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Urban geology and three-dimensional (3D) city models: (it could be) a symbiotic relationship

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1) *Hessian Agency for Nature Conservation, Environment and Geology*
2) *Technical University of Darmstadt*

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3D city models are state of the art – Kassel 3D

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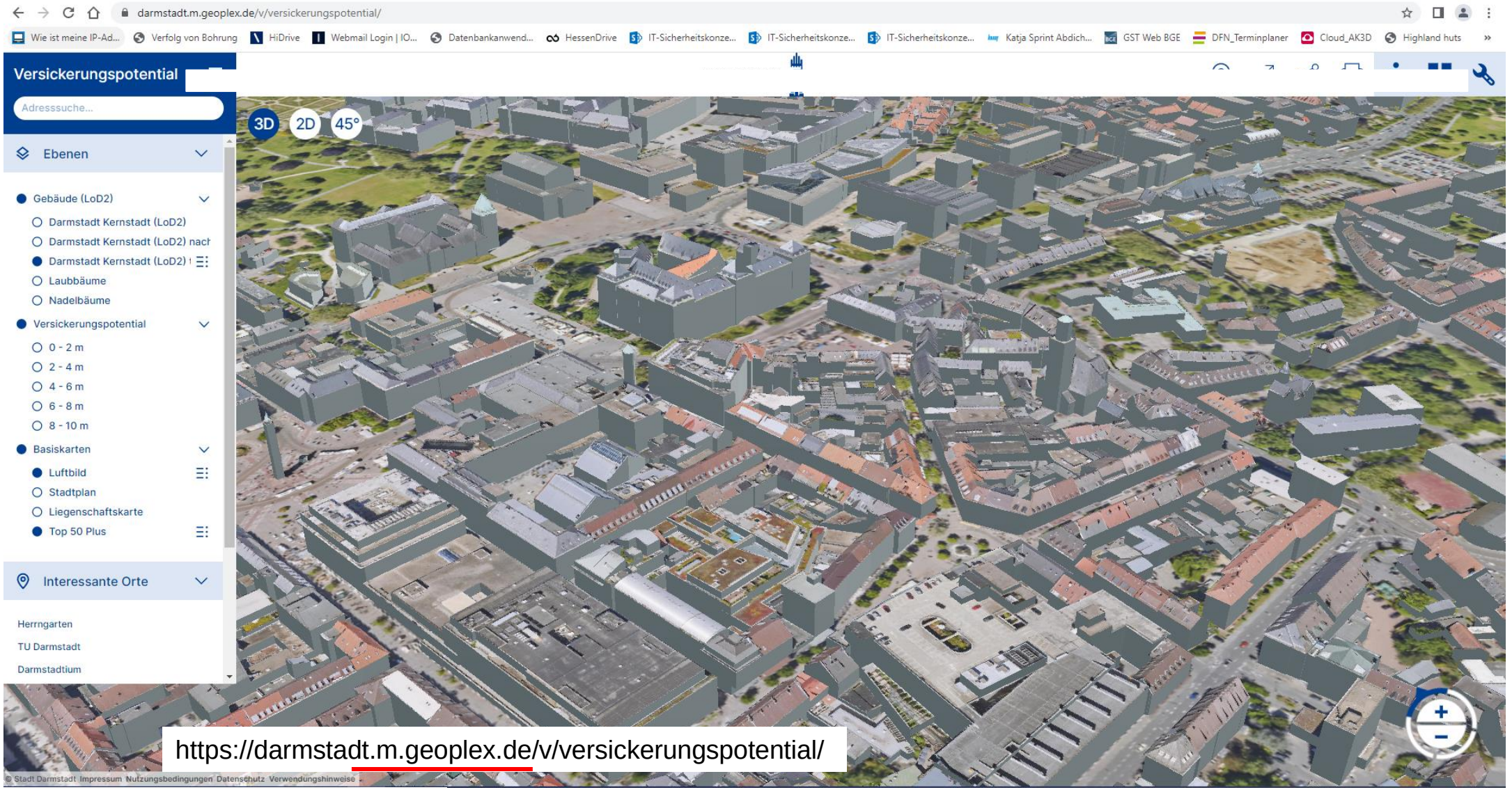
3D city models are state of the art – Kassel 3D



https://darmstadt.m.geoplex.de/v/versickerungspotential/

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3D city models are state of the art – Kassel 3D

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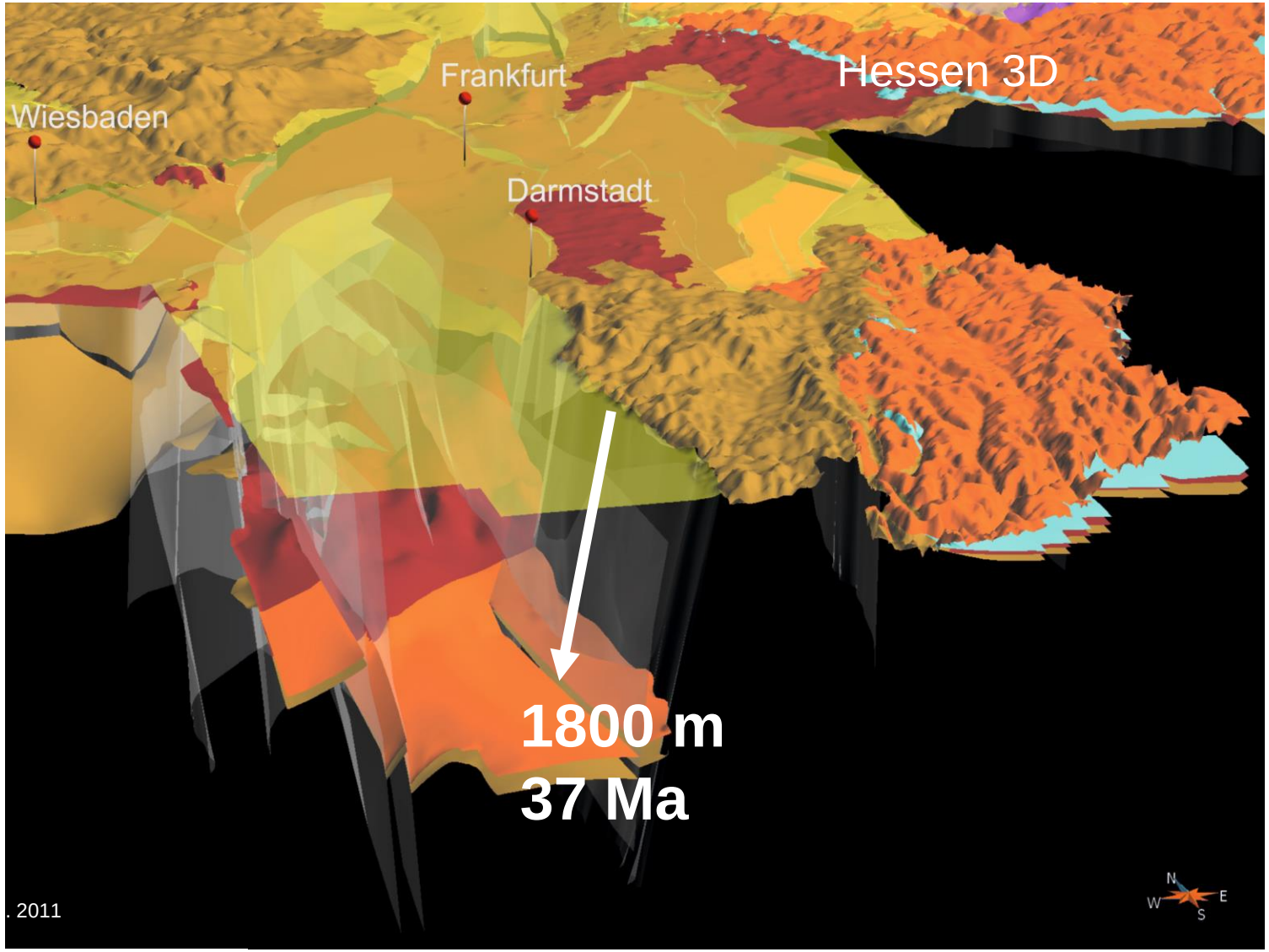
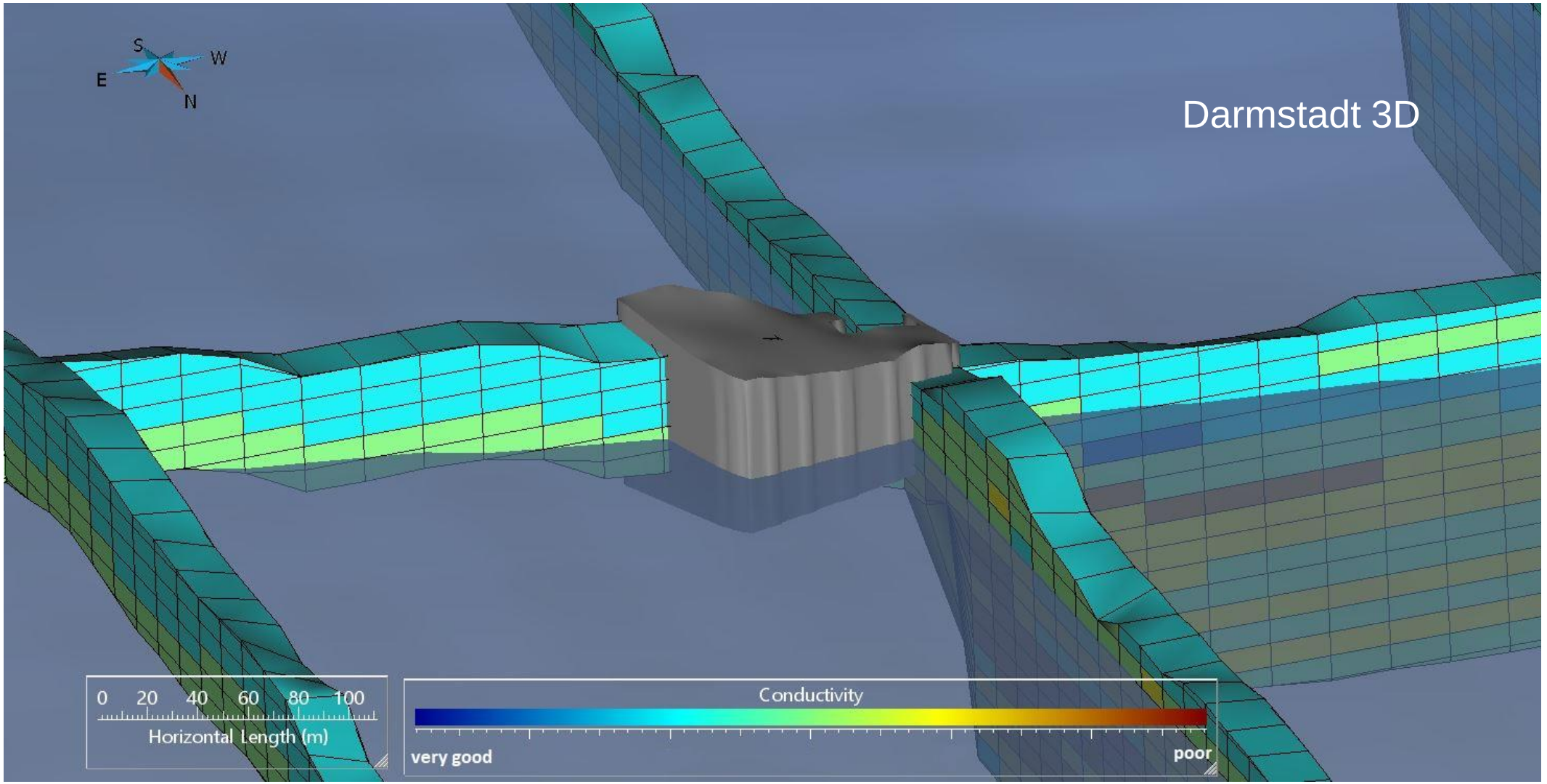
And so is geological 3D modelling …. isolated



And so is geological 3D modelling …. .and integrated



But why don‘t we see them together that often?

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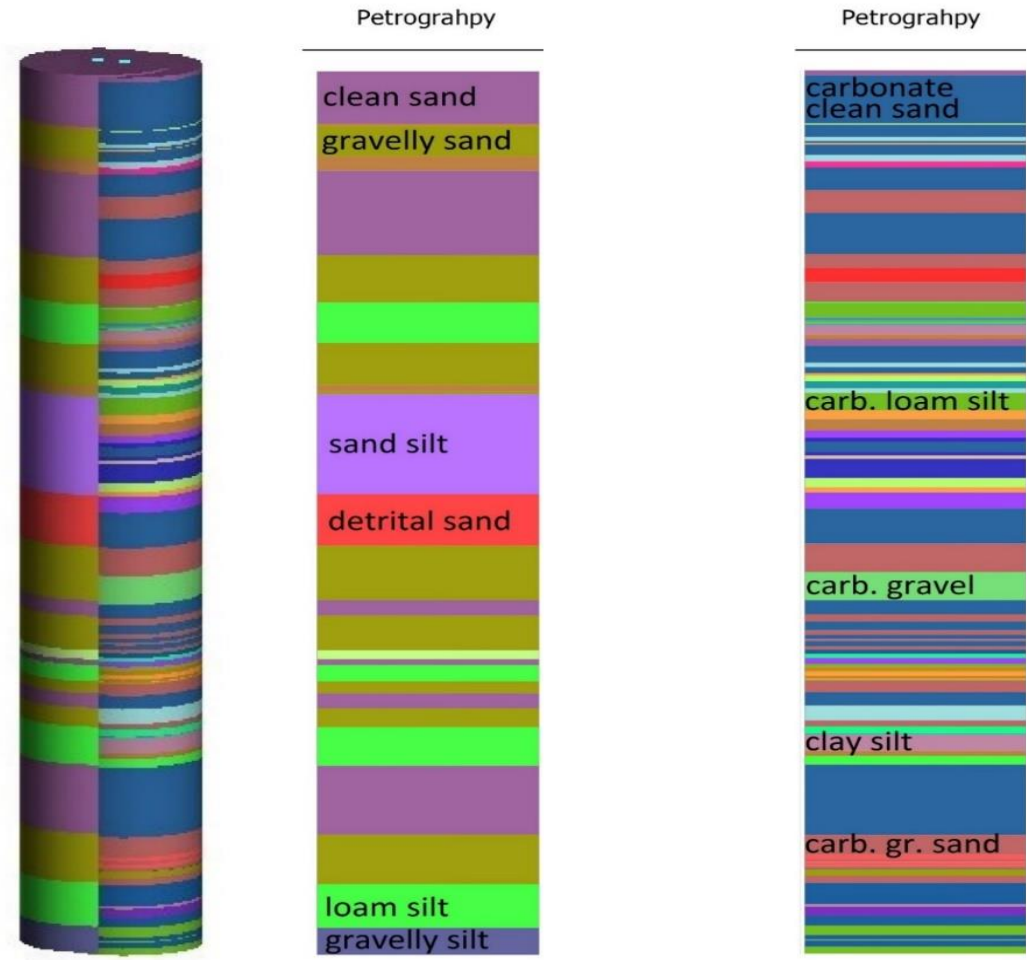
1) Geological semantics are often too complex and heterogenous



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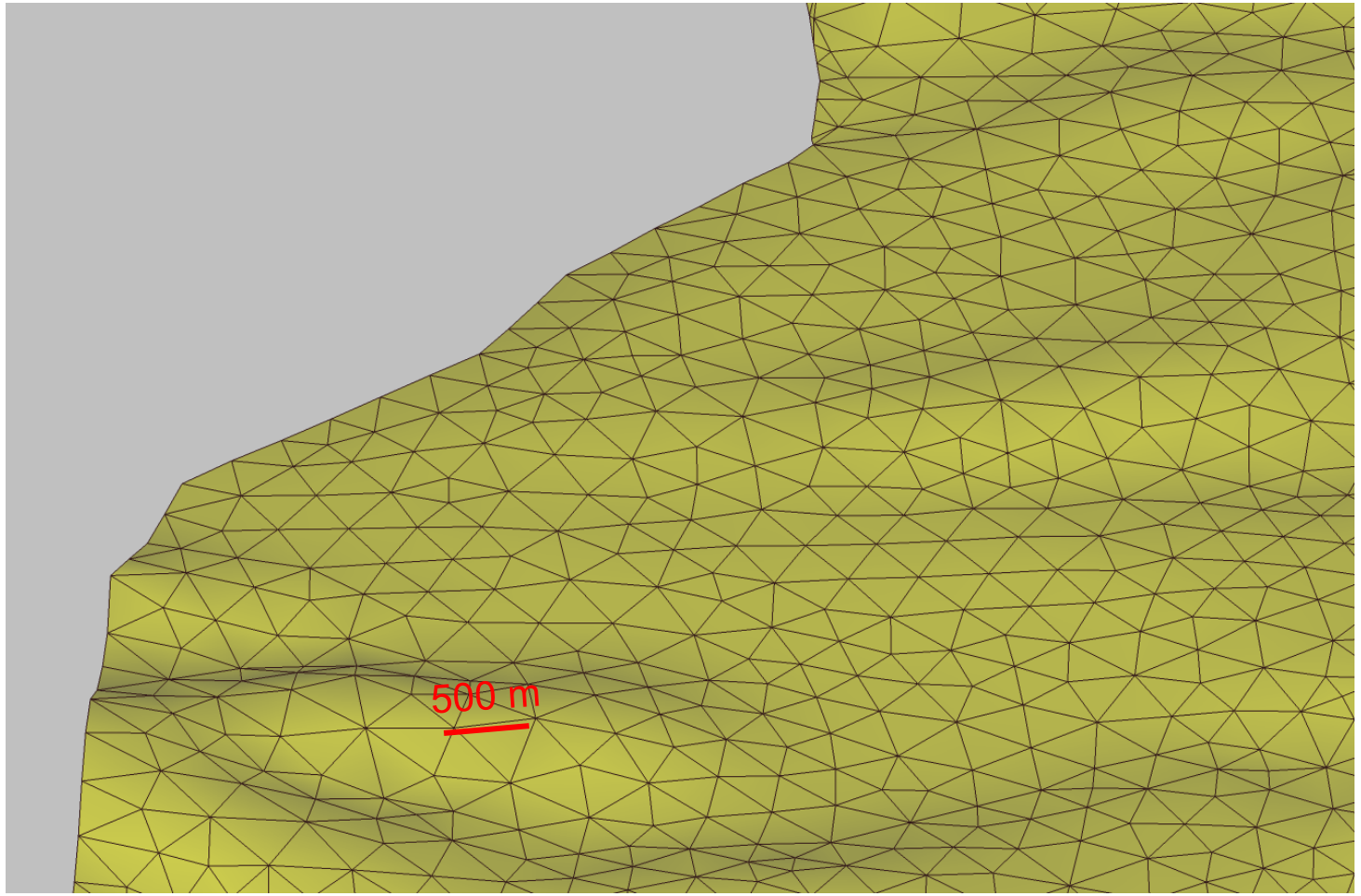
But why don‘t we see them together that often?

1) Geological semantic often is too complex and heterogenous

2) Geological content often does not have the required resolution



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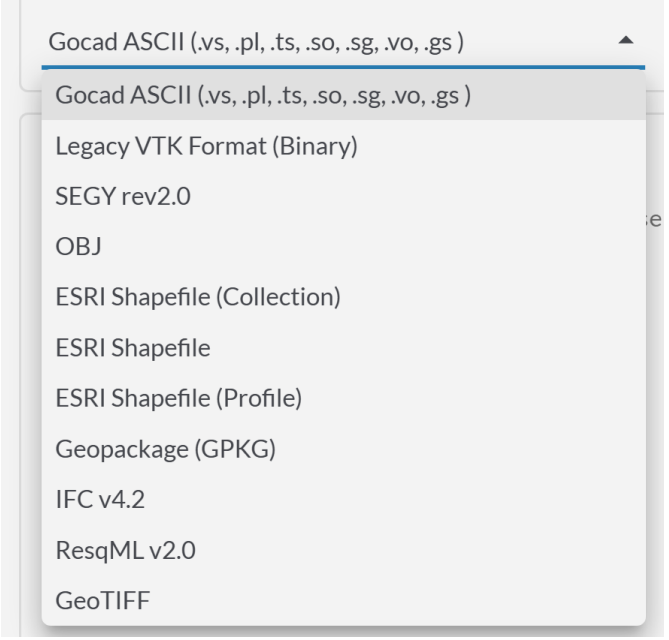
But why don‘t we see them together that often?

1) Geological semantic often is too complex and heterogenous

2) Geological content often does not have the needed resolution

3) Geological 3D-content usually is not interoperable

- Common 3D city model platforms do not support geological data formats
- Interfaces for integration are rarely available, if at all



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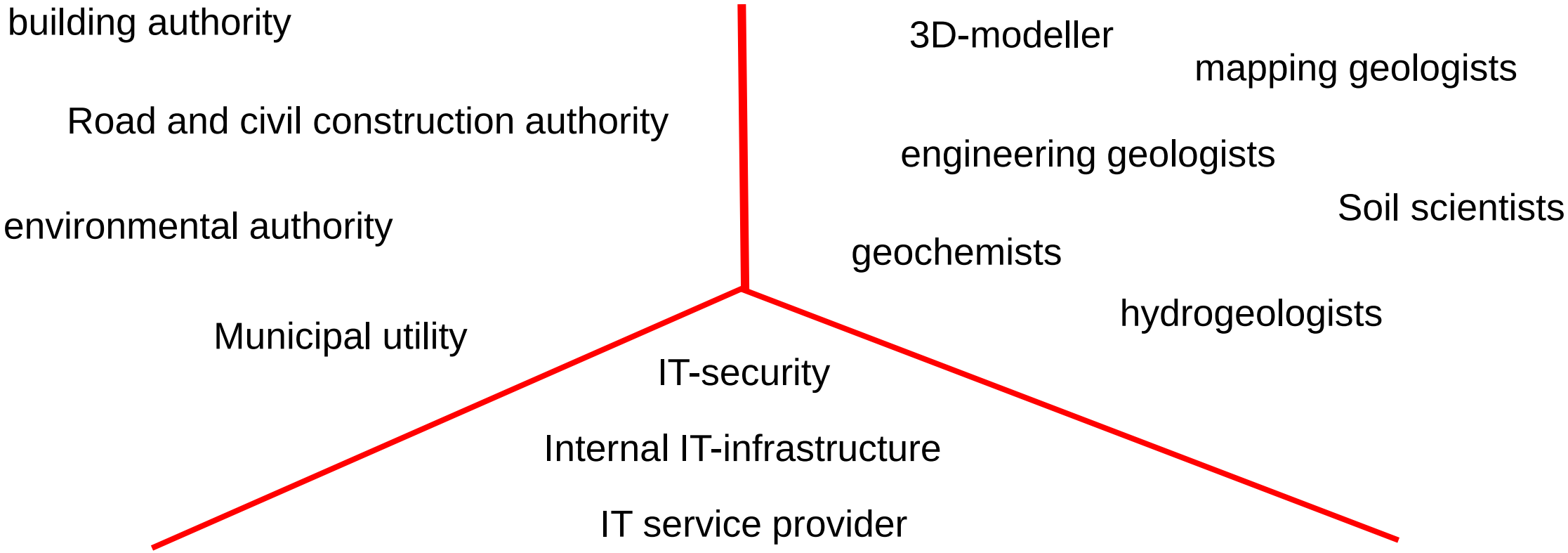
Steps to address the lack of interoperability

- Establishing close cooperation with municipal stakeholders
- Defining urban geoparameter requirements in collaboration with cities
- Consolidating all available geological information
- Developing high-resolution/customized geological 3D information
- Analyzing existing IT infrastructures
- Implementing interfaces and standardized exchange formats
- Providing interoperable, service-based access to customized geological information in both 2D and 3D

Behind the scenes

Human interface (elaborating, translating, negotiating, mediating, de-escalating)



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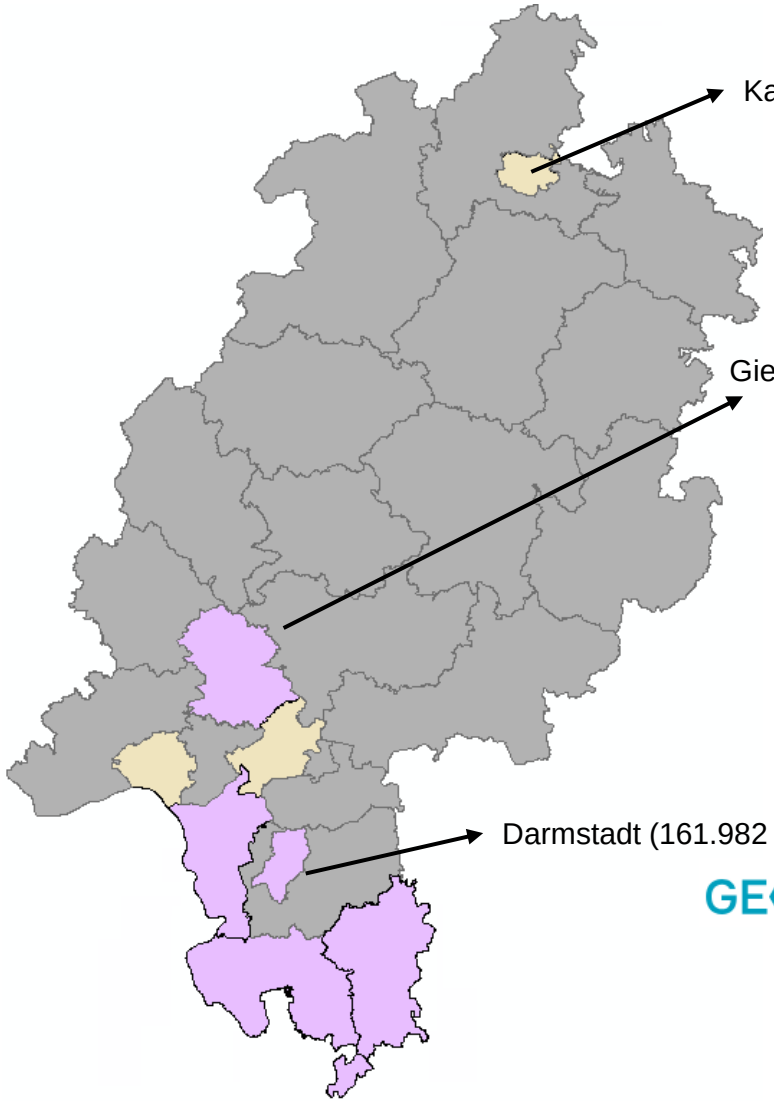
Our work currently covers three project areas



Kassel (203.657 inhabitants)[1],VCS)

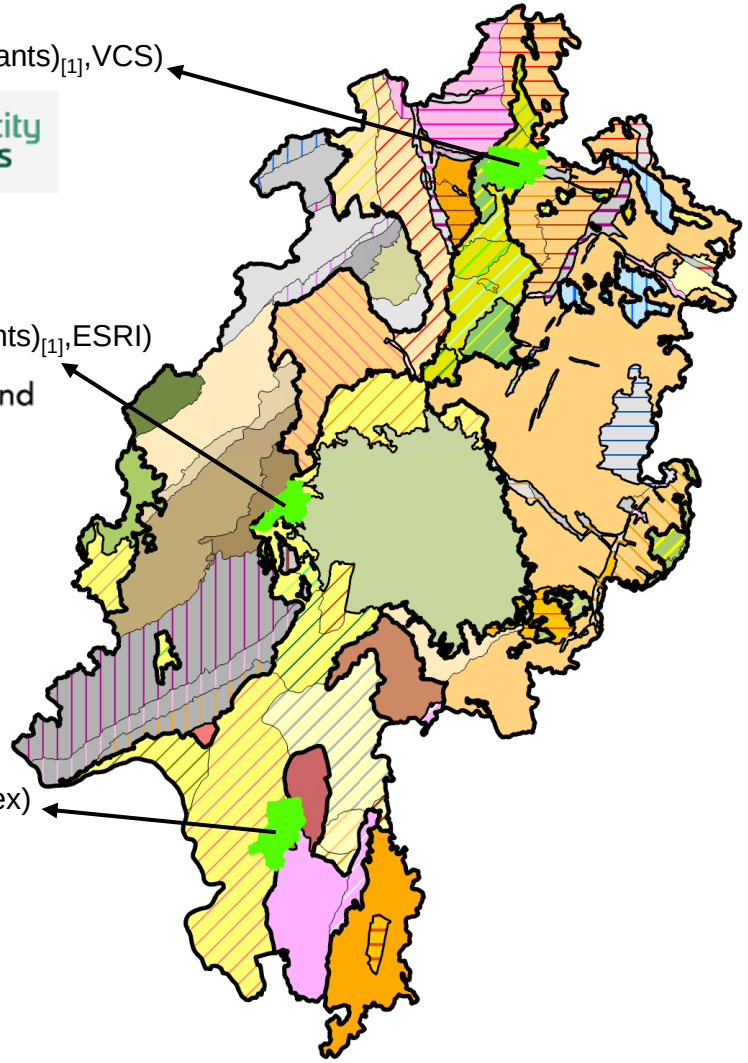
virtual city systems

Gießen (93.523 inhabitants)[1],ESRI)

esri Deutschland

Darmstadt (161.982 inhabitants)[1], Geoplex)

GEOPLEX



Relevant topics cities

Urban Geoparameters	Kf	KG	IP	RP	GB	SD	BGS	BNB
Kassel	xxx	xx	xxx	x	x	xxx	xxx	xx
Gießen	xxx	xxx	xxx	xx	xxx	xxx	xxx	xx
Darmstadt	xxx	xxx	xxx	xxx	xx	xxx	xxx	x

Kf = Kf-permeabilities
KG = grain size distribution
IP = infiltration potential
RP = radon potential

GB = excavability
SD = absorbable soil pressure
BGS = weak construction ground
BNB = cohesive/non-cohesive

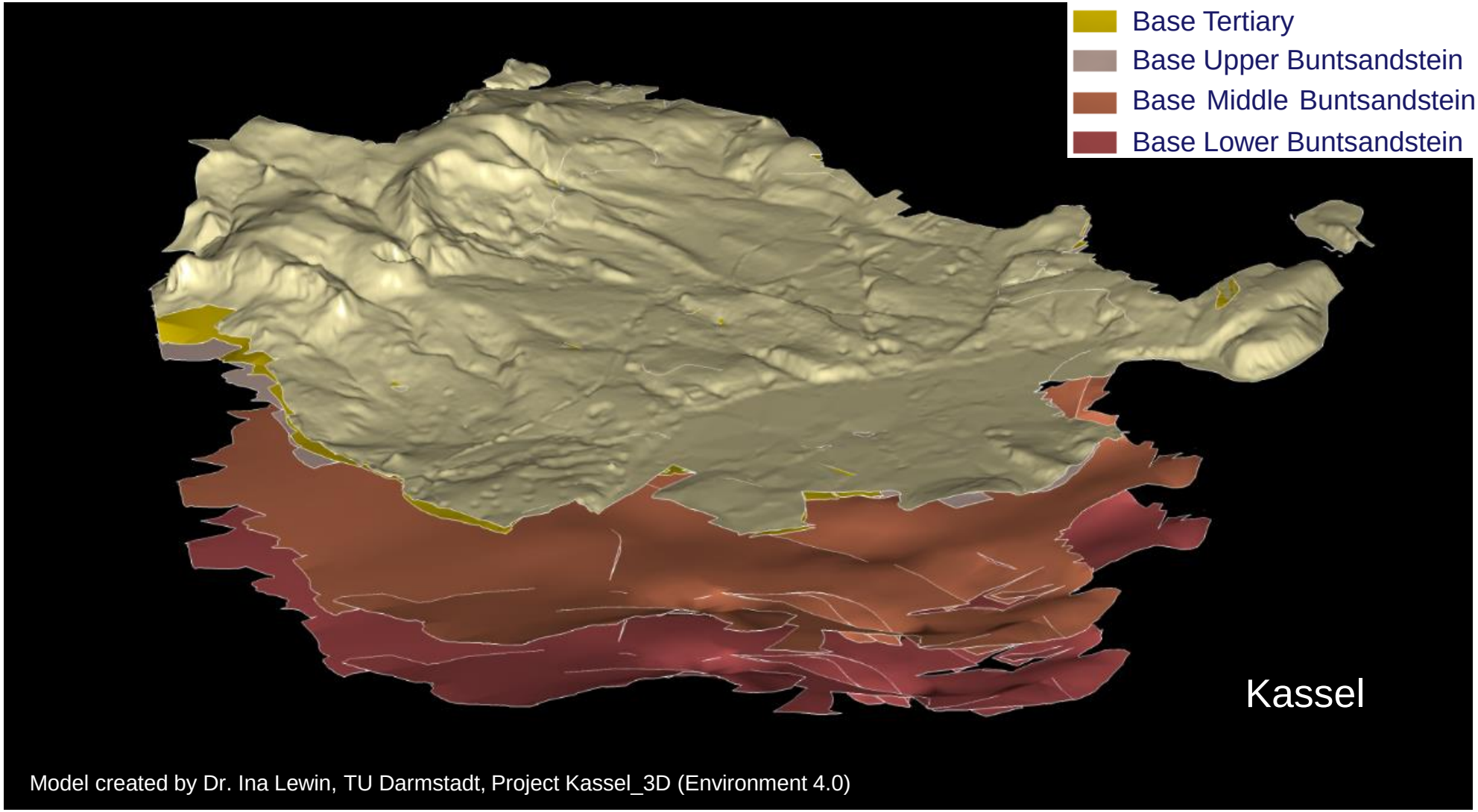
Relevant topics cities

Hydrogeology	FA	GWS	KA	HA	HT	EWS	LG	DFÜ
Kassel	xxx	xxx	-	x	xxx	xxx	x	x
Gießen	xxx	xxx	-	xxx	xx	xxx	?	?
Darmstadt	xxx	xxx	-	xxx	-	xxx	x	-

FA = depth groundwater table
GWS = variation gw table
KA = karst
LG = data logging
DFÜ = data transfer

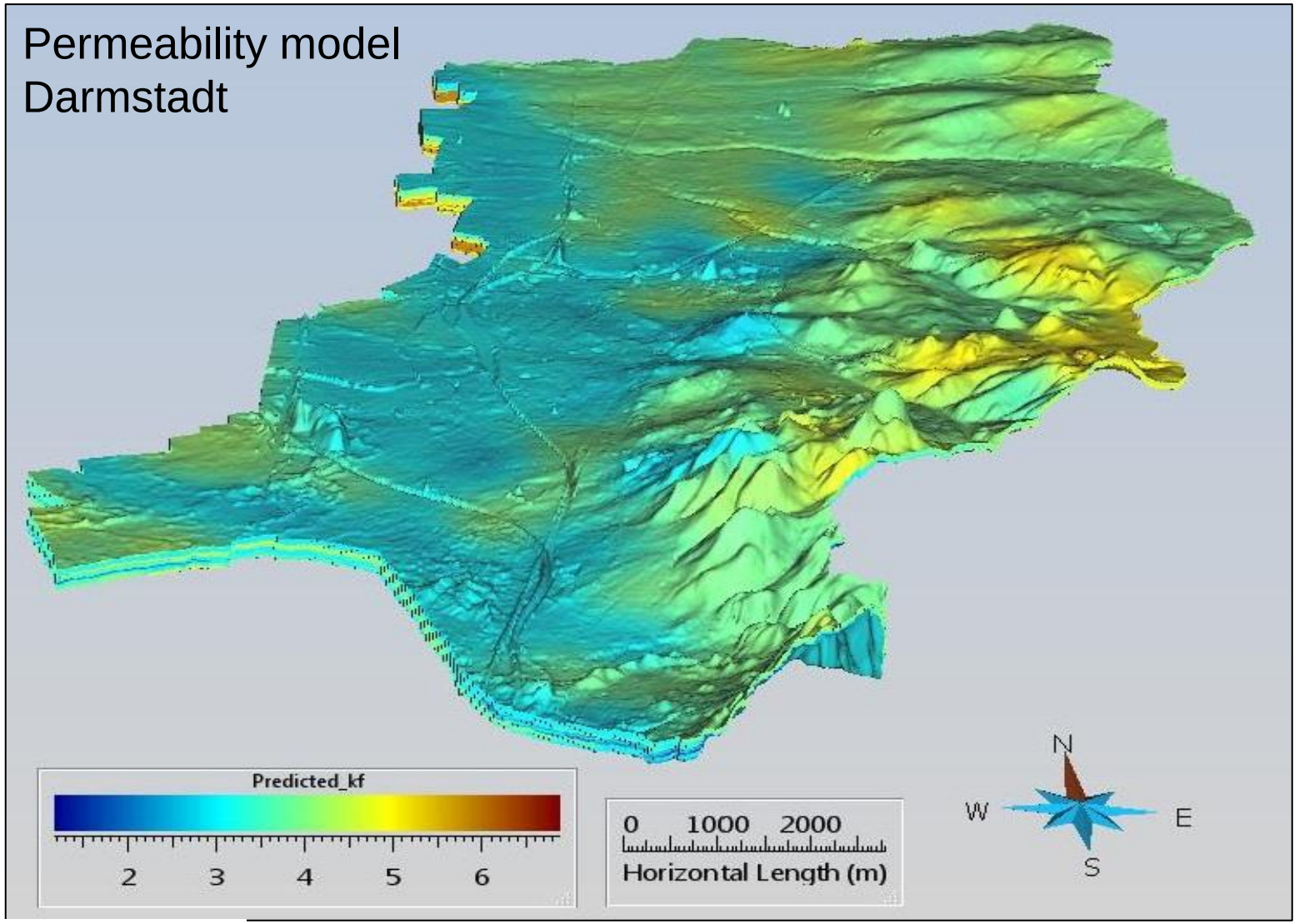
HA = cavity type
HT = hydrothermie
EWS = geothermal heat extraction

Lithostratigraphic models



Model created by Dr. Ina Lewin, TU Darmstadt, Project Kassel_3D (Environment 4.0)

Volumetric models



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Interoperable deployment enabled by GST

OGC-Interfaces + exchange formats > 3D city models

Exchange format
3D-Tiles

Getting connected!!

API	Point	Line	Triangle	Voxet	2D-Grid	Sgrid	Solid	Attribute	Symbology
3D GeoV	X	X	X	X	X	X	X	-	-
Styles	-	-	-	-	-	-	-	-	X
3D-Tiles	X	X	X	X	X	X	X	-	X

Supported by Geoplex and VCS, but not preferred by ESRI and QGIS

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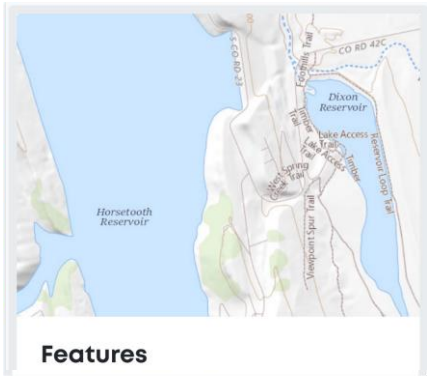
Interoperable deployment enabled by GST

OGC-APIs + exchange formats > GIS work environment



Exchange format
I3S

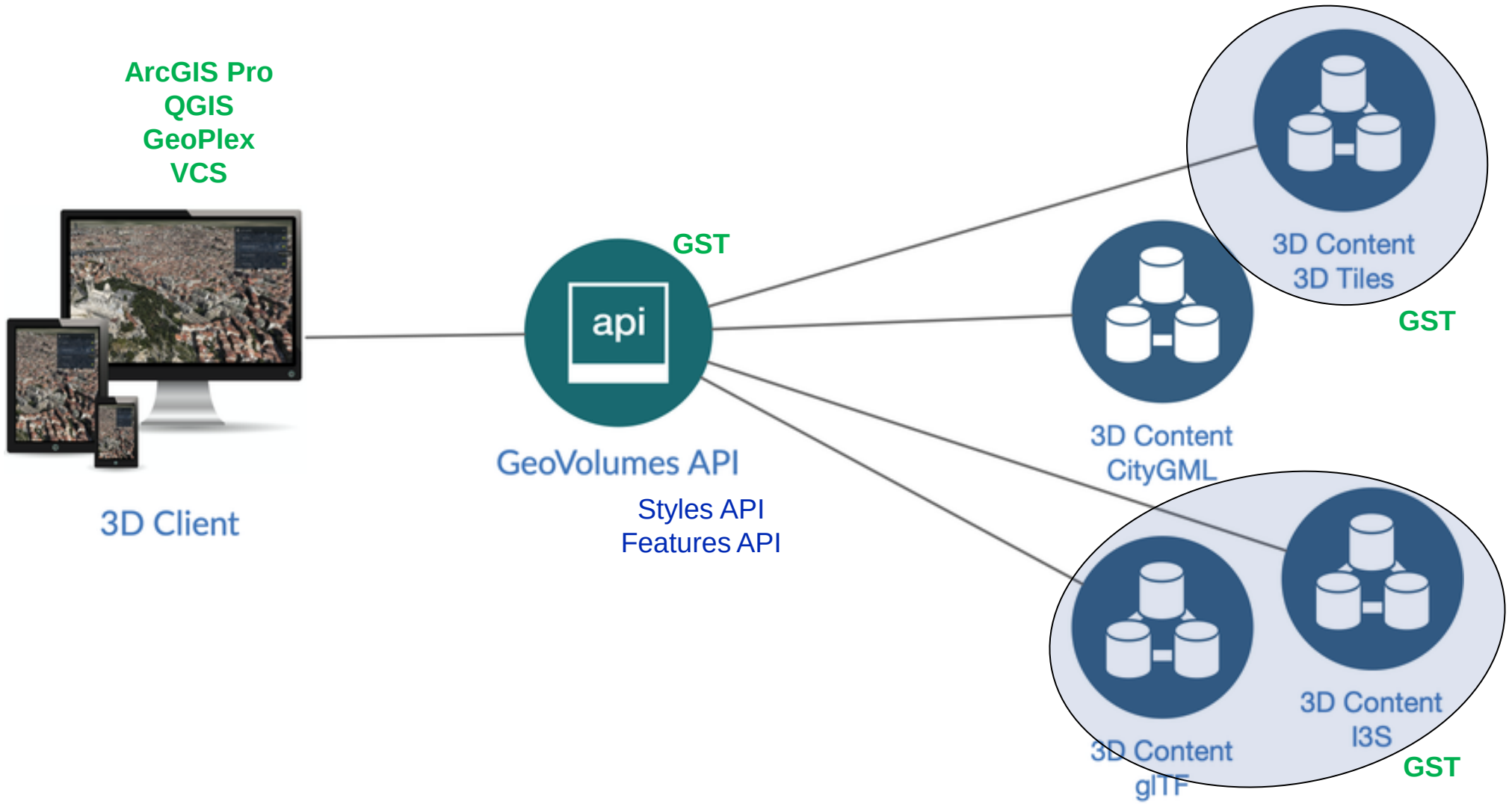
Getting connected!!

API	Point	Line	Triangle	Voxet	2D-Grid	Sgrid	Solid	Attribute	Symbology
Features	x	x	x	x	x	x	x	-	-
Styles	-	-	-	-	-	-	-	-	x
I3S	x	x	x	x	x	x	x	-	x

Supported/preferred by ESRI and QGIS (in realization)

Other formats?? (GOCAD ASCII, GeoH5, RescueML, IFC, GlTF)

Done ……..


ArcGIS Pro
QGIS
GeoPlex
VCS
3D Client
GST
api
GeoVolumes API
Styles API
Features API
3D Content
3D Tiles
GST
3D Content
CityGML
3D Content
glTF
3D Content
I3S
GST

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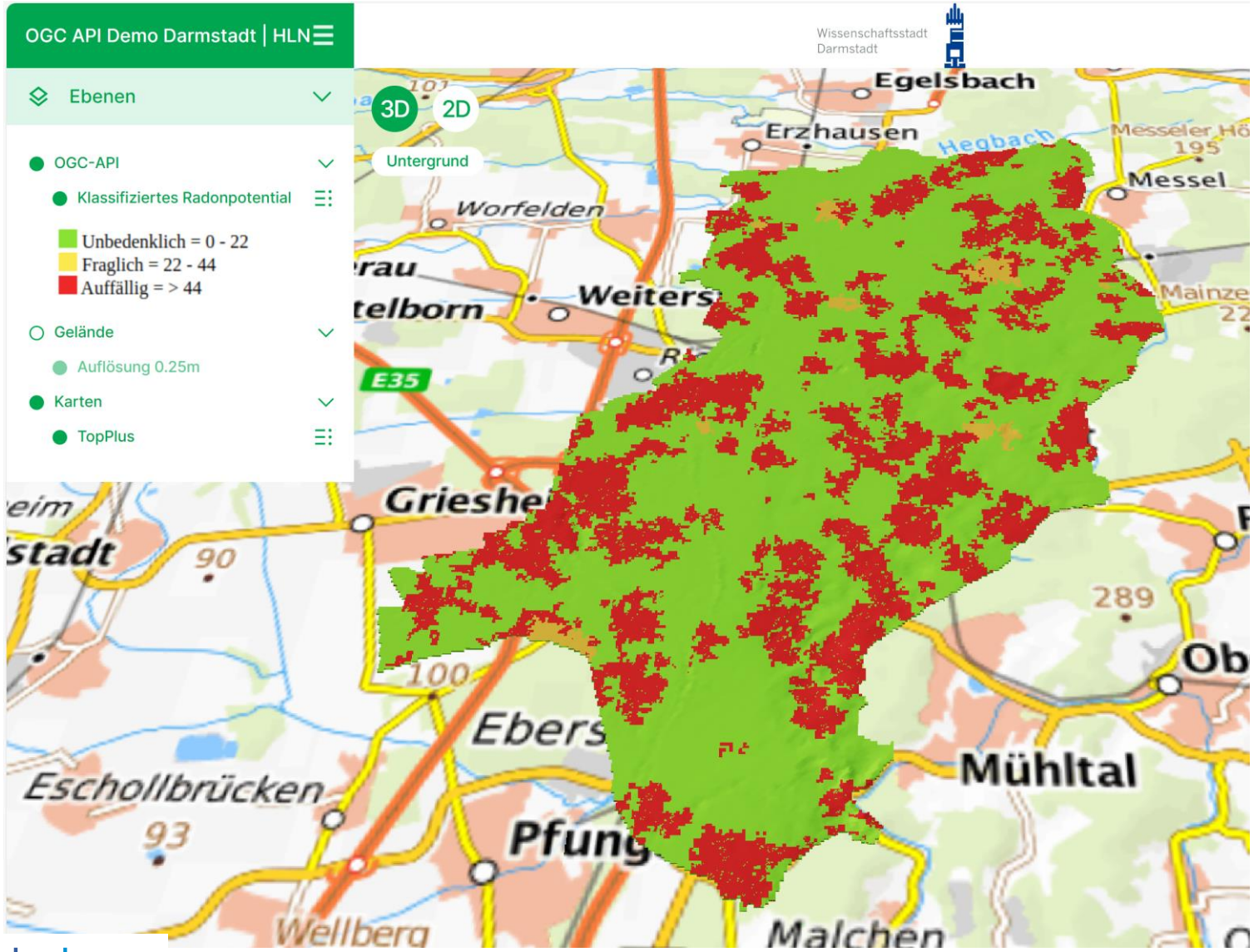
Interoperable deployment enabled by GST

Radon potential in Darmstadt city



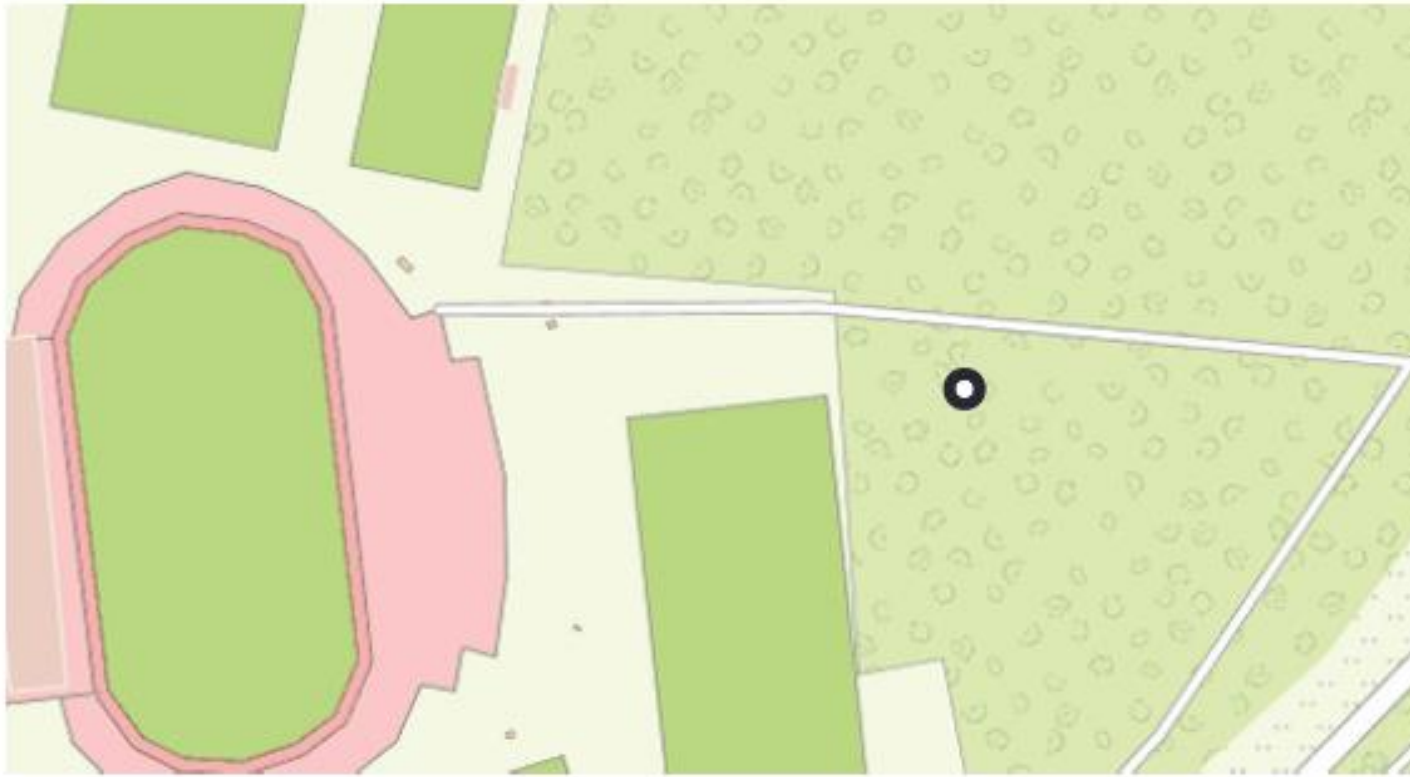
Limited functionality in the 3D city work environments

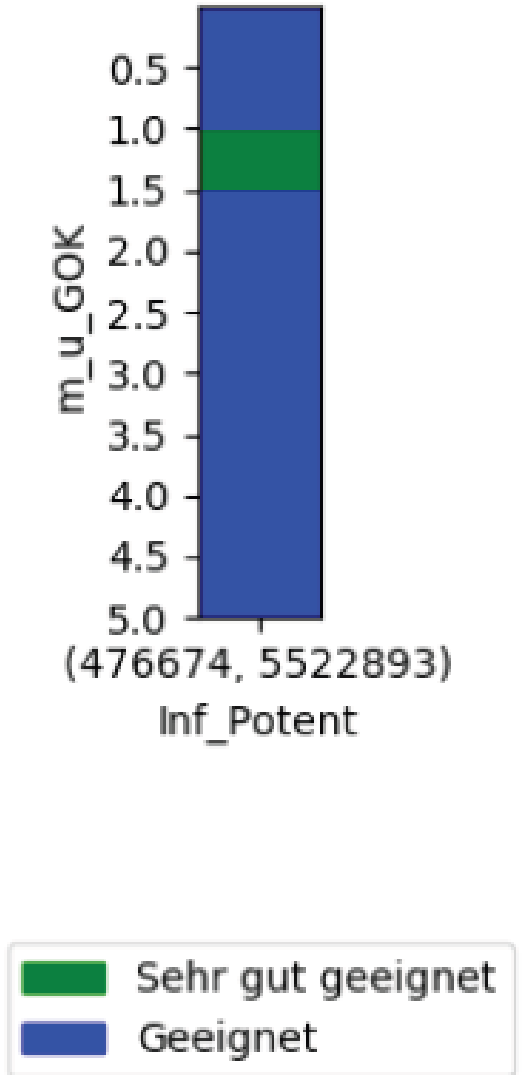
Infiltration potential
Green = very good
Brown = limited suitability

Virtual drillings

Geology profile

Übersicht

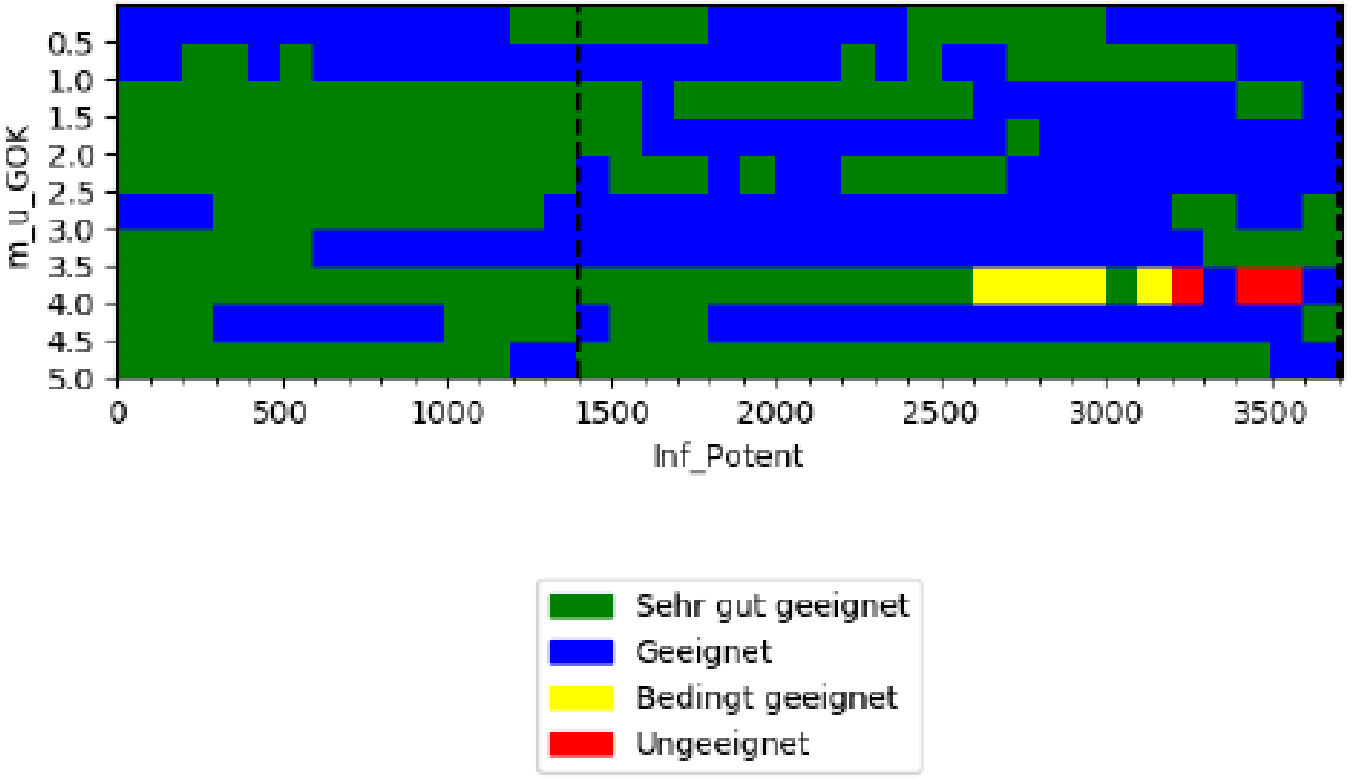




Cross sections

Geology profile

Übersicht




Thank You
rouwen.lehne@hlnug.hessen.de
Legende für radonpotential_category
1.00
1.50
2.00
2.50
3.00
NDV
W
N
E
S