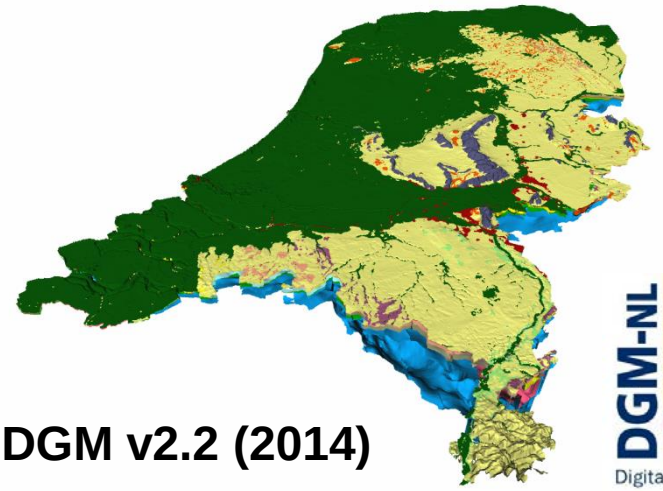
TNO – Geological Survey of the Netherlands

AVAILABLE GEOLOGICAL MODELS

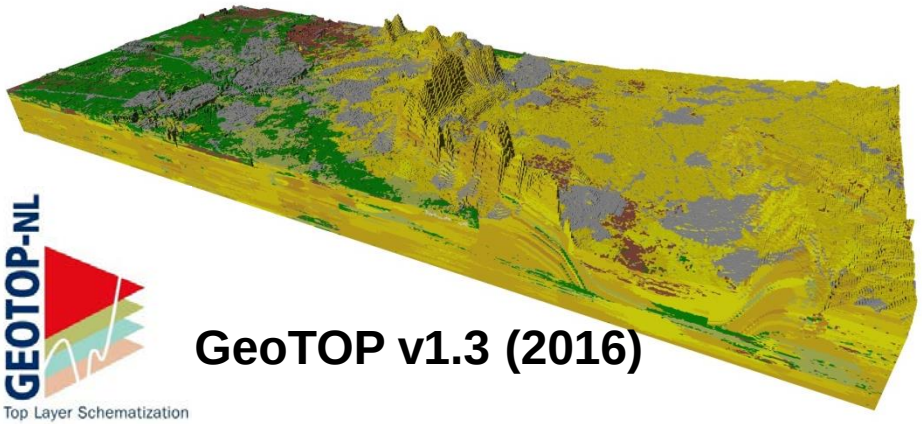


DGMdiep v4.0 (2014)



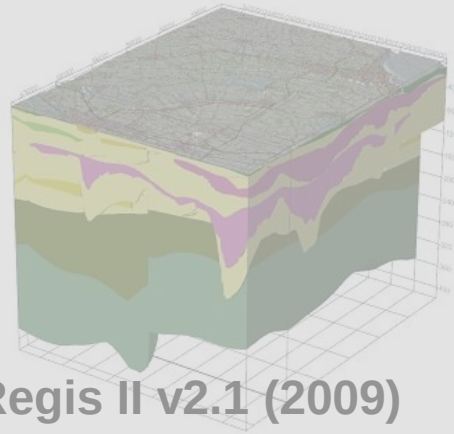
DGM v2.2 (2014)

DGM-NL
Digital Geological Model



GeoTOP v1.3 (2016)

GEOTOP-NL
Top Layer Schematization
DGM+



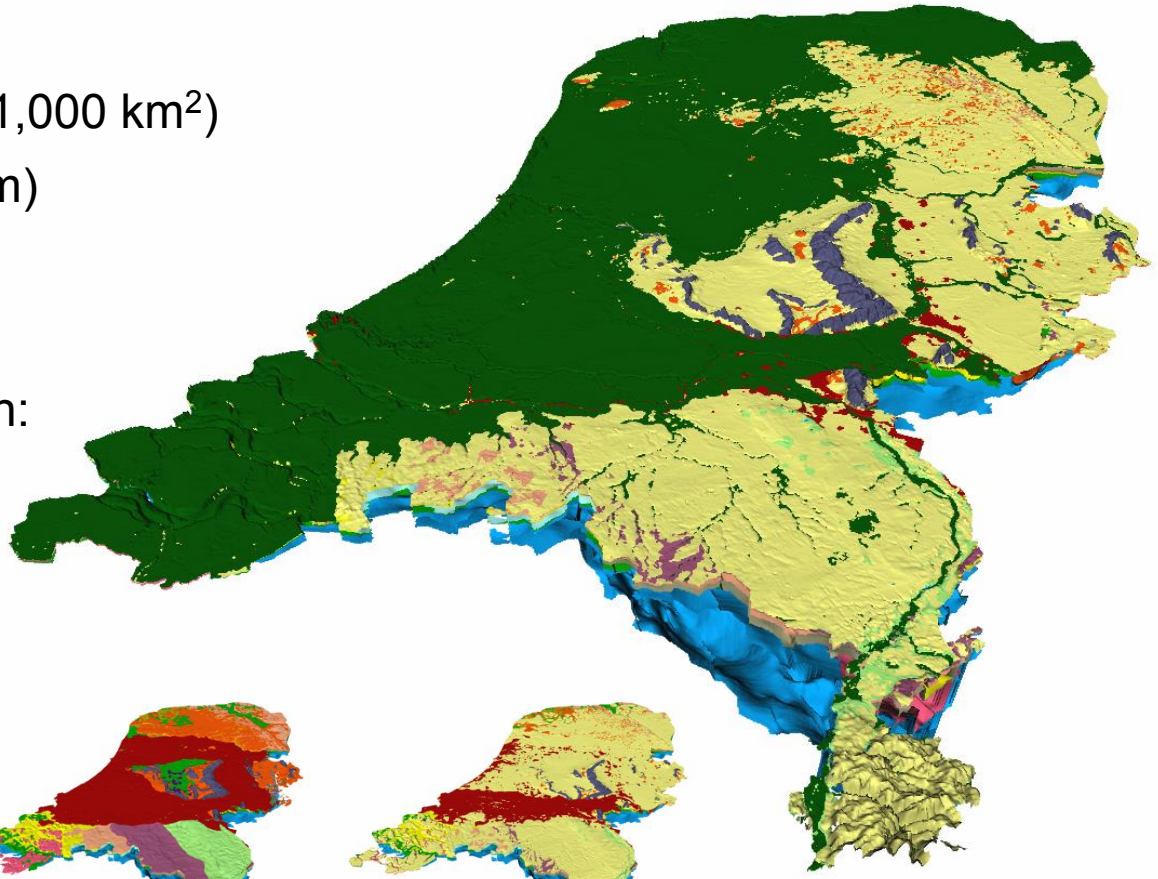
Regis II v2.1 (2009)

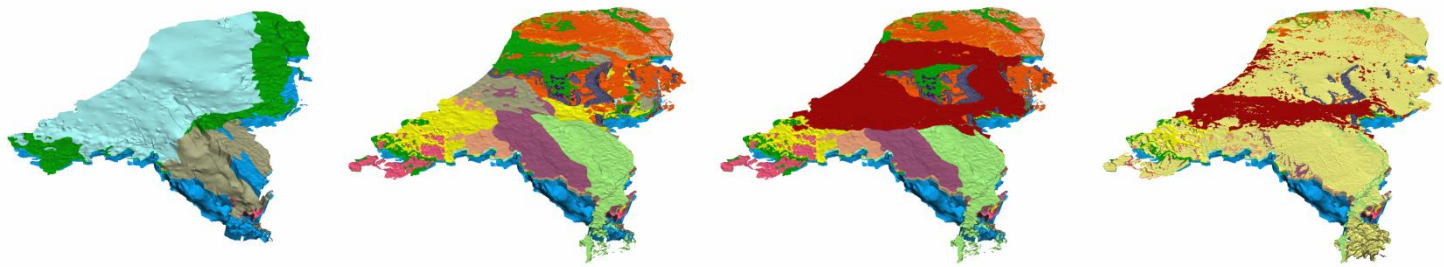
REGIS-NL
Geohydrological Info System

› data, models, viewer software: http://www.dinoloket.nl

DGM – DIGITAL GEOLOGICAL MODEL

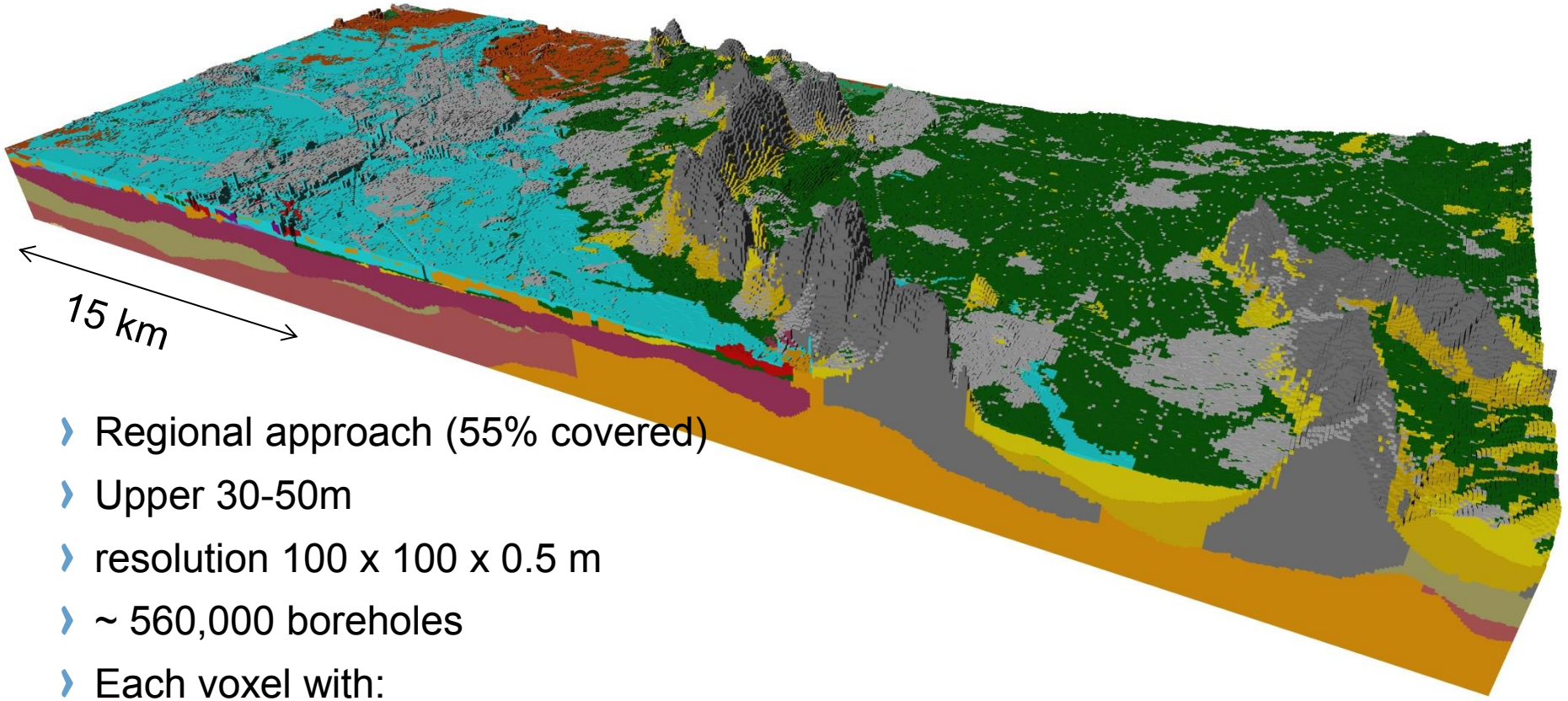
- Layer-based model
- National-wide coverage (~41,000 km^2)
- Shallow subsurface (~ 500 m)
- Resolution 100 x 100 m
- ~ 26,000 boreholes
- Lithostratigraphical units with:
  - top, bottom, thickness
  - uncertainties





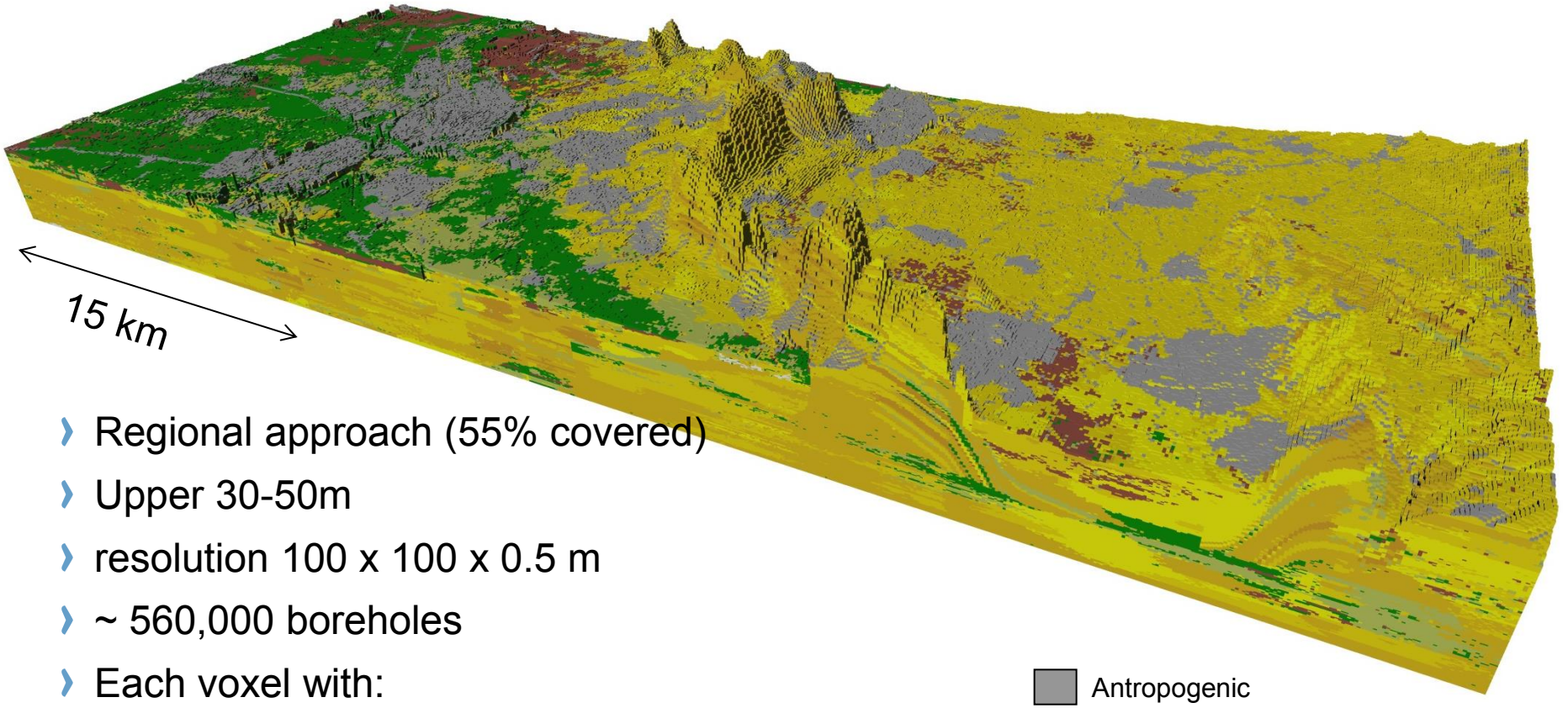
DGM v2.2 (2014)

GEOTOP – STRATIGRAPHICAL UNITS



- Regional approach (55% covered)
- Upper 30-50m
- resolution 100 x 100 x 0.5 m
- ~ 560,000 boreholes
- Each voxel with:
  - Refined lithostratigraphical units, including Holocene sequences

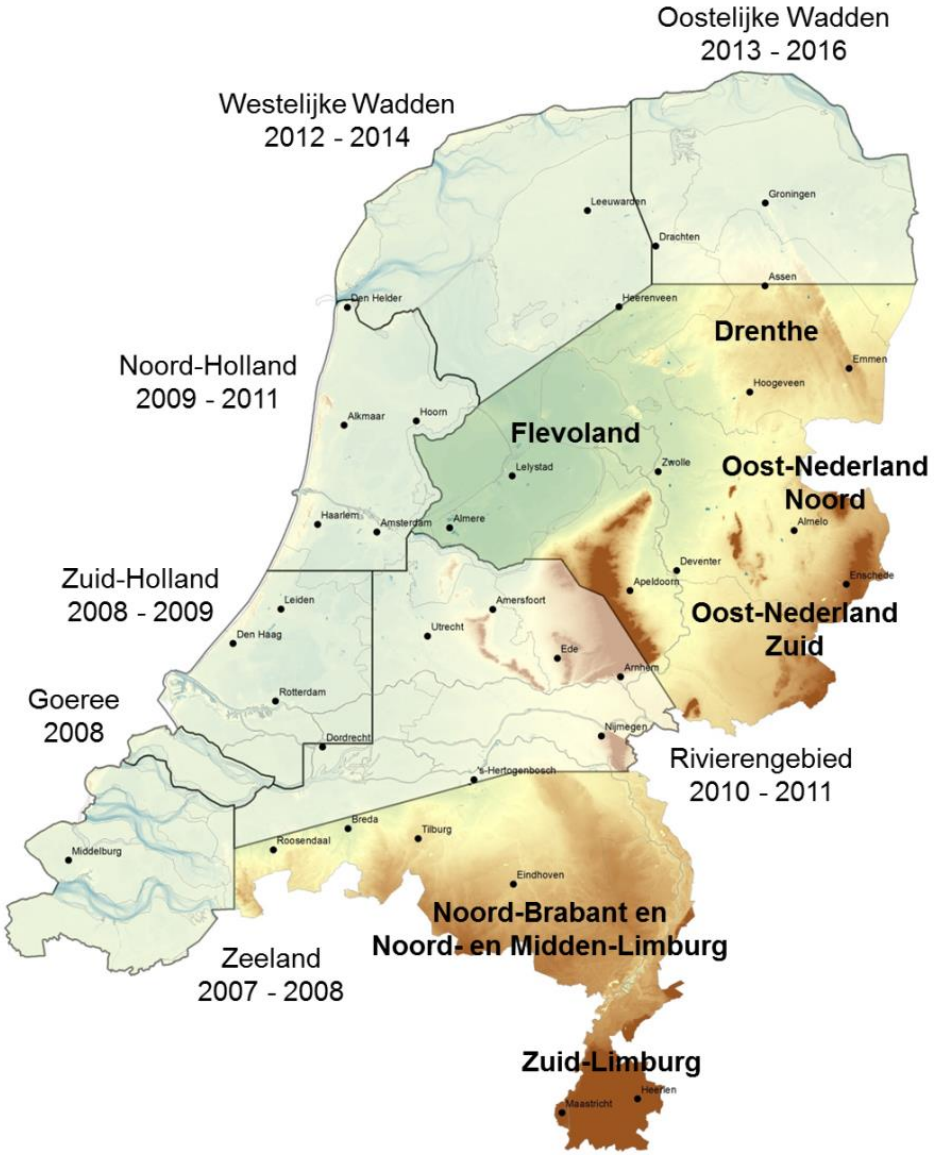
GEOTOP – LITHOCLASSES



- Regional approach (55% covered)
- Upper 30-50m
- resolution 100 x 100 x 0.5 m
- ~ 560,000 boreholes
- Each voxel with:
  - lithology (sand, clay, peat) + probability

STATUS GEOTOP

- GeoTOP v1.3 (~55% coverage)
- 13 regions, 7 publically available
- Next region: Noord-Brabant en Noord- en Midden Limburg



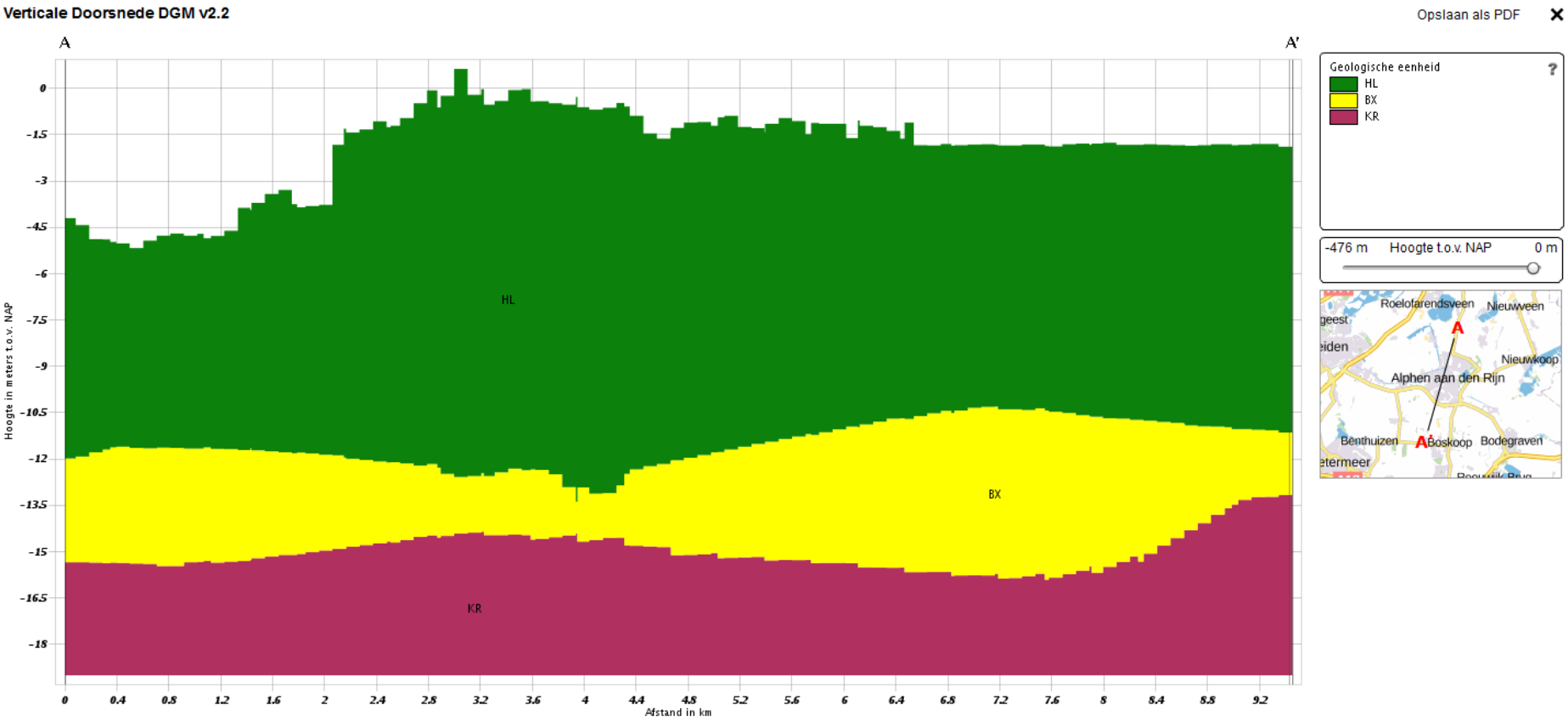
DGM VS. GEOTOP

- **similarities**
  - datamodel (rasters top, bottom, thickness)
  - resolution 100 x 100 m
  - workflow (interpretation, modelling, QC)

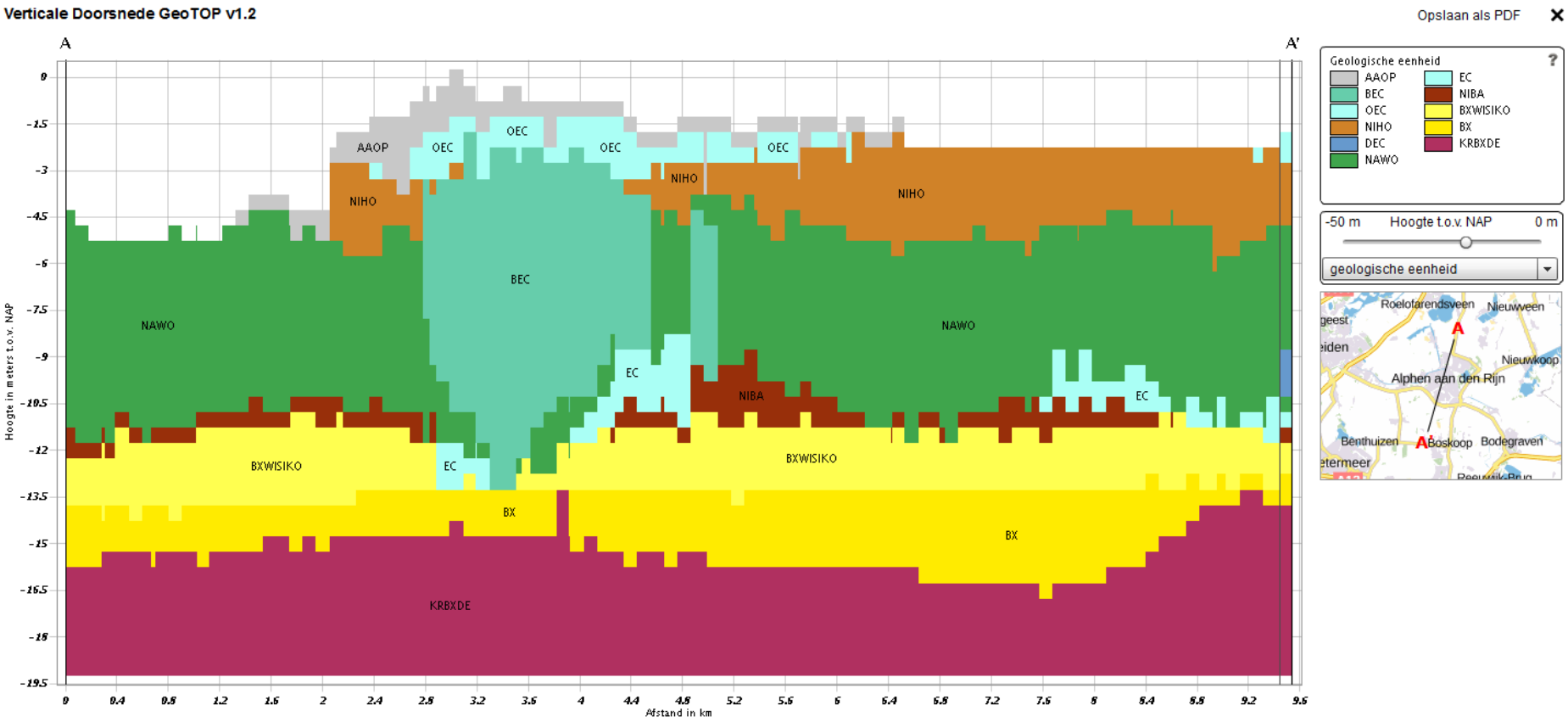
- **differences**
  - number of borehole descriptions (~ 26.000 vs. ~ 560.000)
  - geological units (Holocene: 1 vs. 24)
  - interpretation method (manual vs. automatization)
  - model regions (1 vs. 13)

→ New model directive DGM+: Integrate DGM and GeoTop

MODELLING – DGM



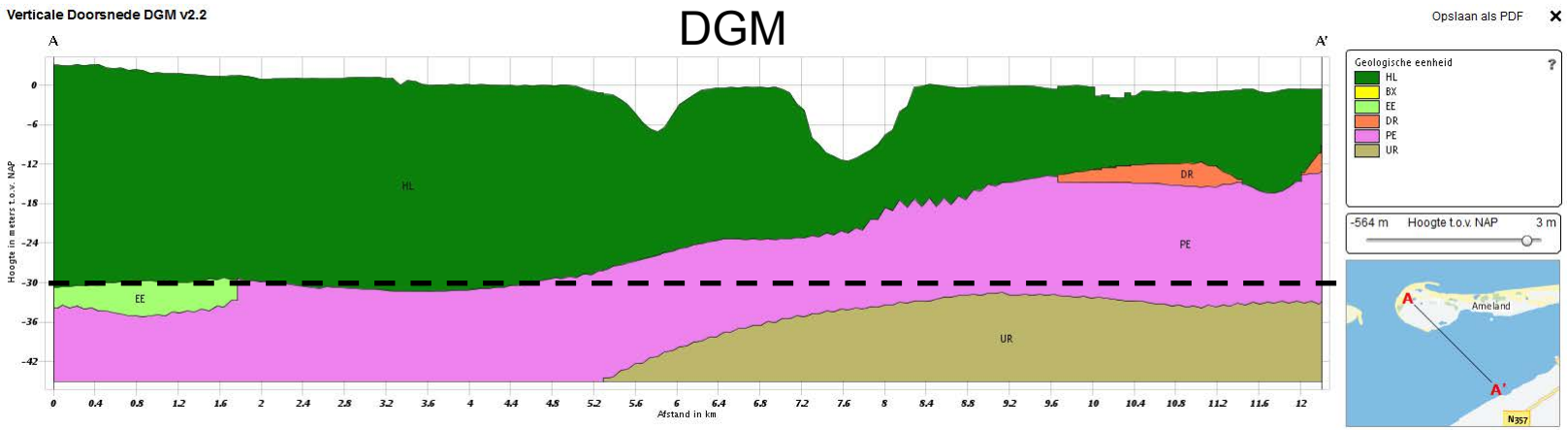
MODELLING – GEOTOP



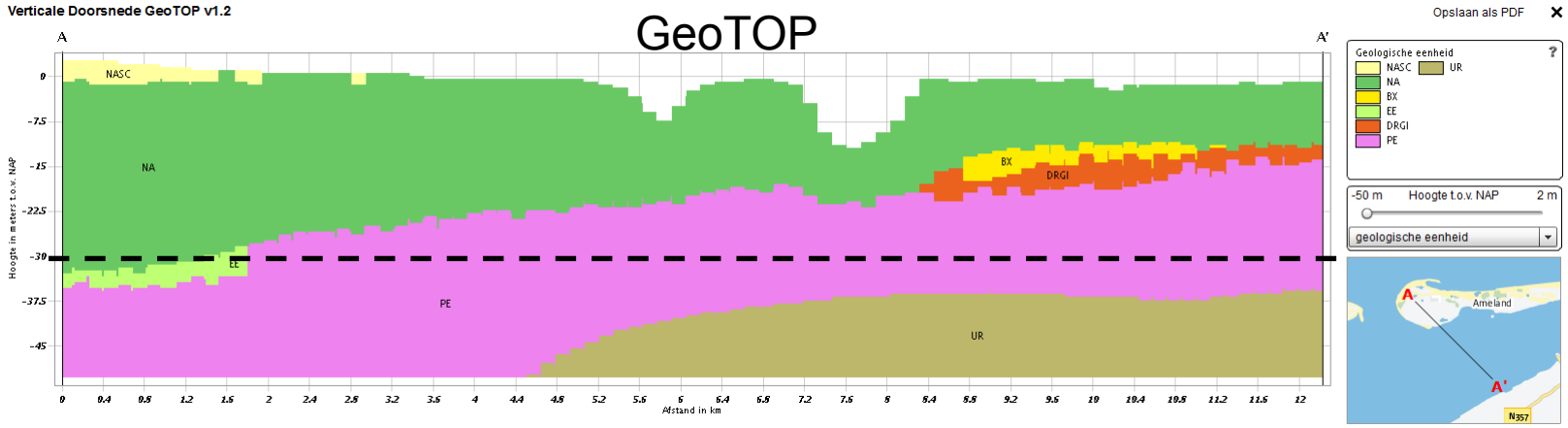
Much more detail in the Holocene sequence

INCONSISTENCIES (1)

DGM



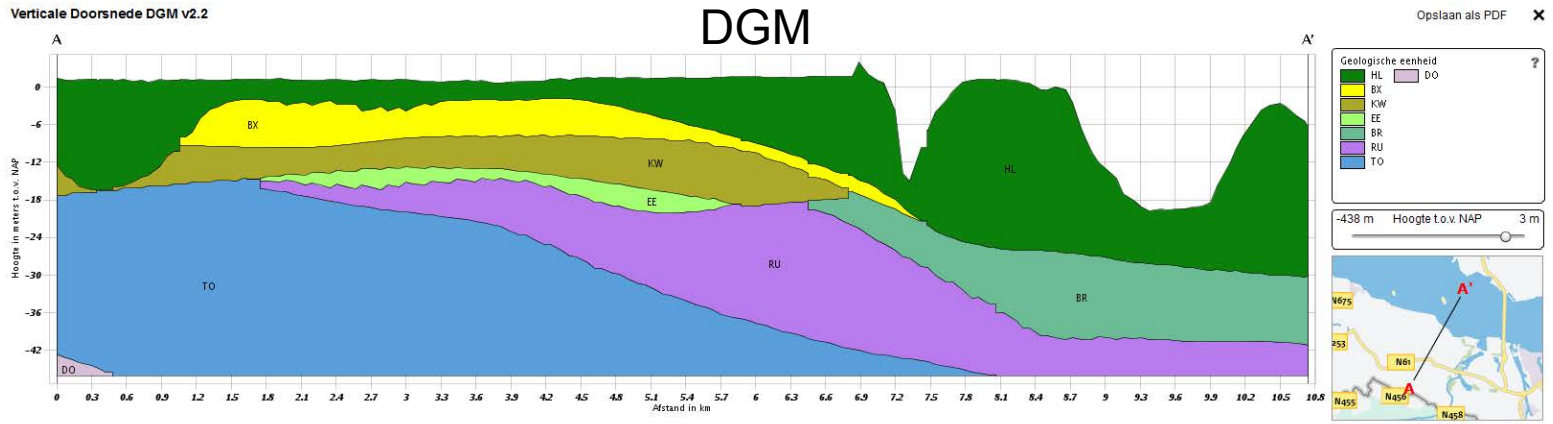
GeoTOP



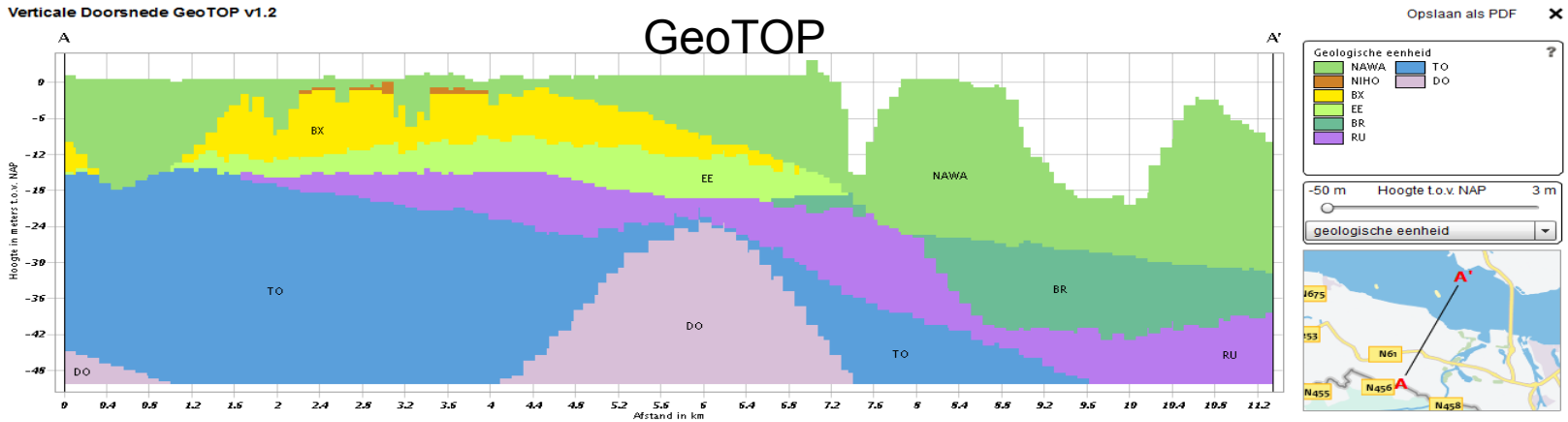
Variation in layer model: number of holes and interpretation method

INCONSISTENCIES (2)

DGM



GeoTOP



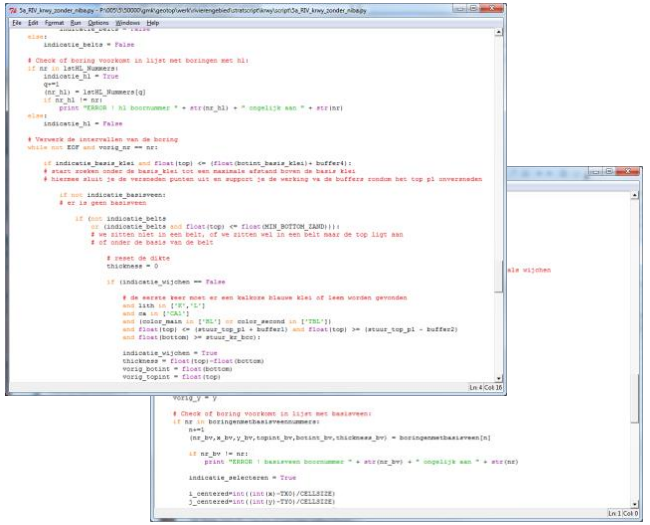
Variation based on newly released DGM model vs old regional GeoTOP model

DGM+: KEY REGISTRY SUBSURFACE DATA

Key registry maintained by the Survey

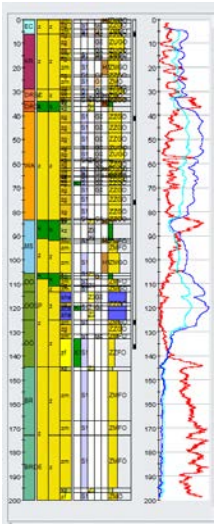
- Expect increase in borehole data
- Demand for periodic updates
- Quality Control (QC)

DGM+: INTERPRETATION BOREHOLE DESCRIPTIONS



- **Automatic interpretation**: ~560,000 boreholes
  - Holocene sequence (24 units)
  - Some Pleistocene Members and Beds
  - Possible other units (research in progress)

  → Need distinct lithological contrast



- **Manual interpretation**: ~26,000 boreholes
  - Pleistocene and older units = DGM v2.2 dataset
  - Define more sub-units (research in progress)
  - Extend DGM dataset (research in progress)

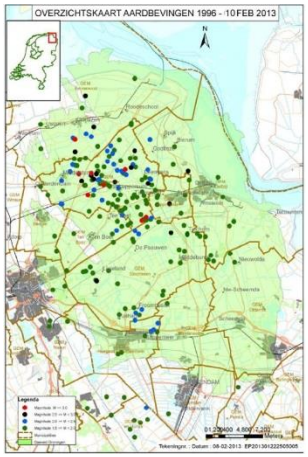
  → Improve deeper part layer model

SUMMARY DGM+

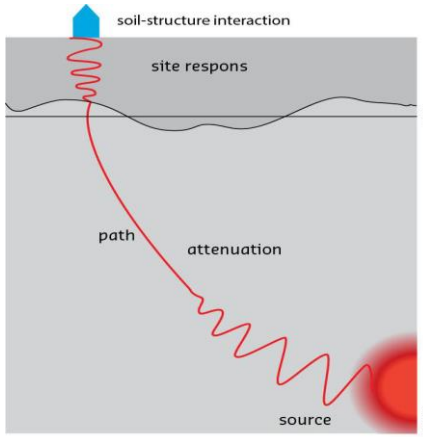
- **DGM+** = integrated layer-based model of GeoTOP and DGM:
  - One nation-wide layer-based model for shallow subsurface down to 500m
  - More detailed and reliable
  - No inconsistencies
  - Reproducible workflow
  - Manageable for consistent periodic updates

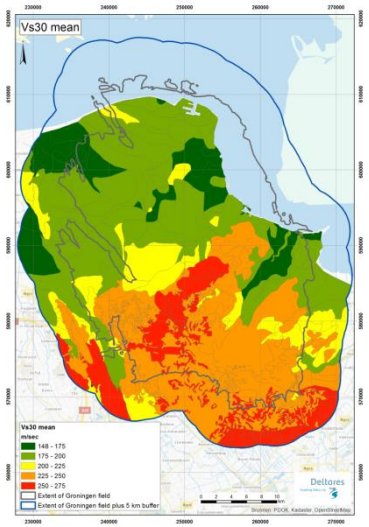
→ More applications possible for end-users.

EXAMPLE: PREDICTION MAPS INDUCED SEISMICITY



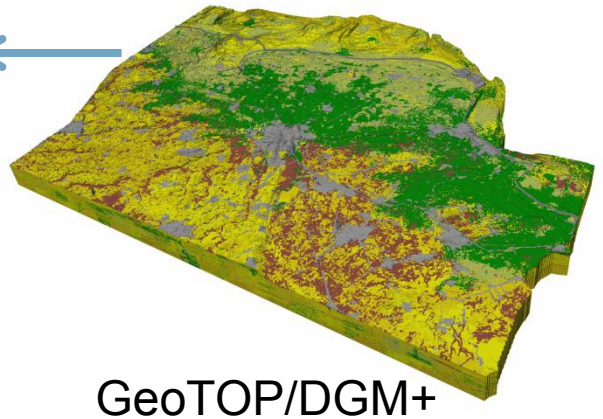
Earthquakes
1963-2013





Risk map

60 Seismic CPT's + statistics:
→ Derive shear wave velocity Vs per voxel and Vs_{30} per voxelstack



GeoTOP/DGM+


THANK YOU!
TNO
innovation
for life