rOpen og MapField
Fremtidsperspektiver for forbedret viden om vandets veje og N-retention

Esben Auken & Anders Vest Christiansen, Troels Vilhelmsen, Rasmus Rumph
HydroGeophysics Group, Department of Geoscience, Aarhus University

rOPEN and MapField - Vision

"Identifikation of landbrugsarealernes følsomhed over for udvaskning af nitrat fra rodzonen"

Photo: SEGES

Innovation Fund Denmark

rOPEN

MapField

The path for a water drop from Sky to Fjord

rOPEN MapField

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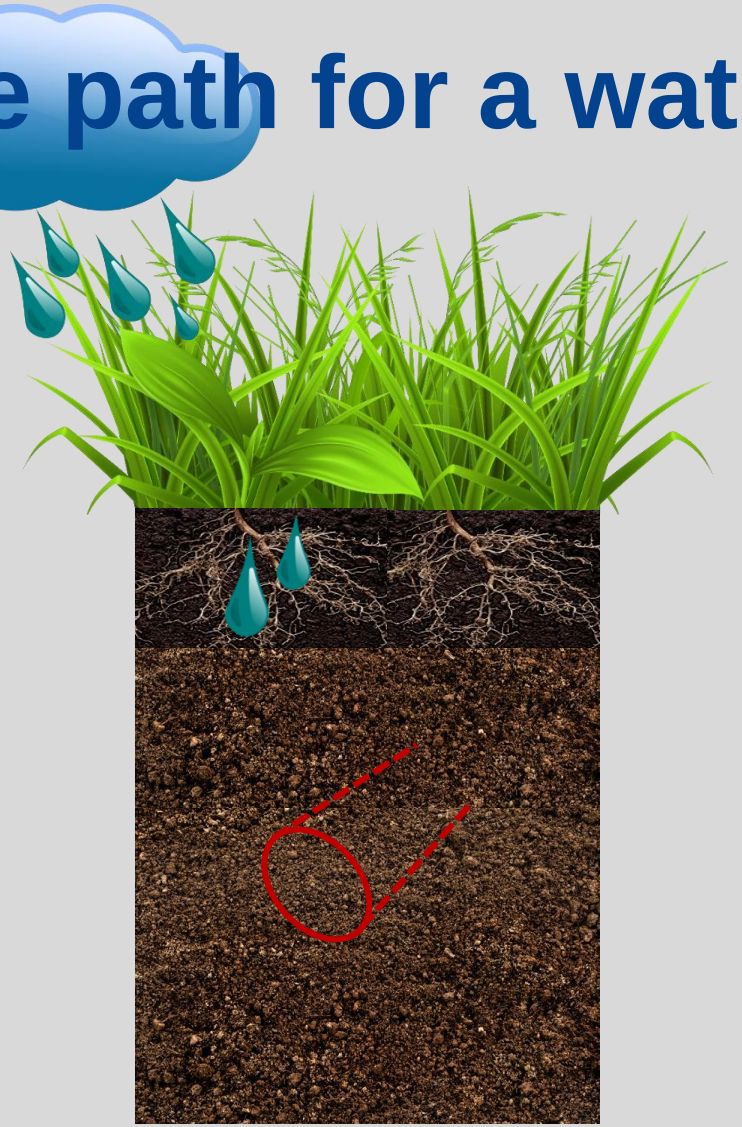
The path for a water drop from Sky to Fjord



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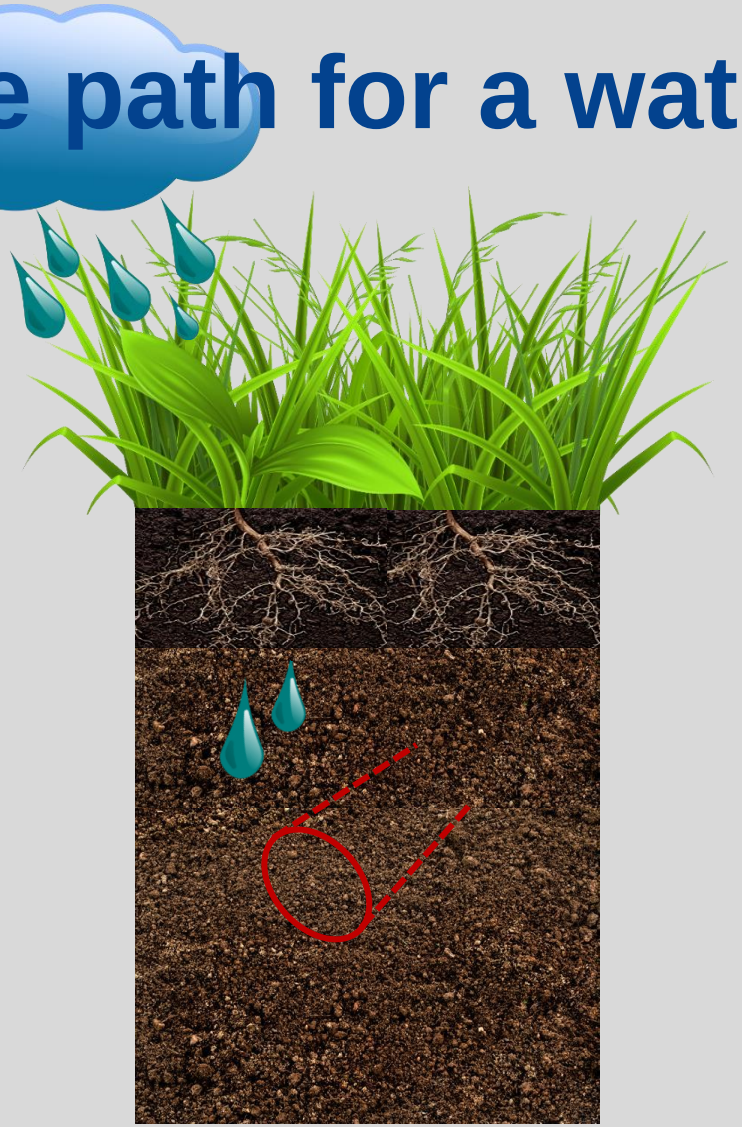

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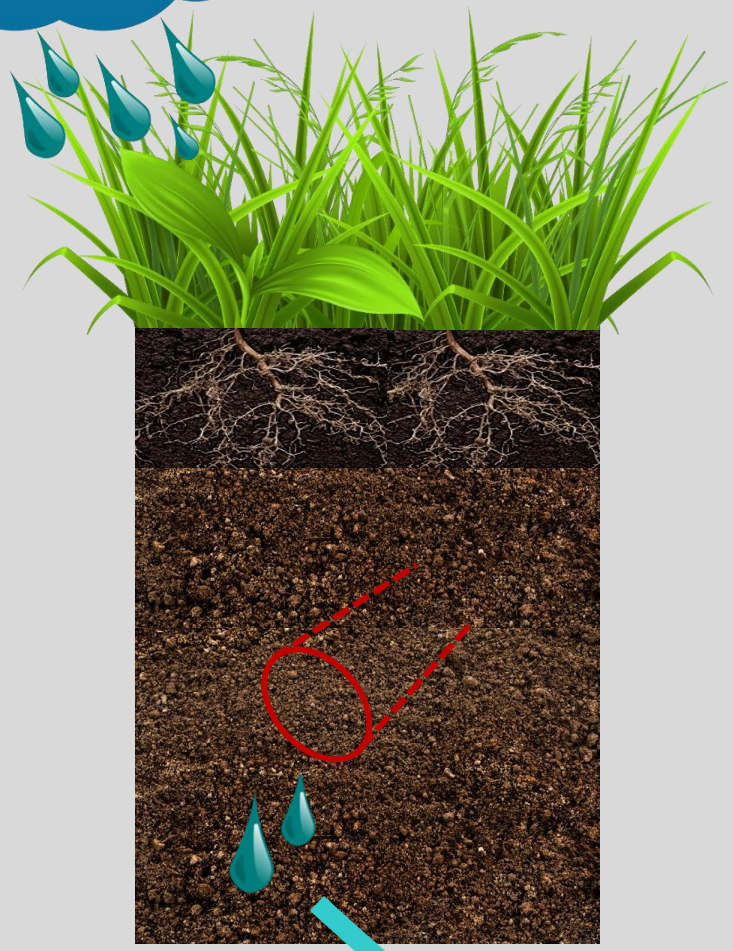

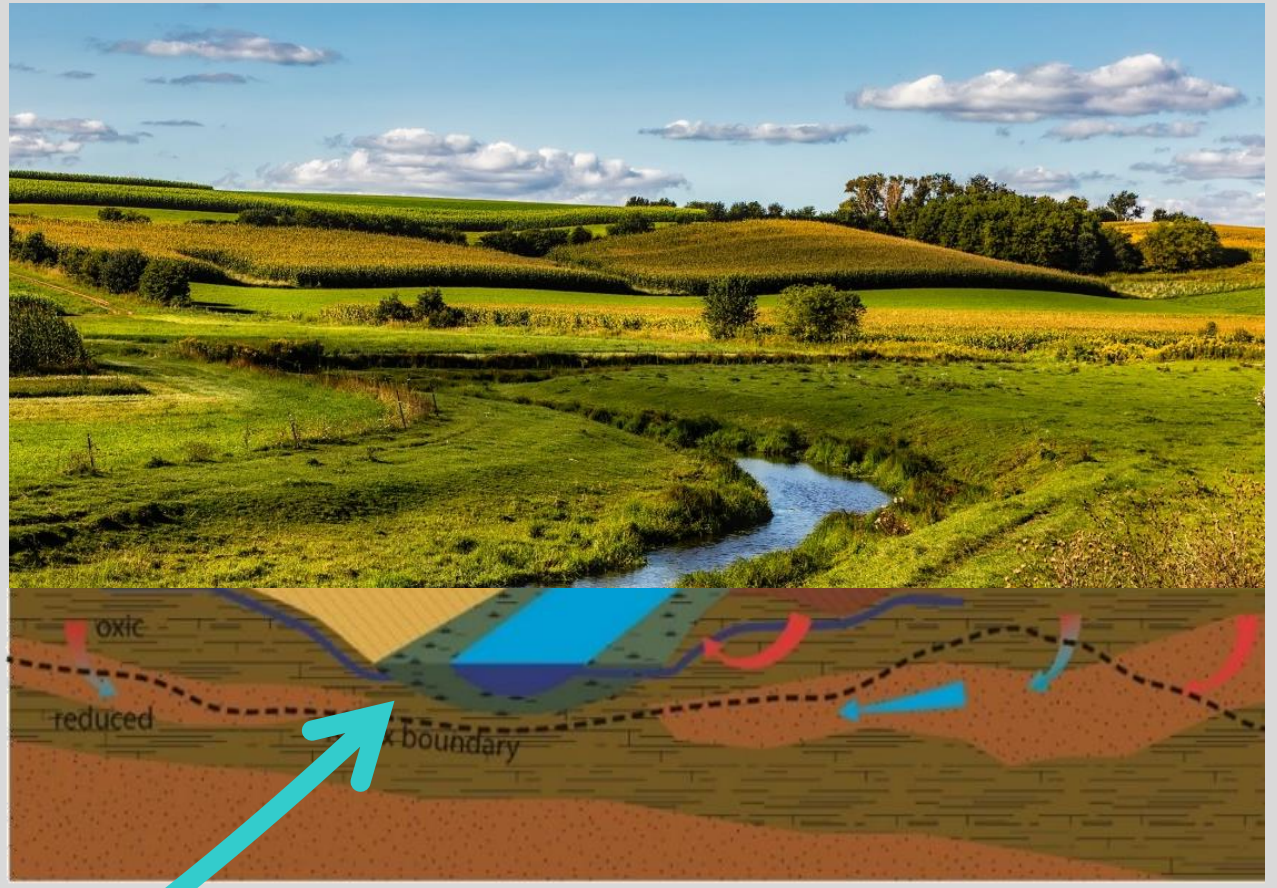

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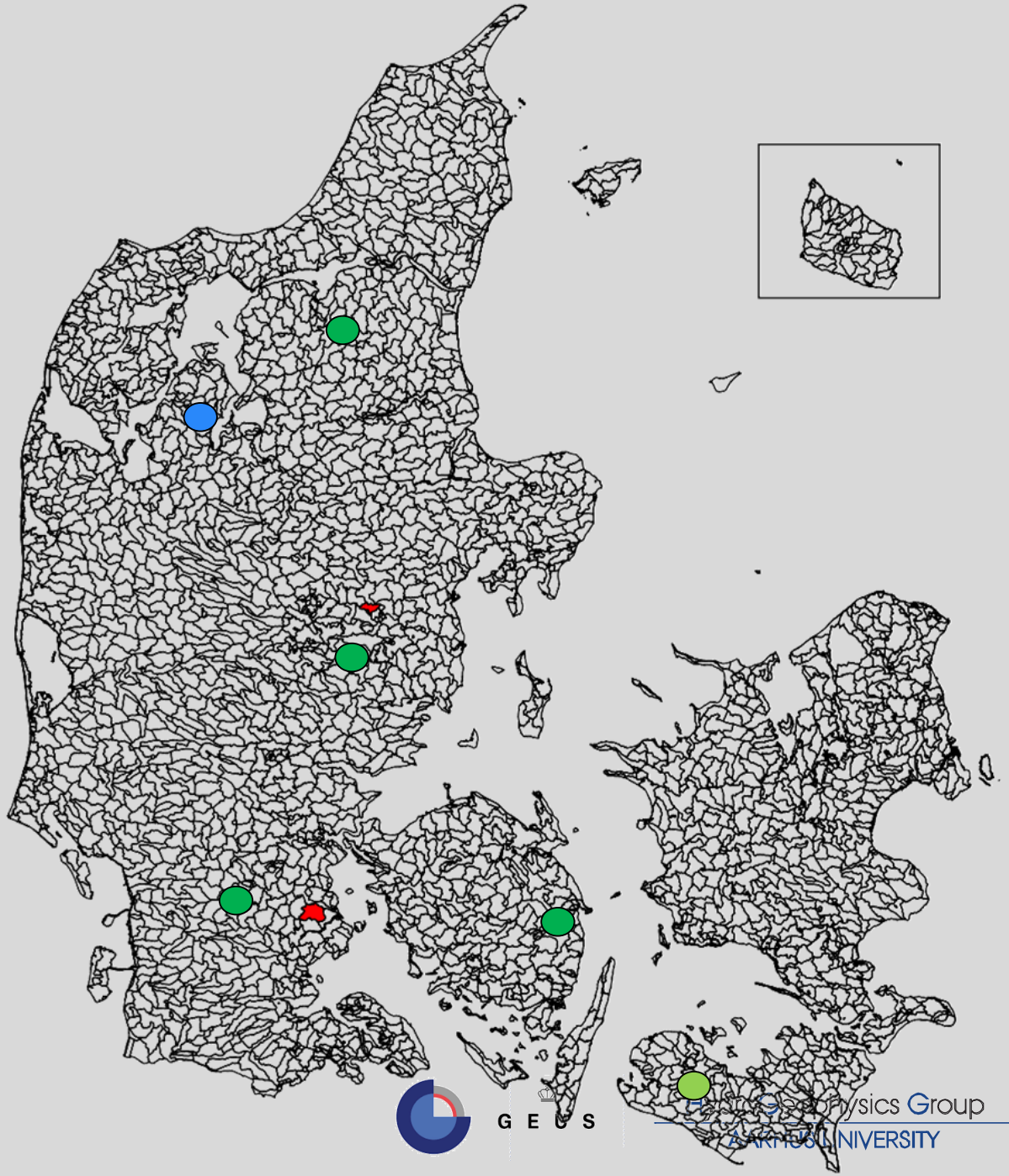
ID15 Catchments

- 3133 ID 15 Catchments in Denmark
- Regulatory basins for agricultural management
- Currently a single retention value for each catchment
- Field sites



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How we like the rOpen tool to be

- **Data, data, data, data**
- **Decision support must be heavily data driven**
- **Data-driven and transparency is expected to result in buy-in from farmers**
- **It must be cost-effective**
- **It must be fast**

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UNIVERSITY OF COPENHAGEN

USGS science for a changing world

ARIZONA

Innovation Fund Denmark

midt regionmidtjylland

Region Syddanmark

NIRAS

ORBICON

DANSKE REGIONER

SKYTEM

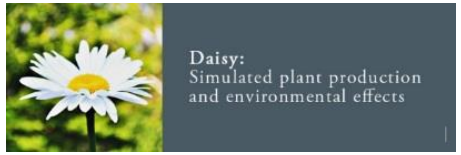
SEGES

AGS Aarhus GeoSoftware

Ministry of Environment and Food of Denmark
Environmental Protection Agency

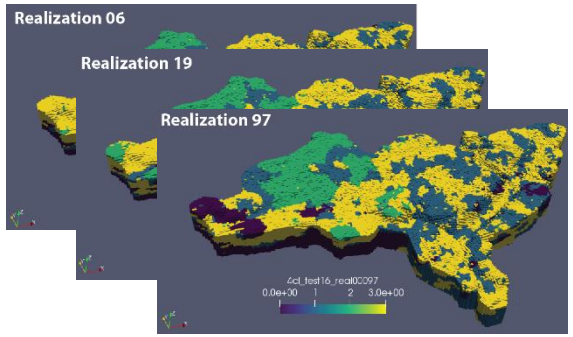
rOpen Decision support tool

Soil – crop modelling

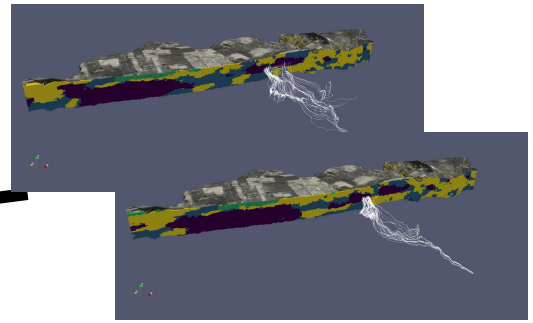


+N-LES$_4$

Geophysical mapping and modelling

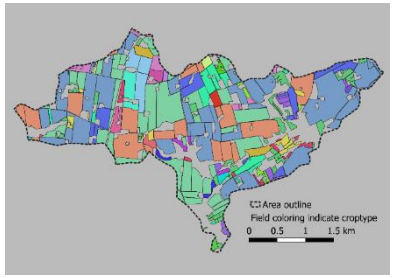


Groundwater modelling

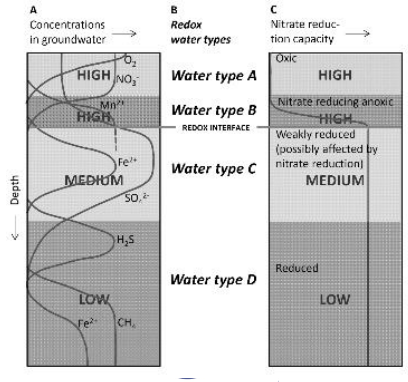


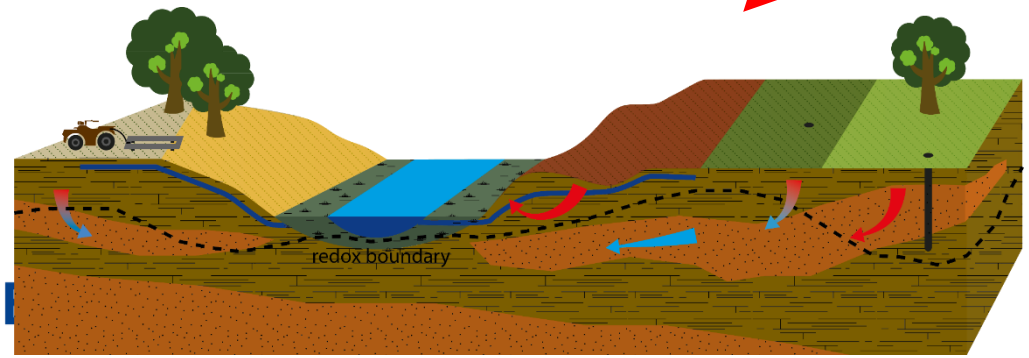
Decision support tool

GIS, land use, lithology, etc.



Geochemical modelling





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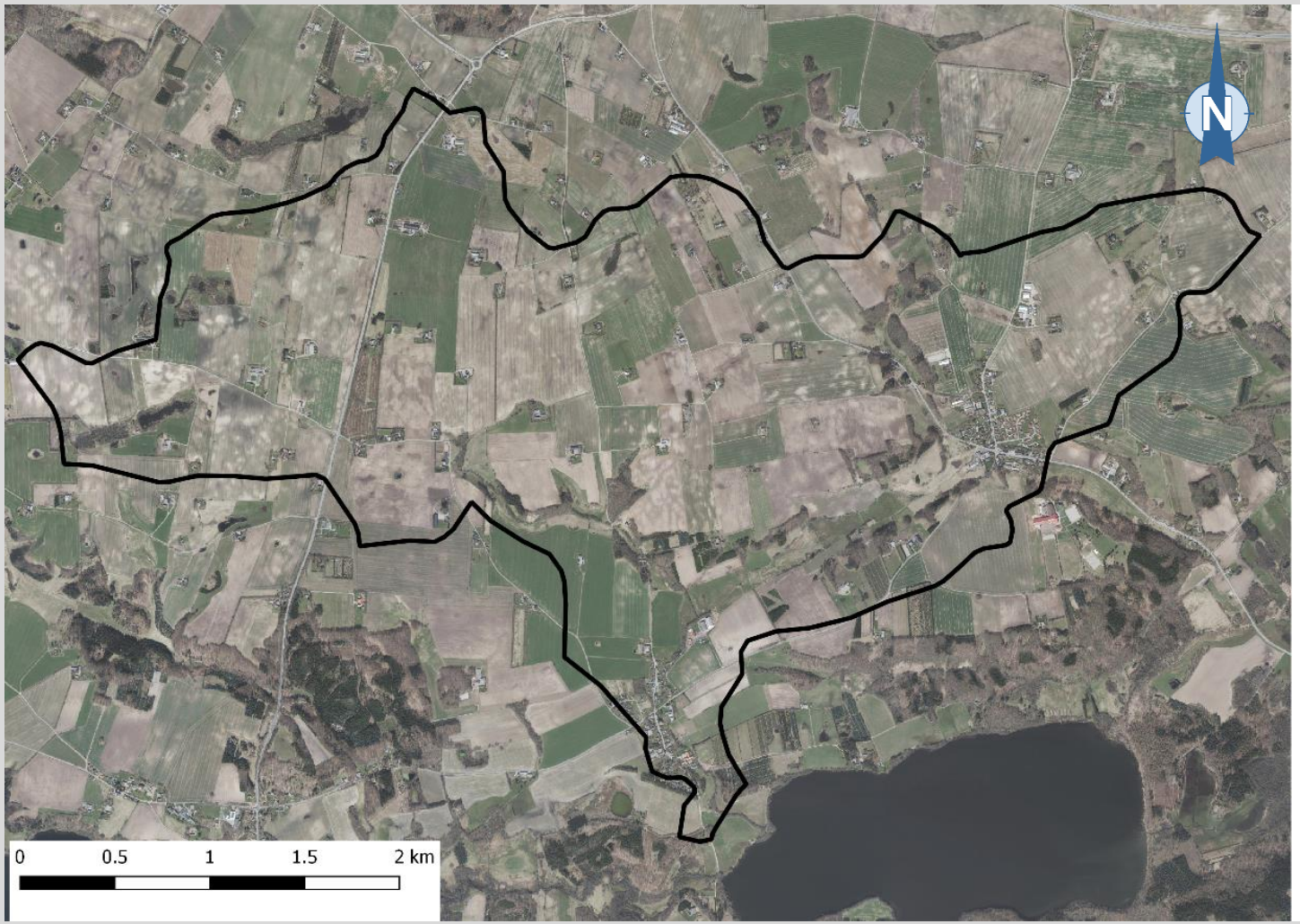
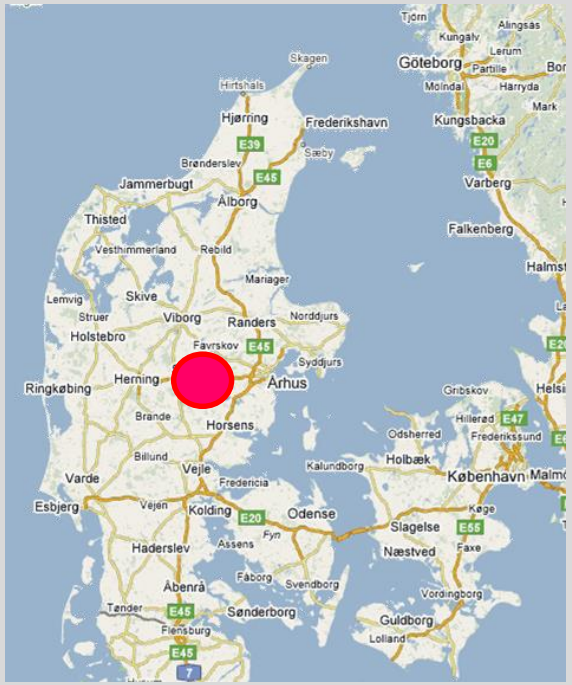
The subsurface structures and geology

- **Fertility of the soils determines the conditions for the crops and the yield**
- **The geological layers determines the transport path of water and N below soil and drains**
- **High resolution images of the geology**

Mapping for N-retention, Javngyde



- **1000 hectare area**
- **Mapping shallow geology for nitarte retention**



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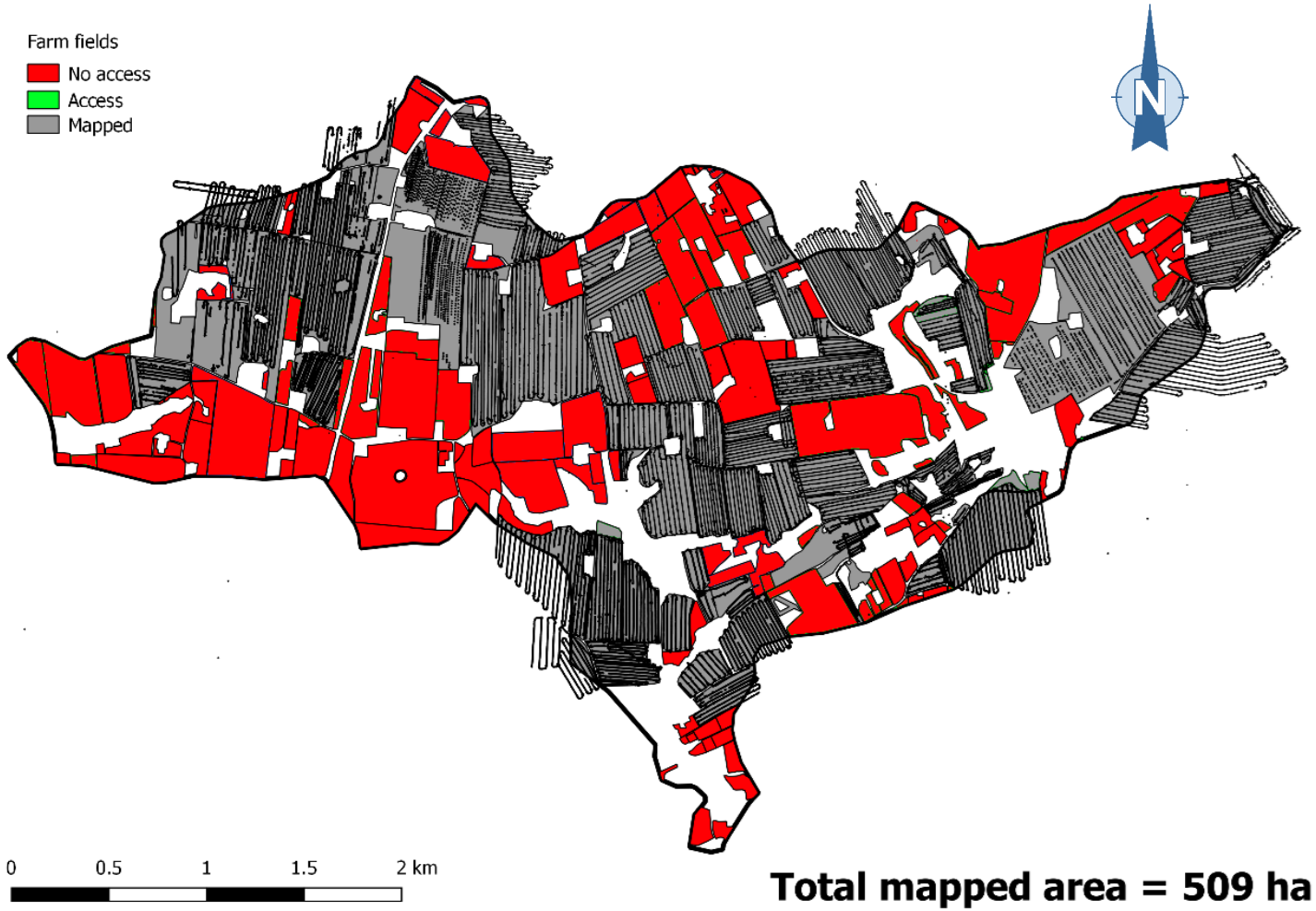
Results, Javngyde

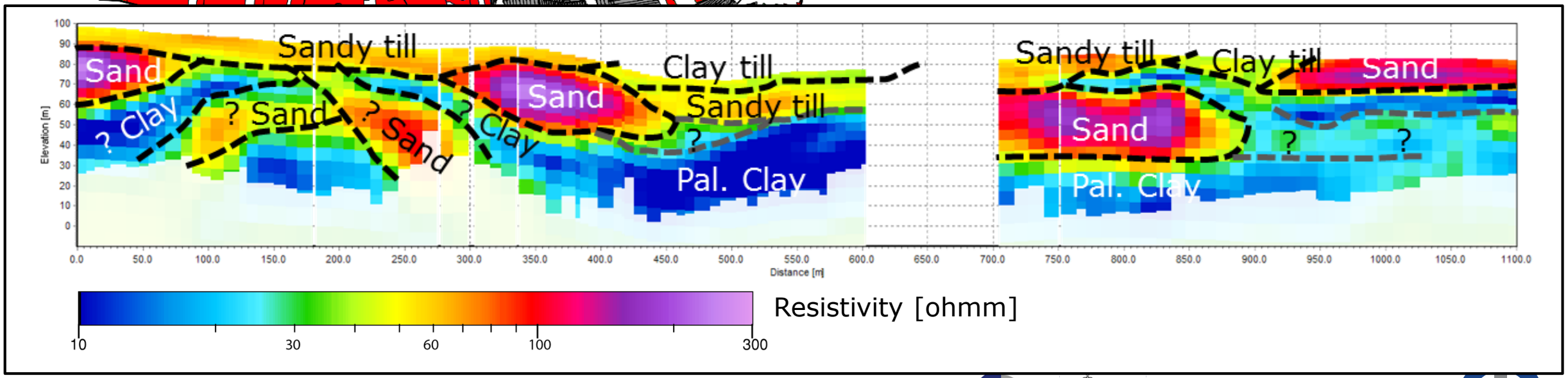


Total mapped area = 509 ha

- **1000 hectar area**
- **Mapped in 11 days (with time for testing)**
- **Between 40-70 hectar per day**

Results, Javngyde

Profile



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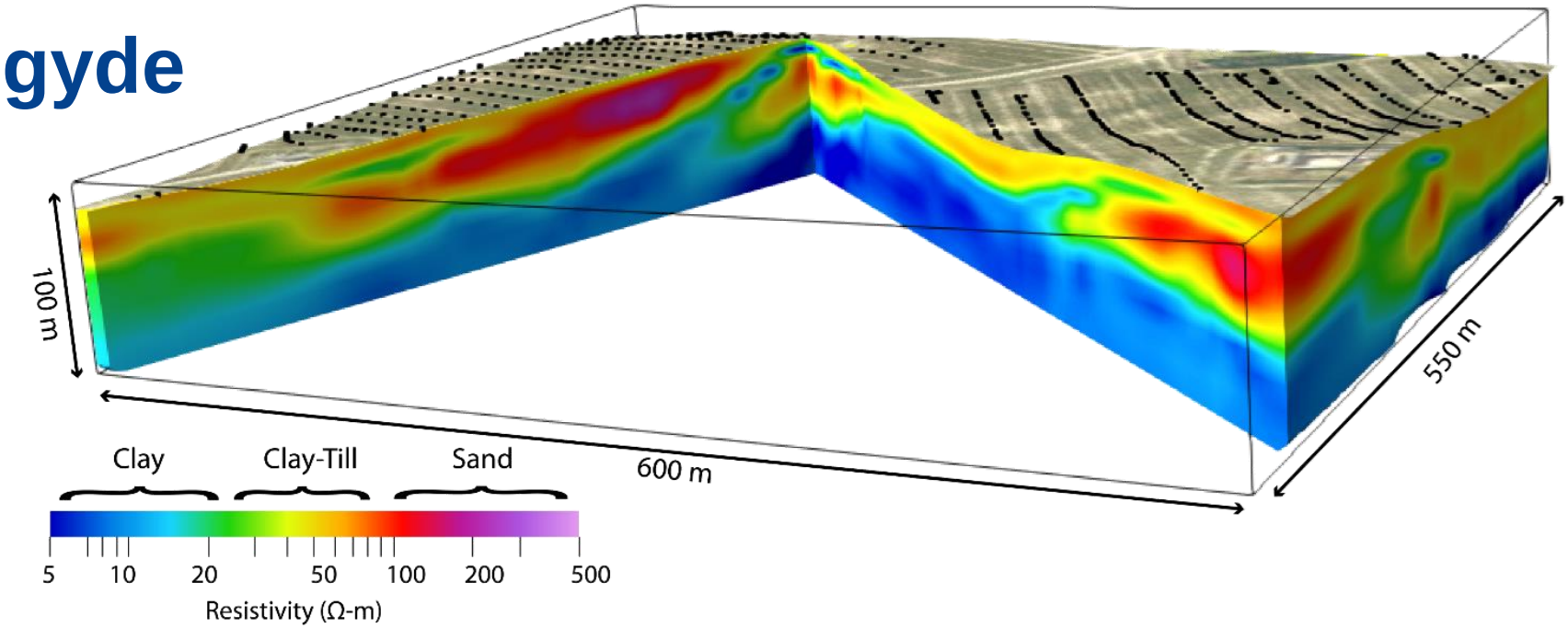
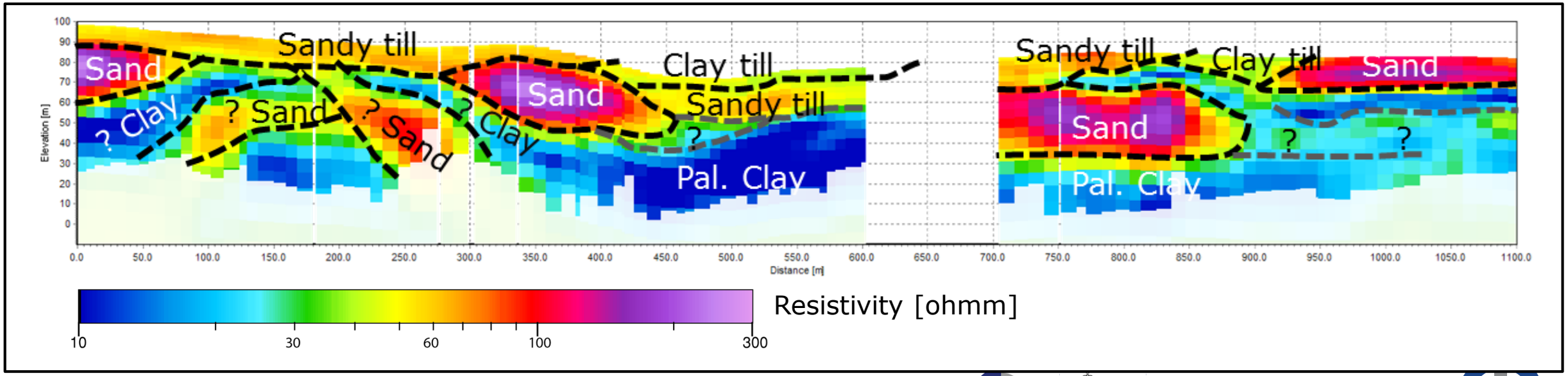
Results, Javngyde





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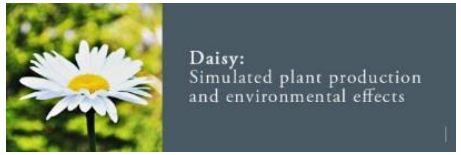
rOpen Decision support tool

Soil – crop modelling



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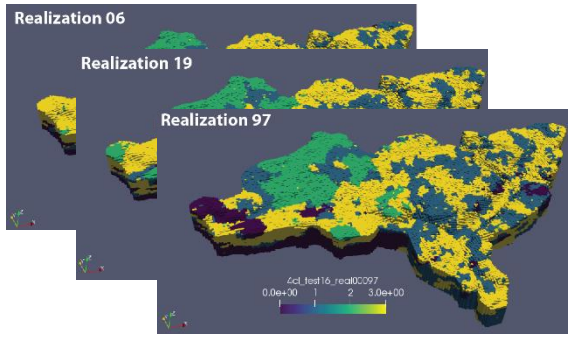
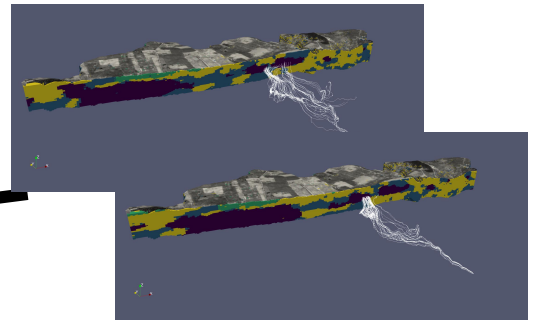
Geophysical mapping and modelling



Groundwater modelling



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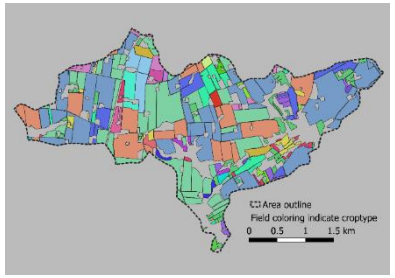

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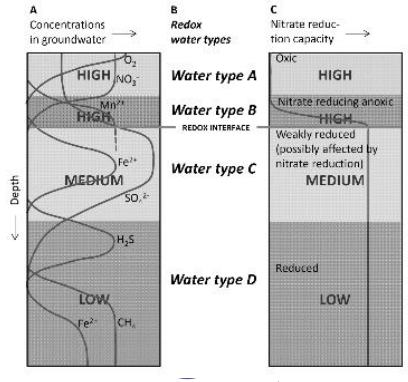

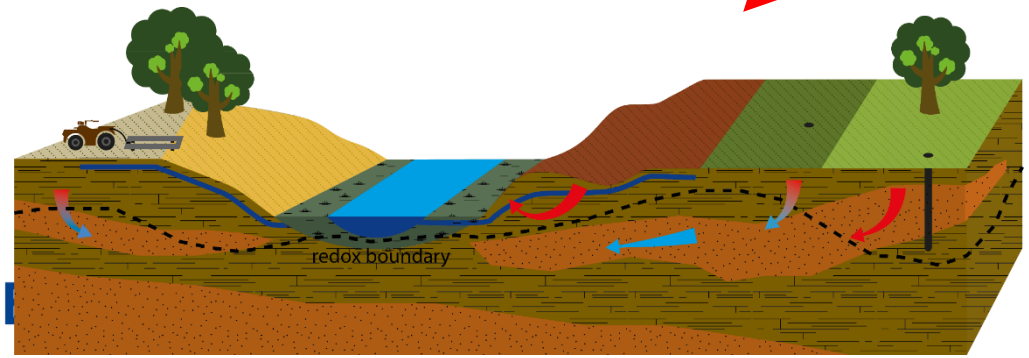

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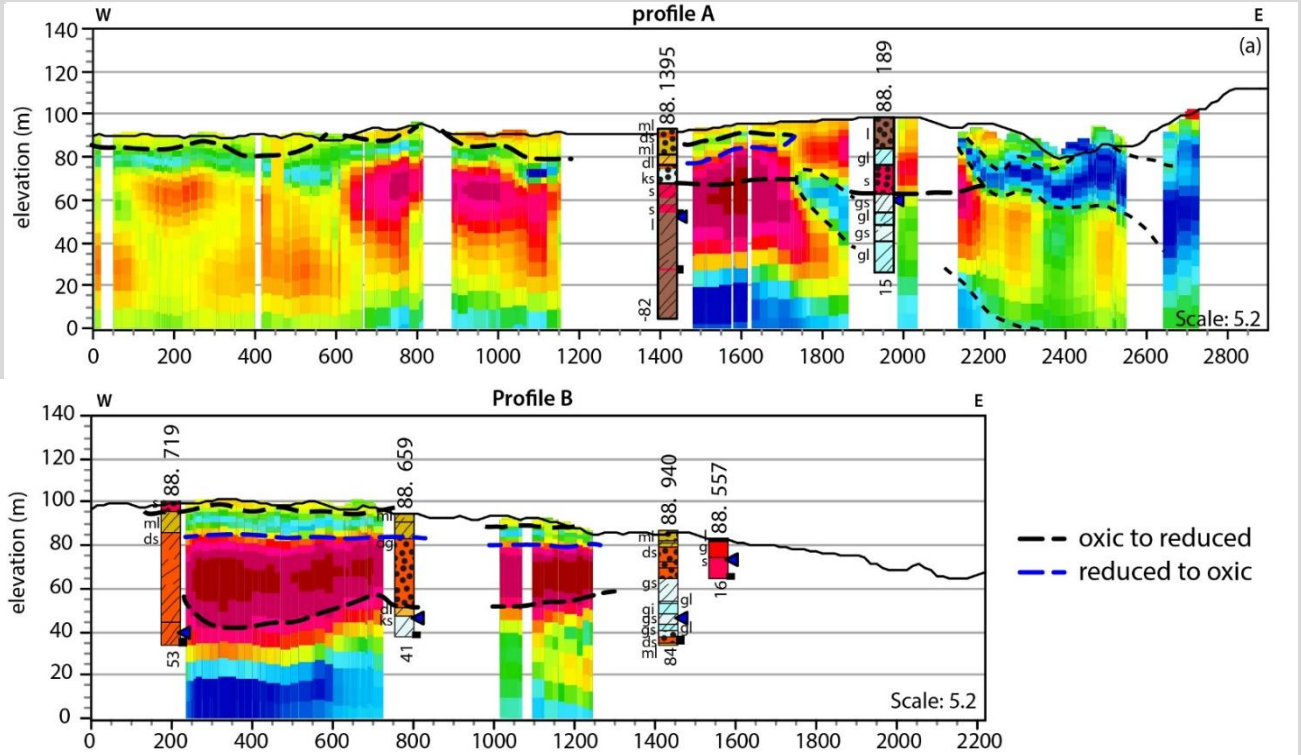
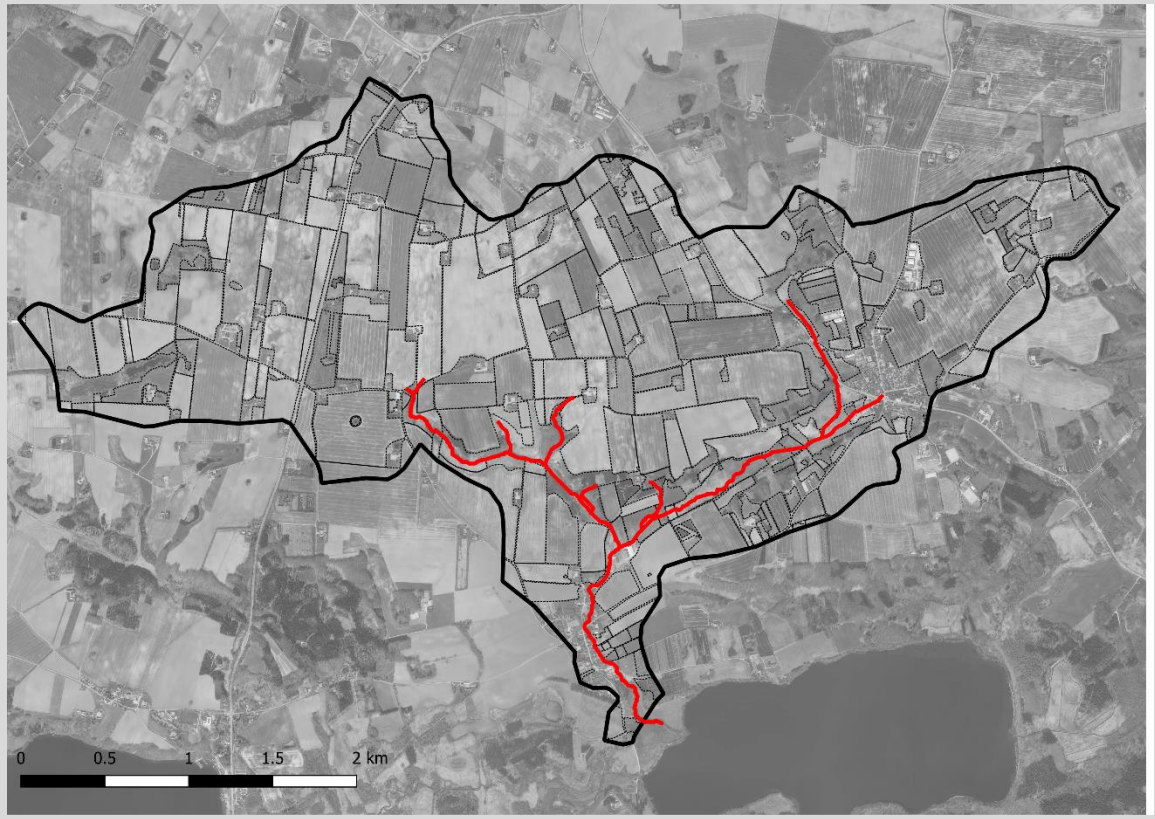
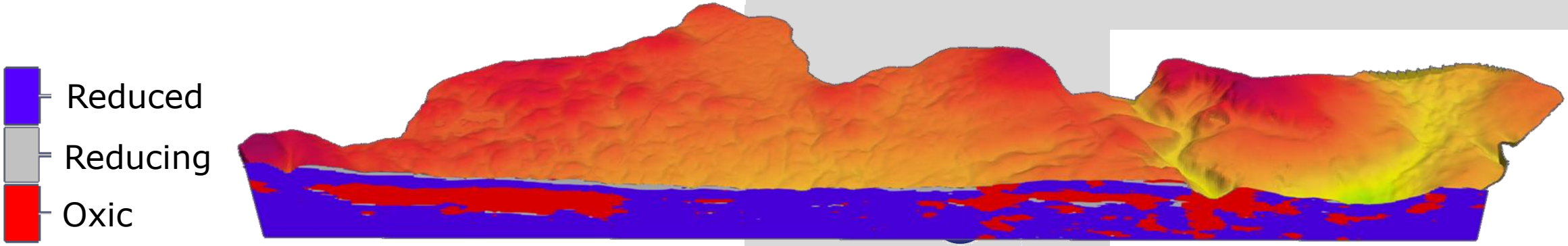
Subsurface sampling

- **Determination of redox zones**
- **N-retention rates**

Conceptual understanding - redox







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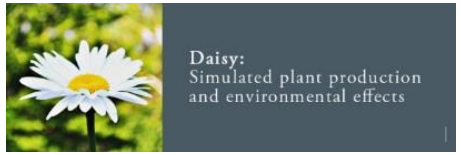

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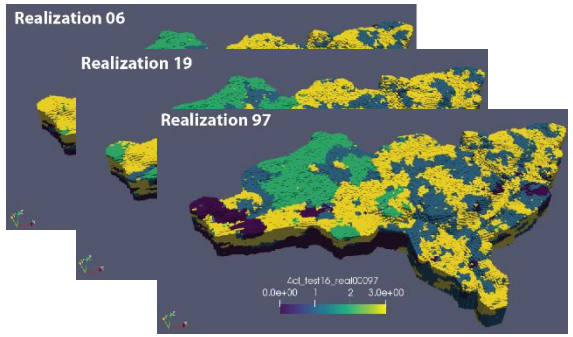

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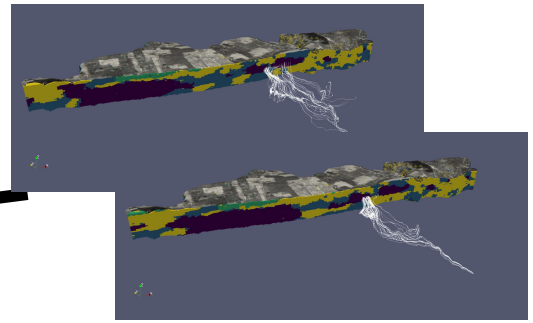

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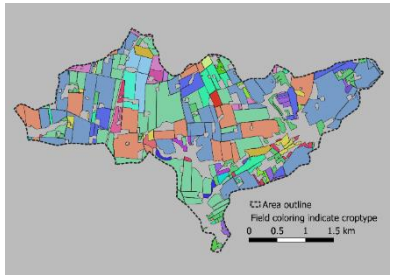

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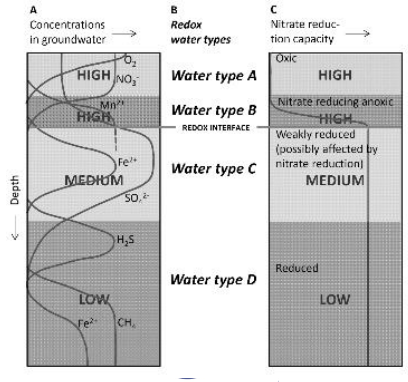

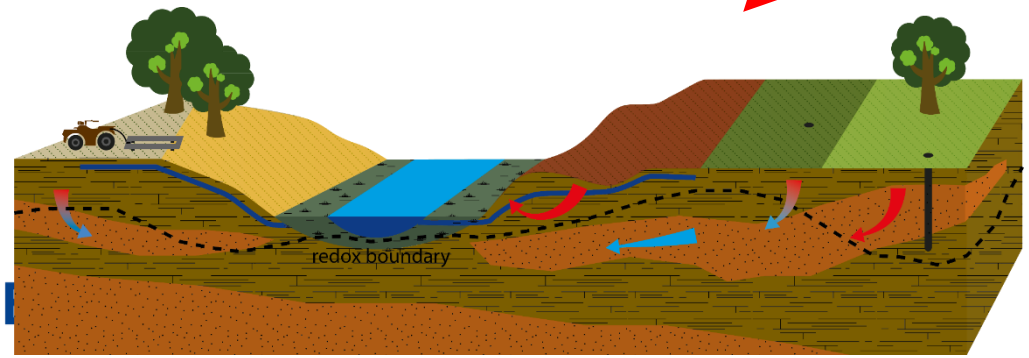

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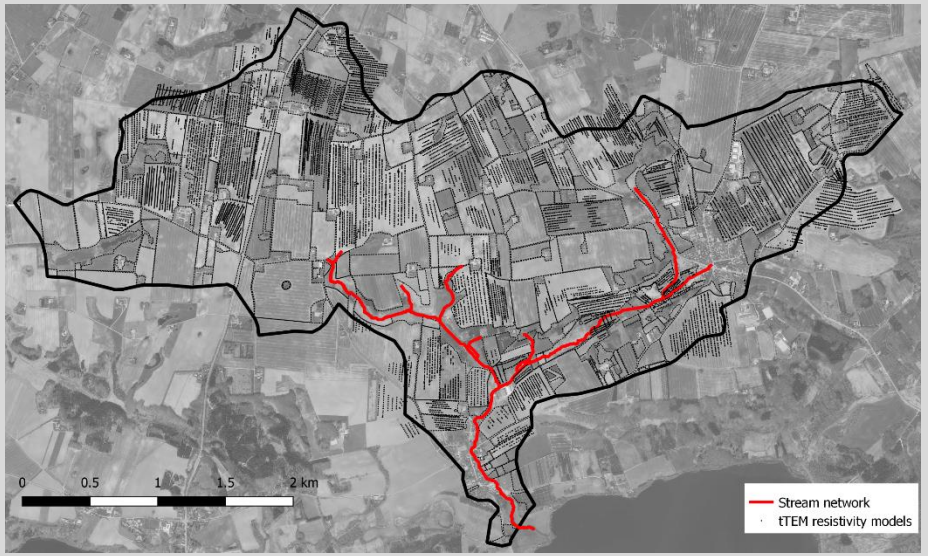
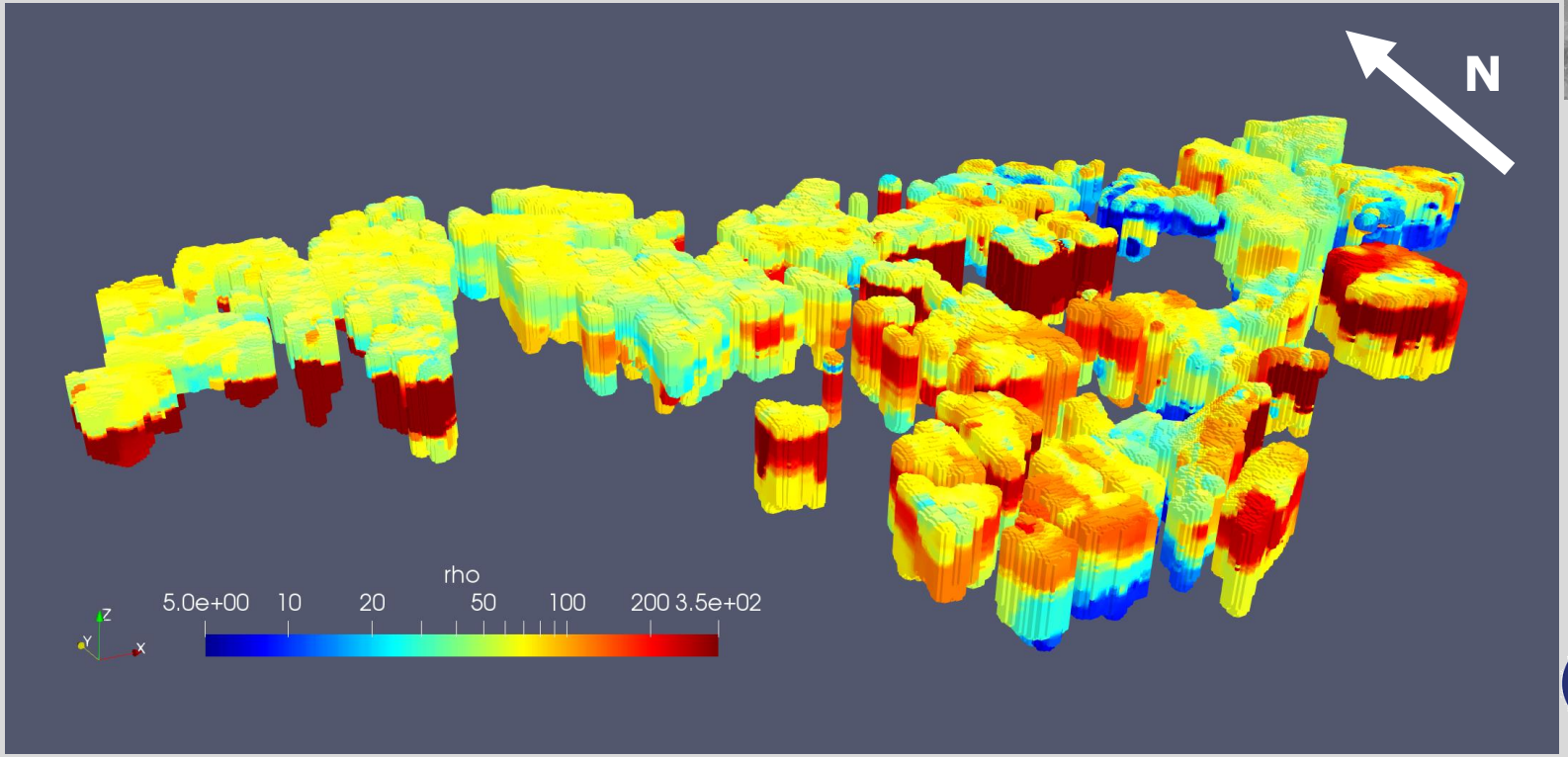
Geostatistics and structural modeling





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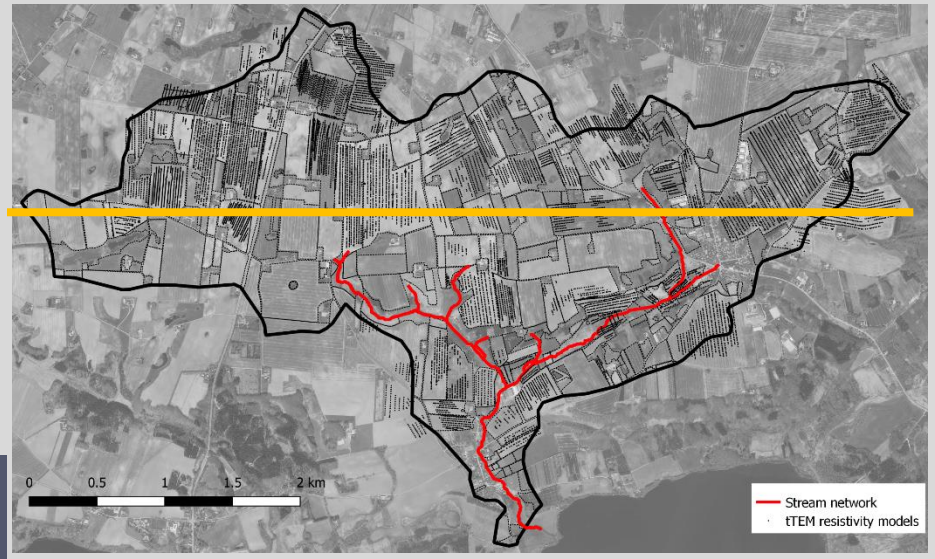

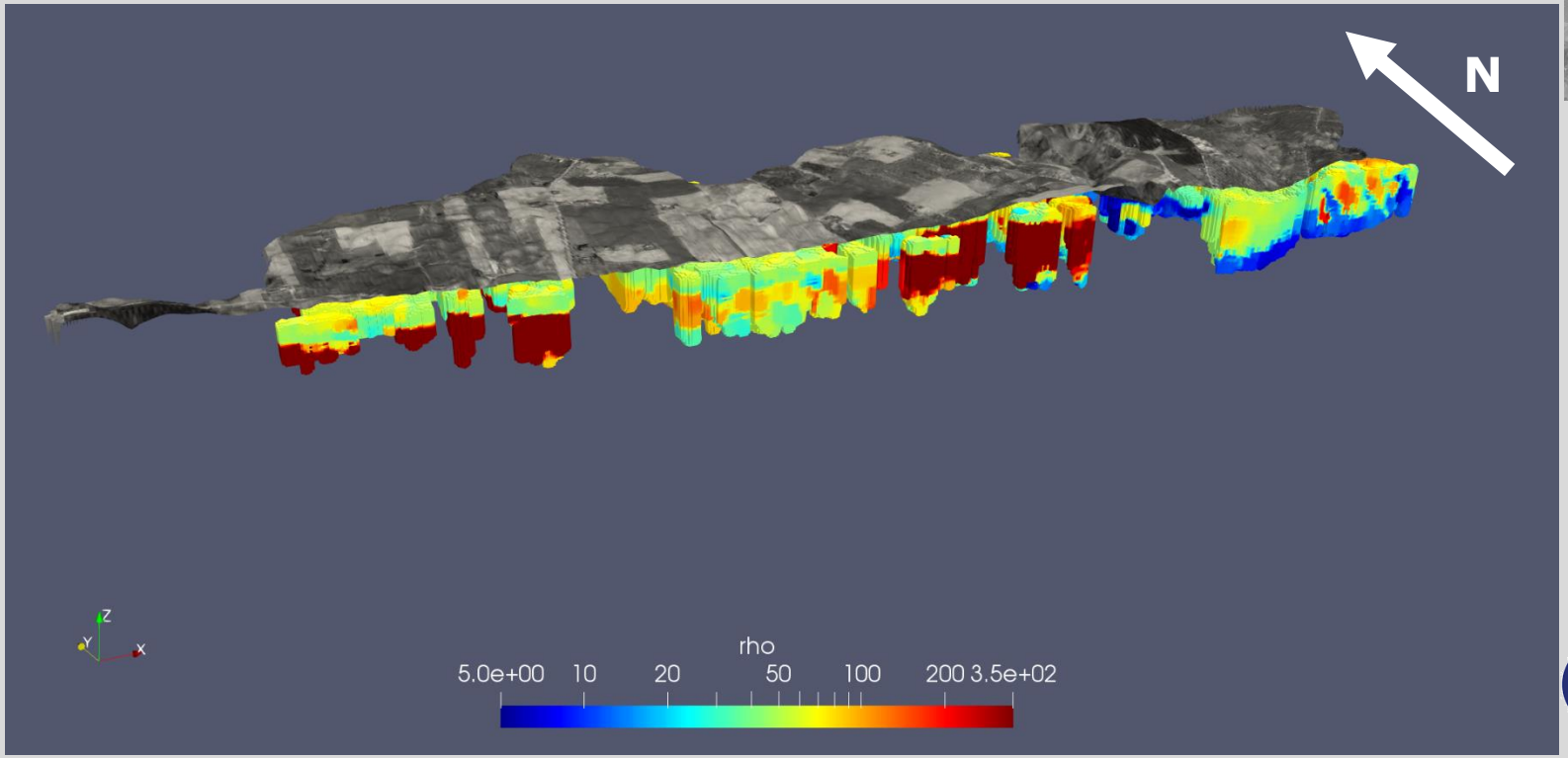

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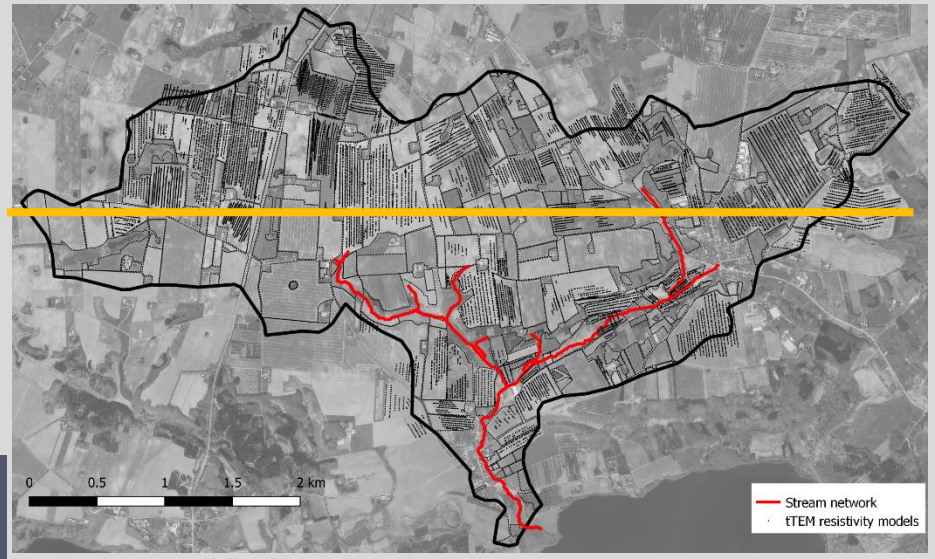
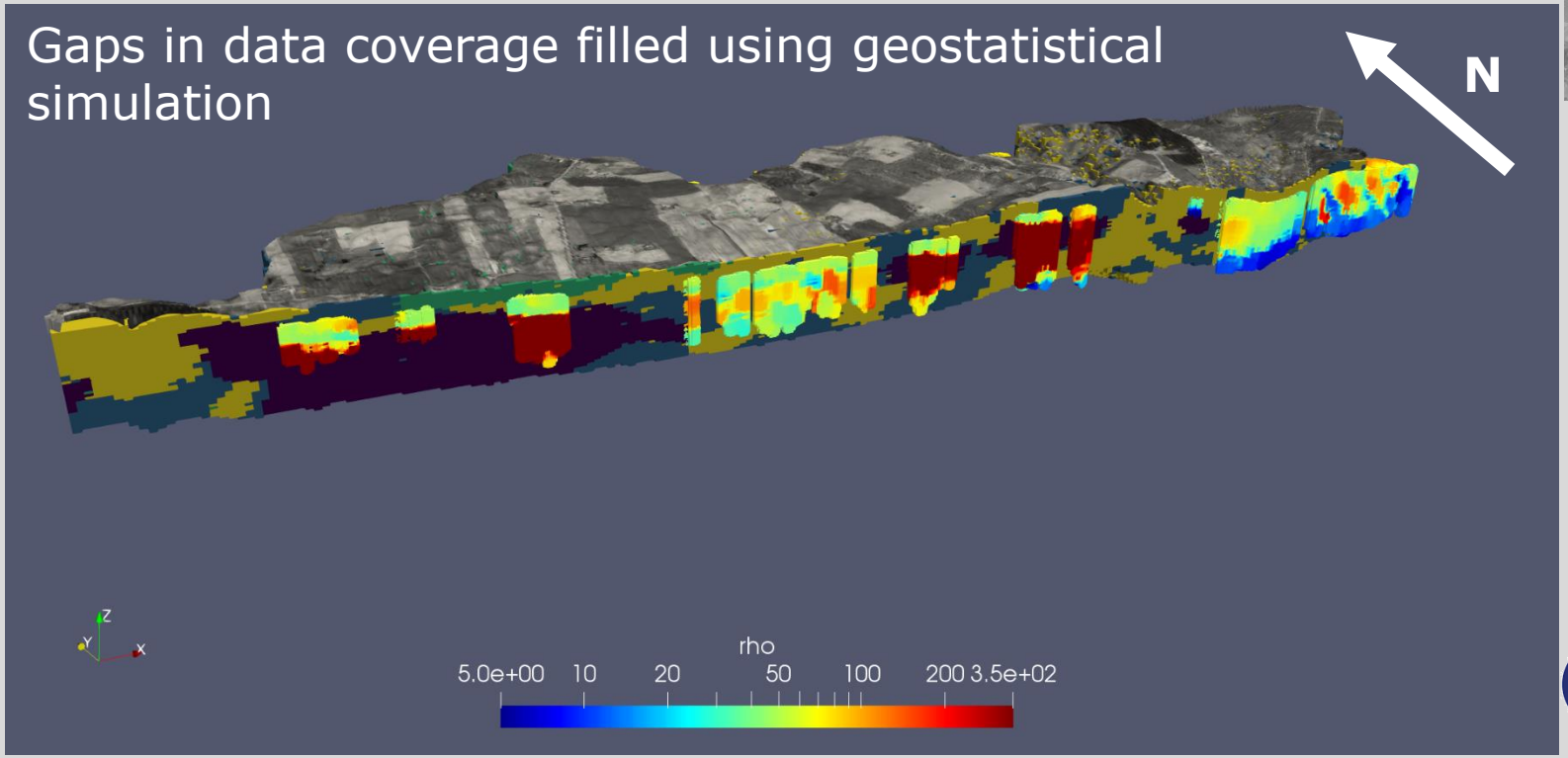


Gaps in data coverage filled using geostatistical simulation



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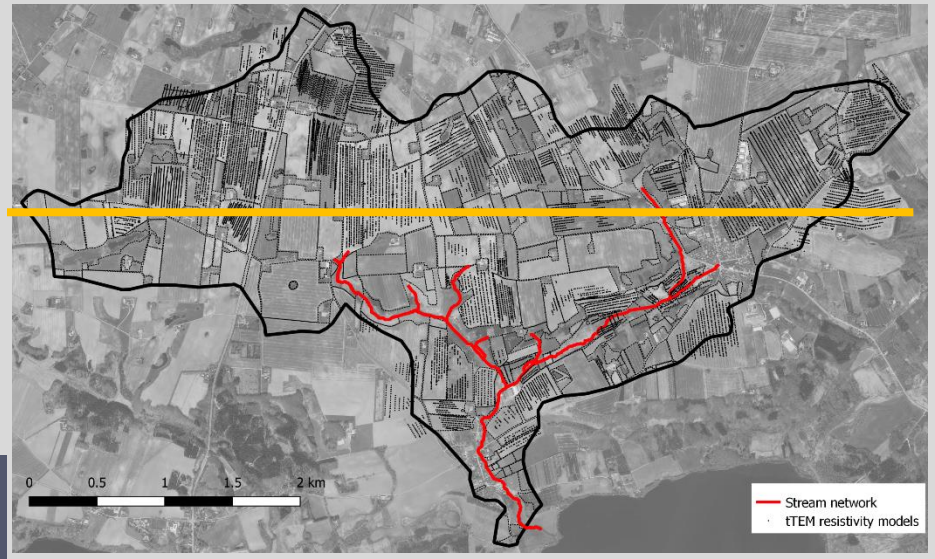

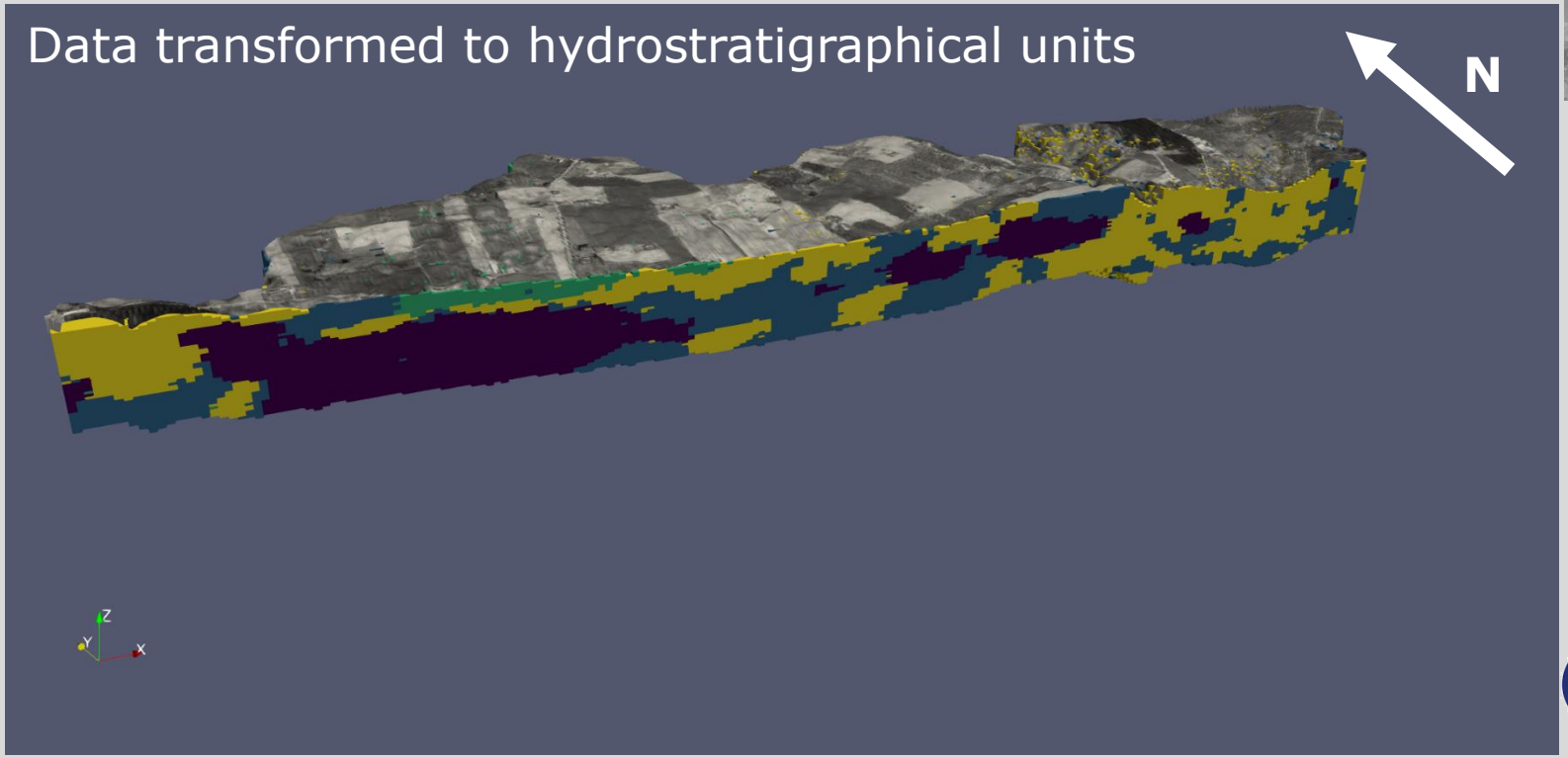

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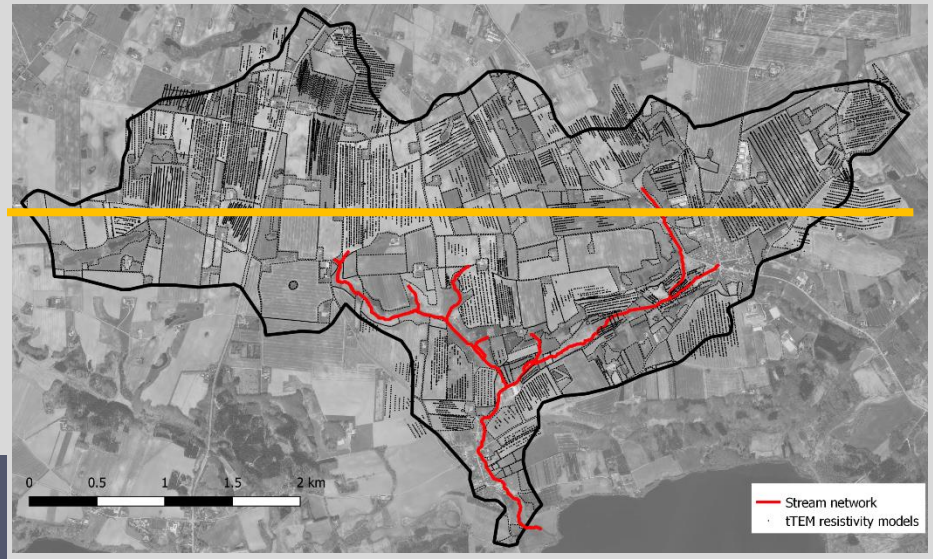

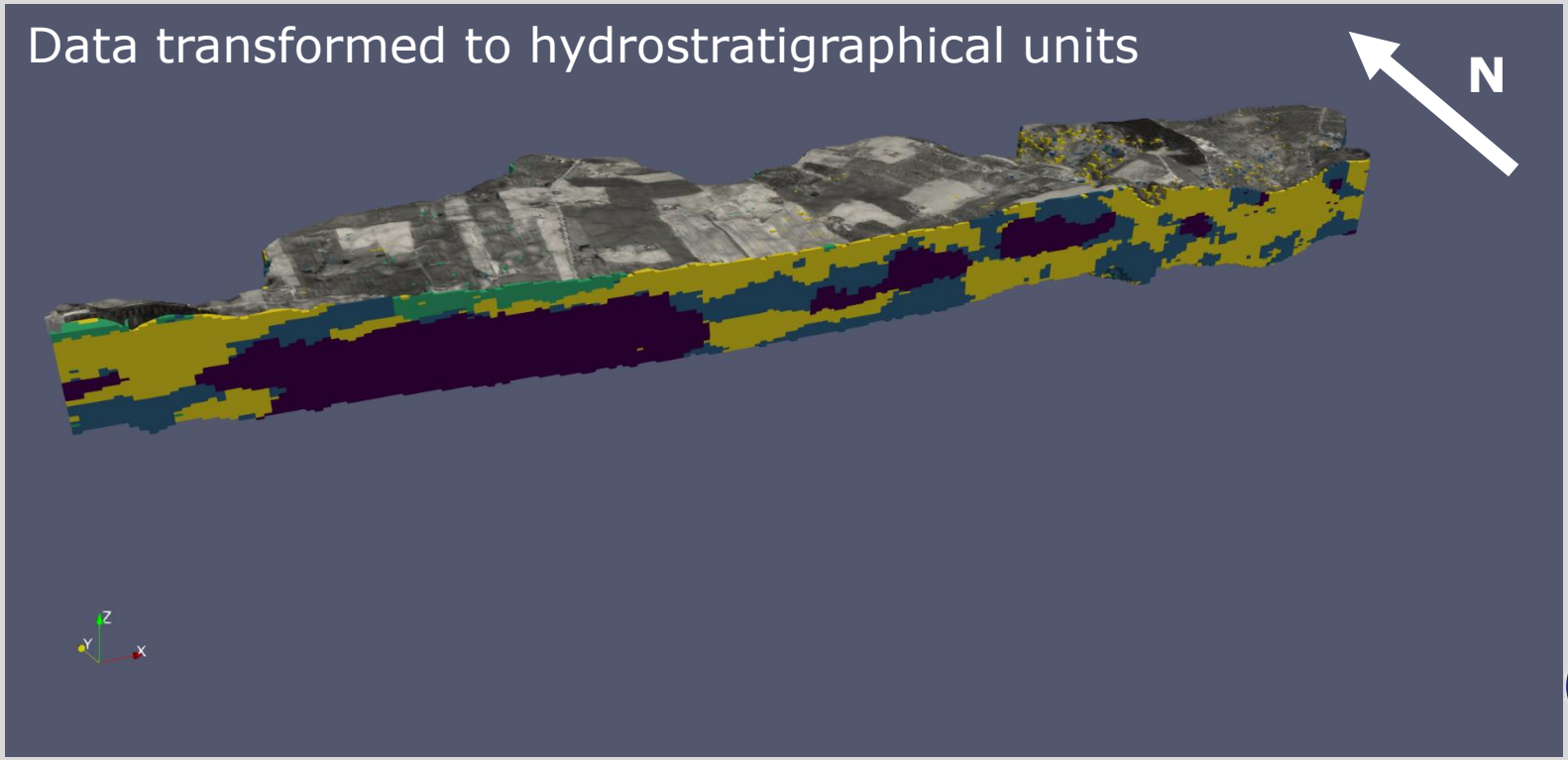

100 or more of these realizations –
all in accordance with the geophysics

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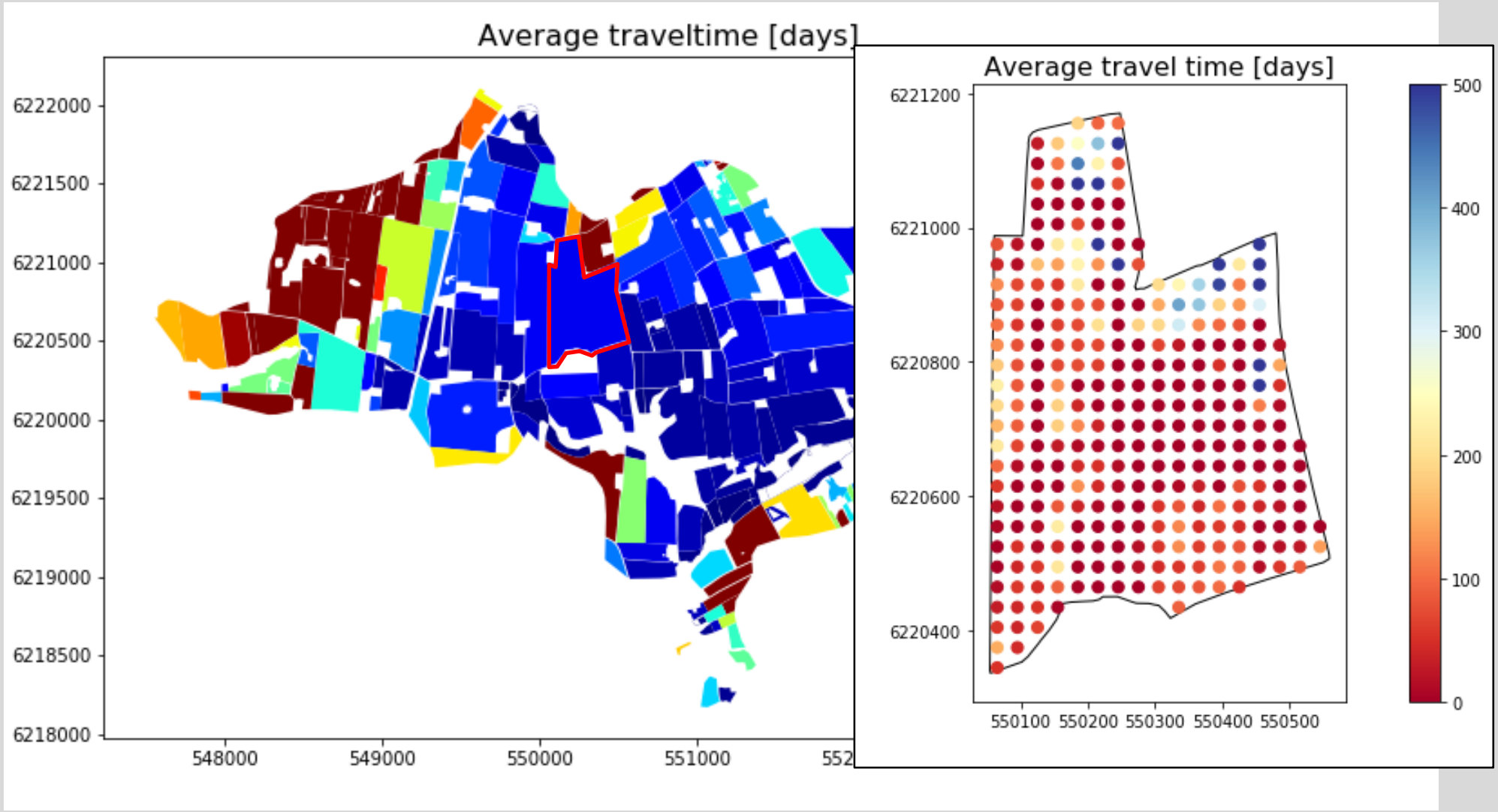
Javngyde, mark #229, dropping water on the field



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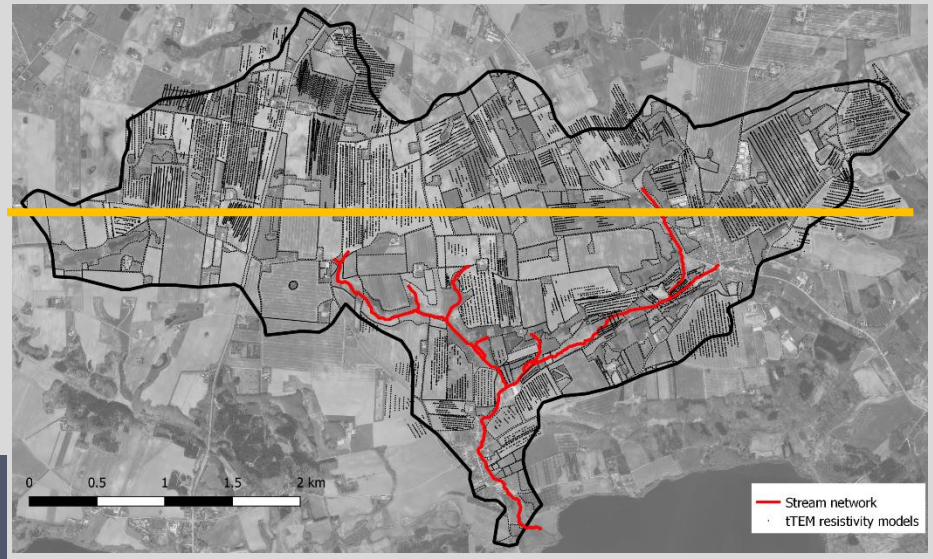
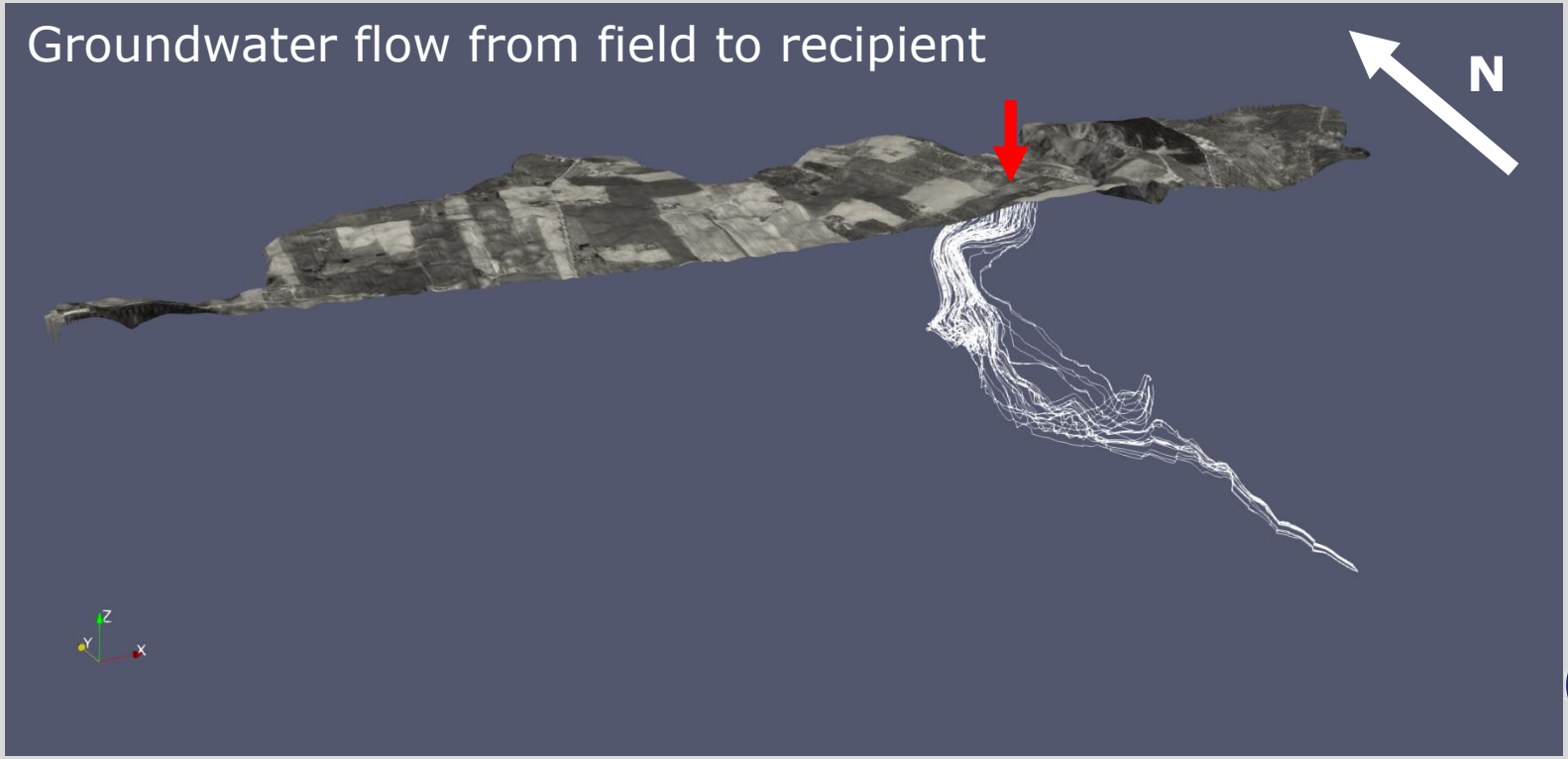
Groundwater flow simulation





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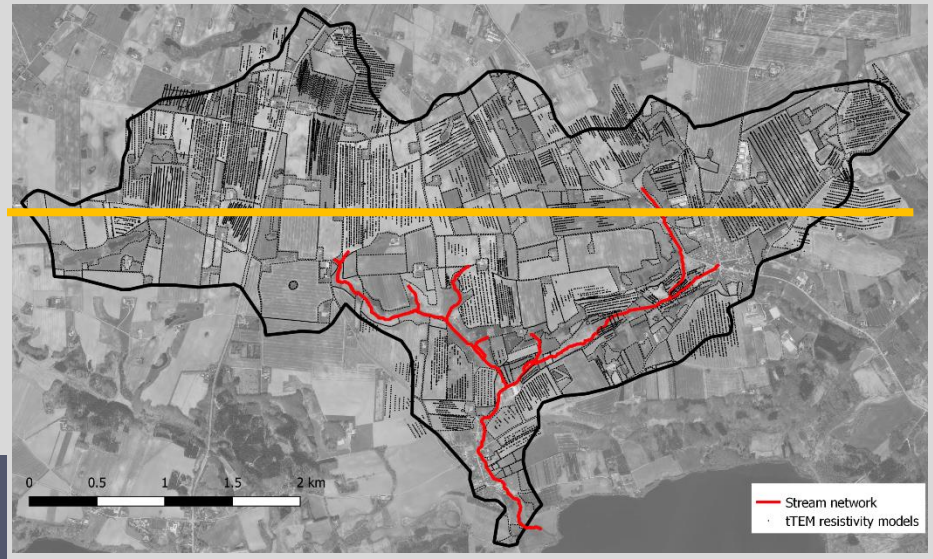

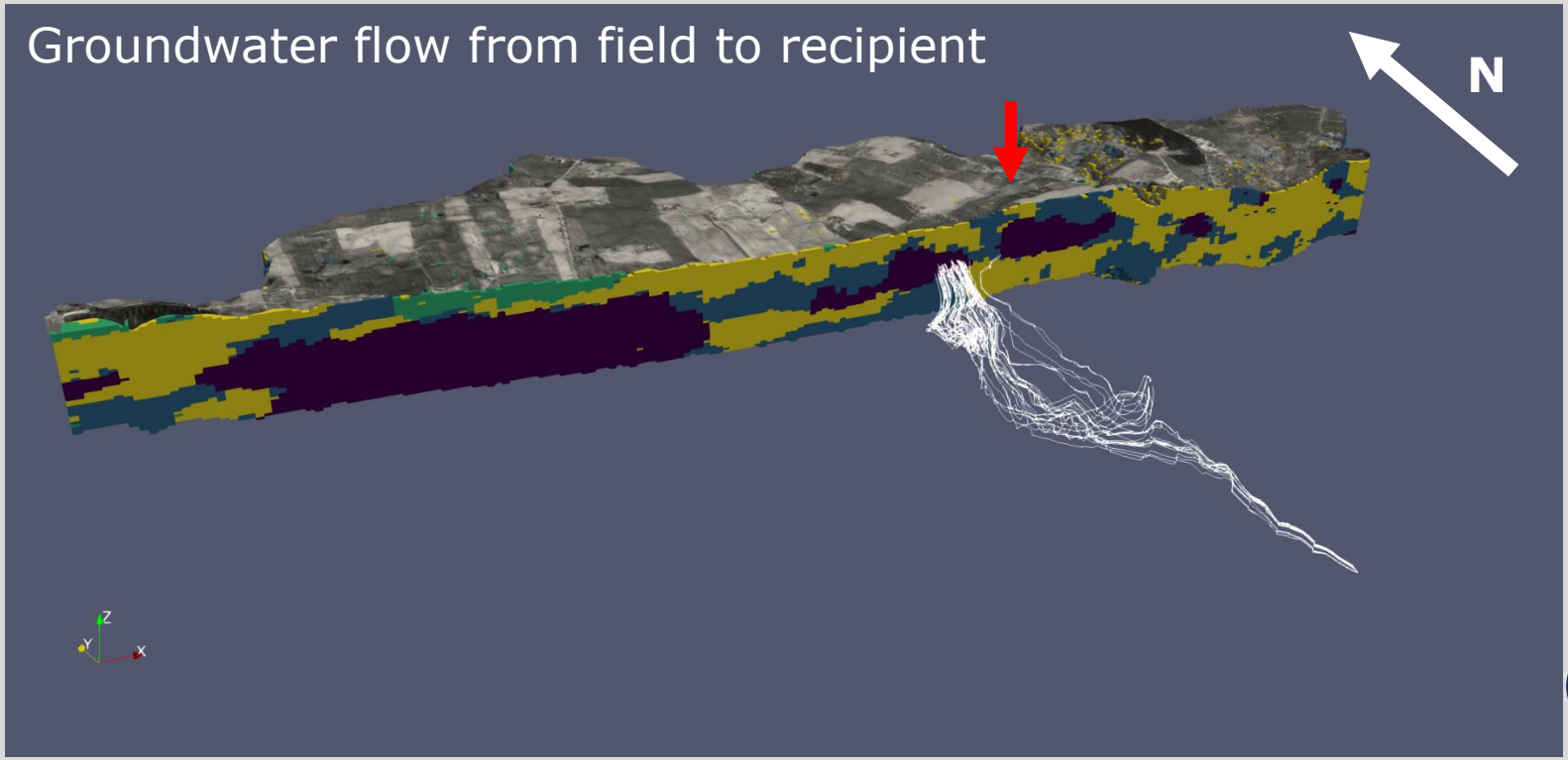

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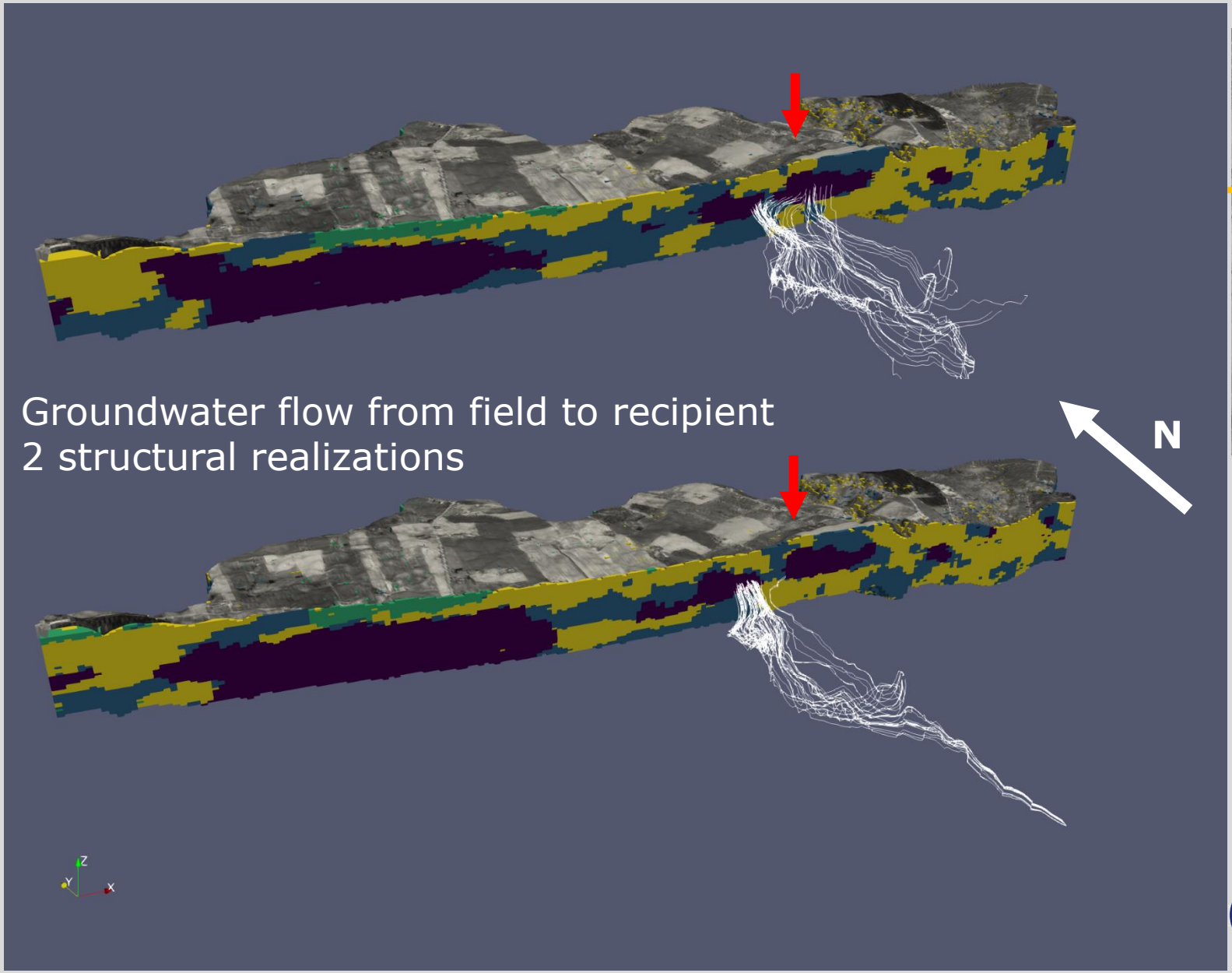
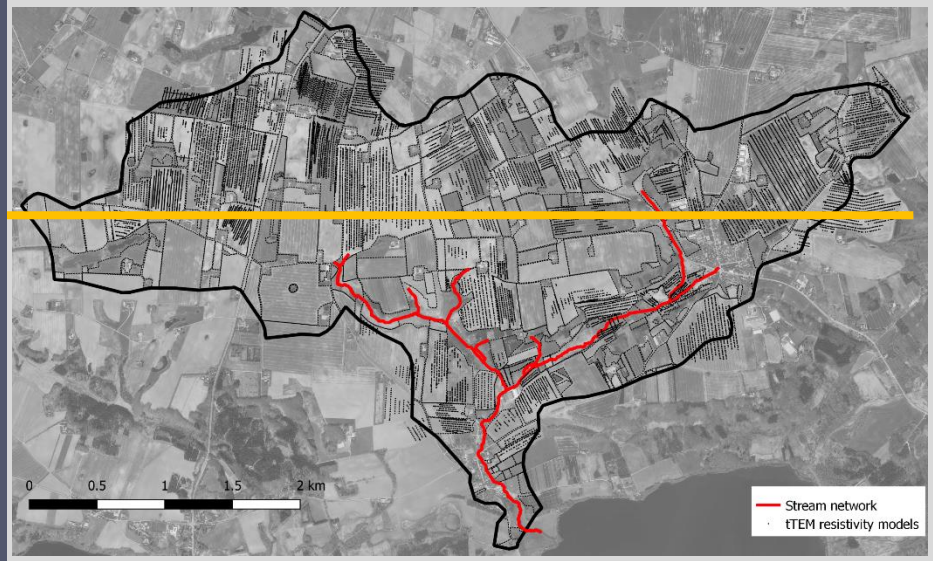
Groundwater flow simulation





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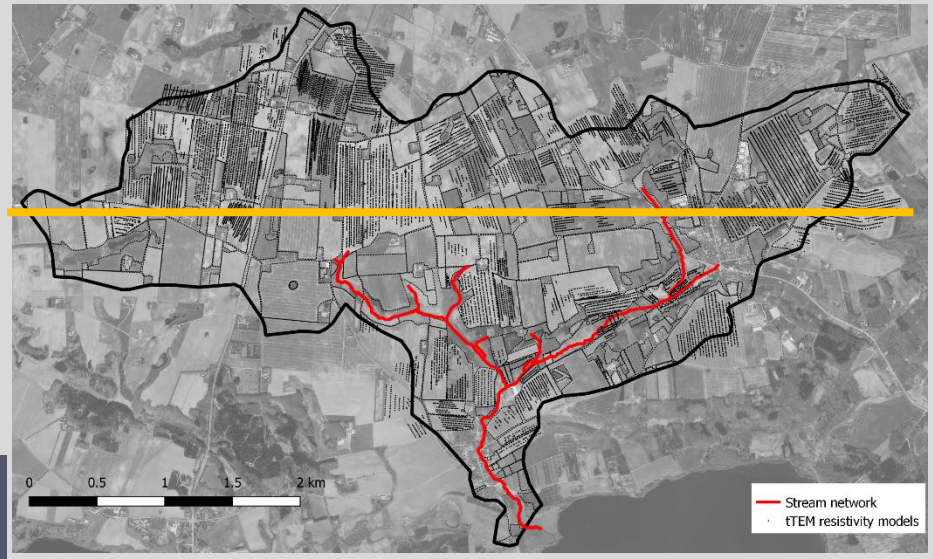
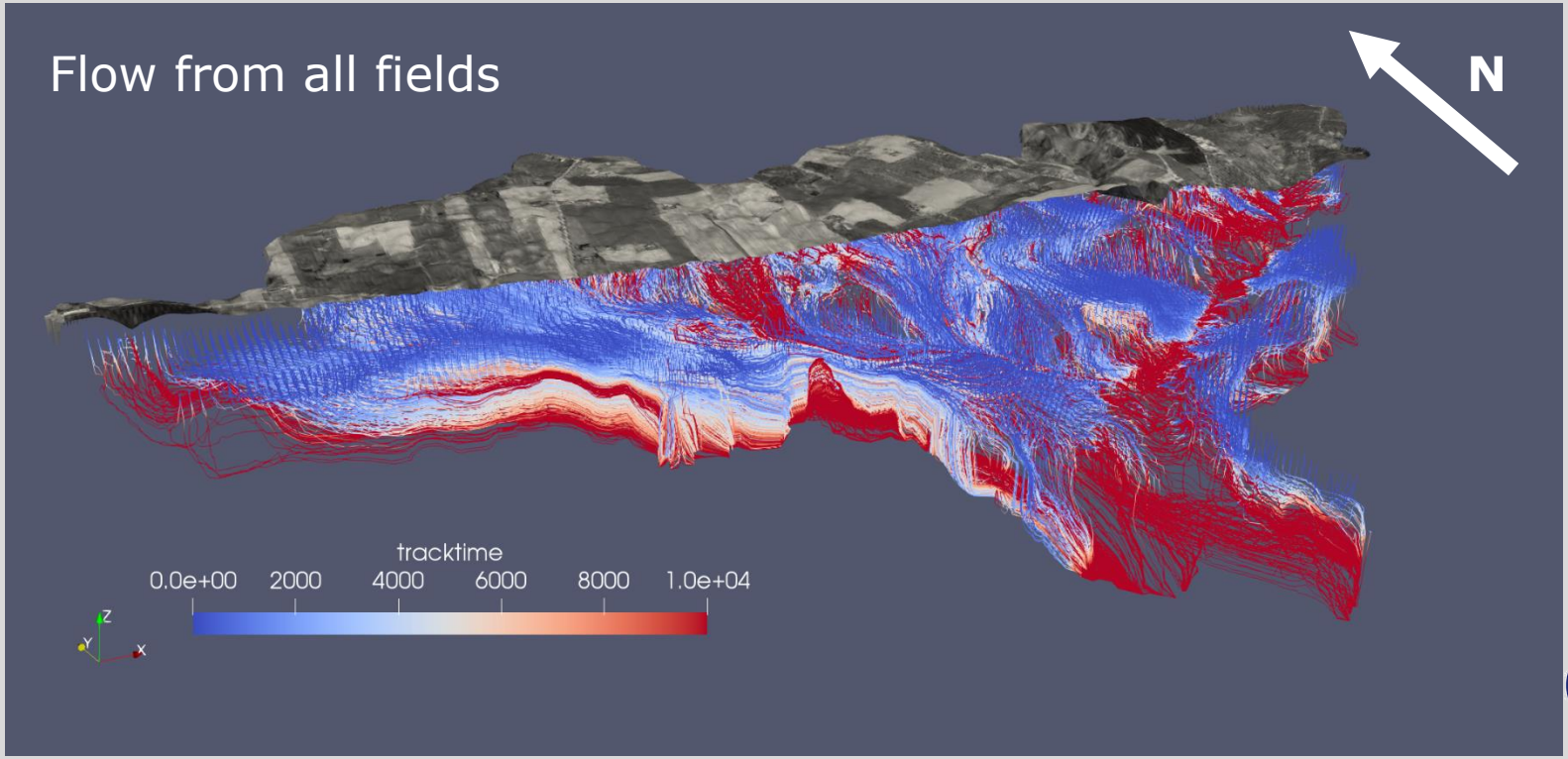
Groundwater flow simulation





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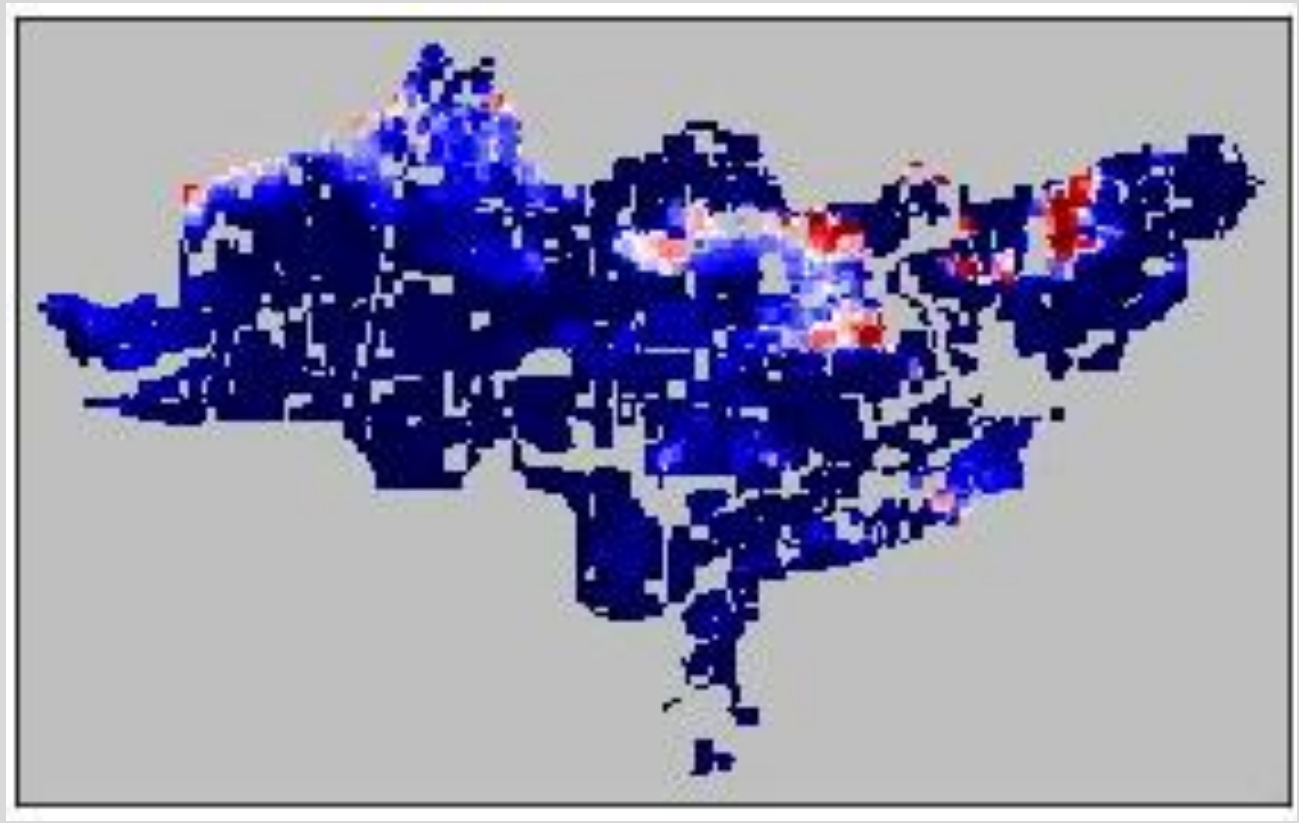
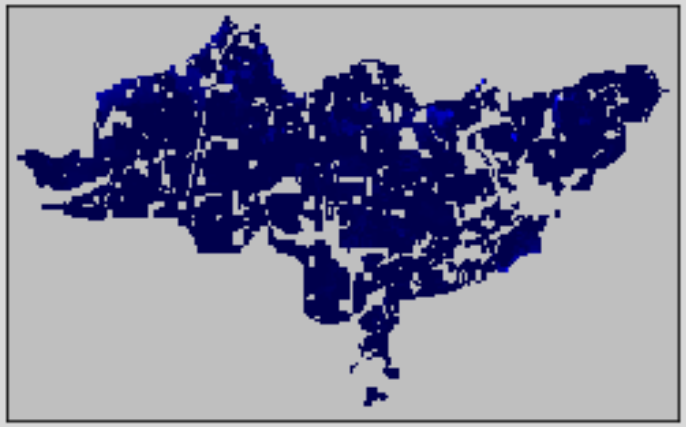
Retention realizations – retention at the outlet

Retention maps



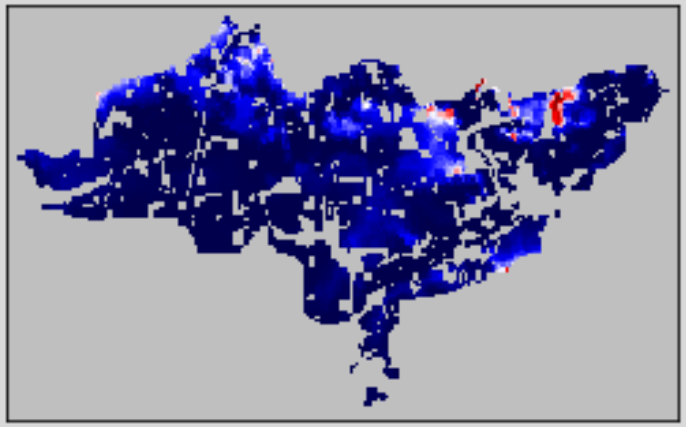
Probabilities

Lowest 10%



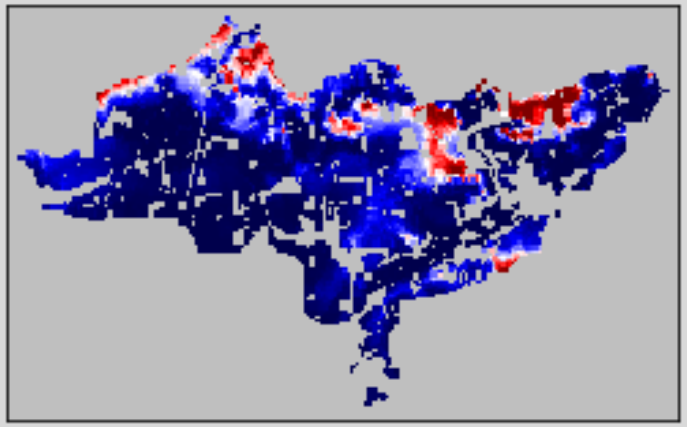
”Pessimisten”

Median



”Neutral”

Highest 10%



”Optimisten”

Between Lowest and Highest we have 80 % of the possible retention values

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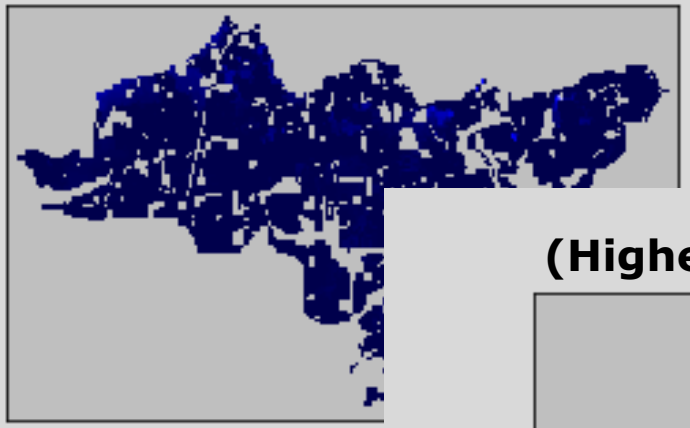
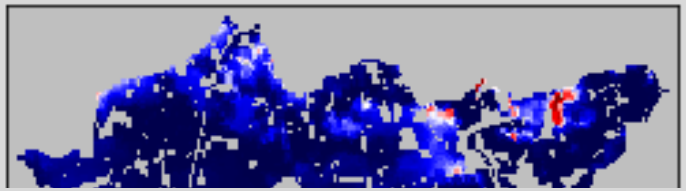
Uncertainity

Lowest 10%

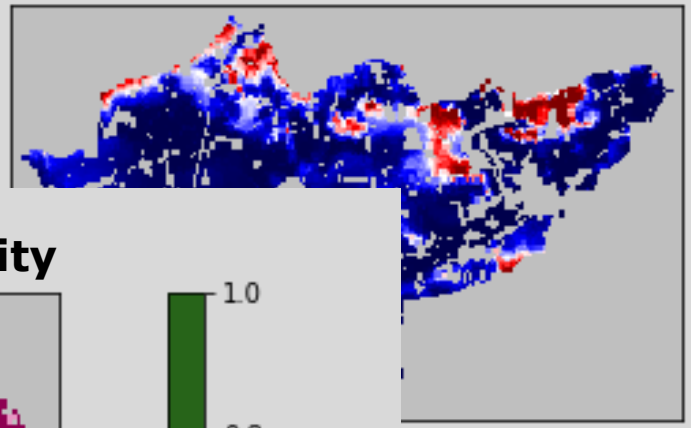


”Pessim

Median

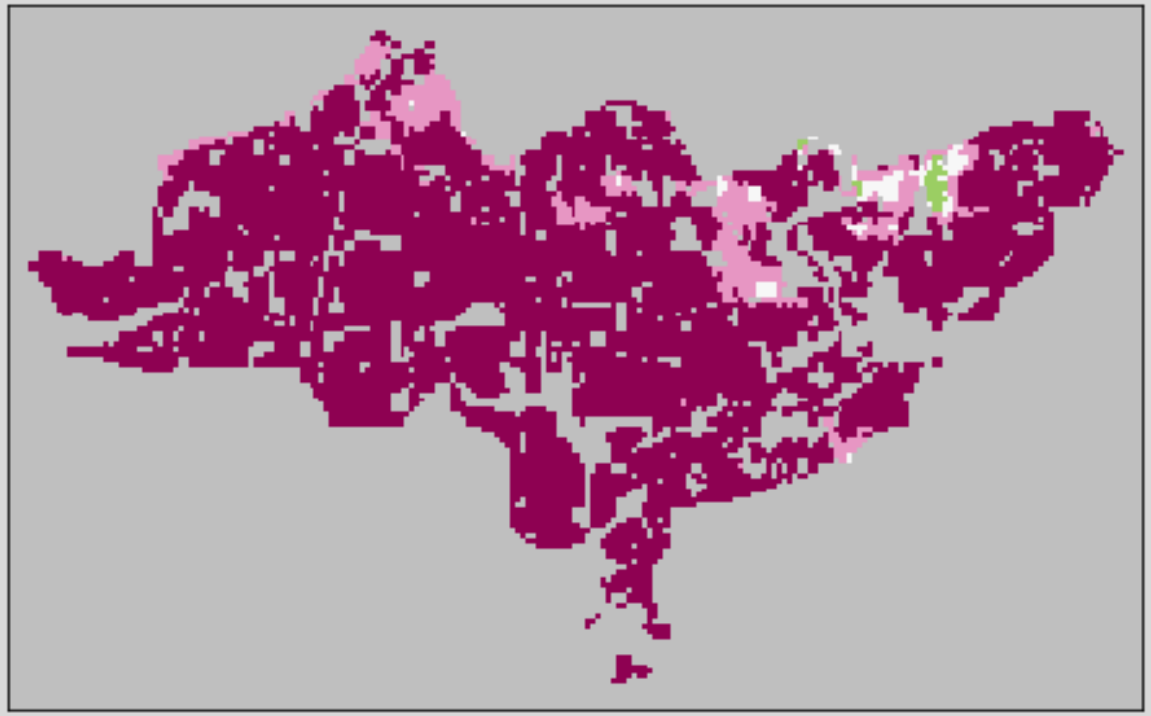


Highest 10%



sten”

(Highest ÷Lowest)/Highest = rel. uncertainity



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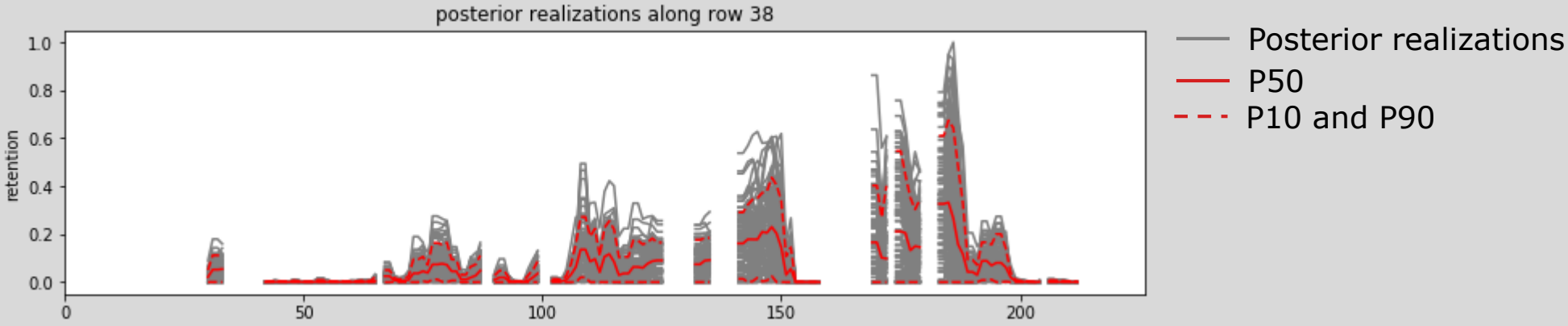
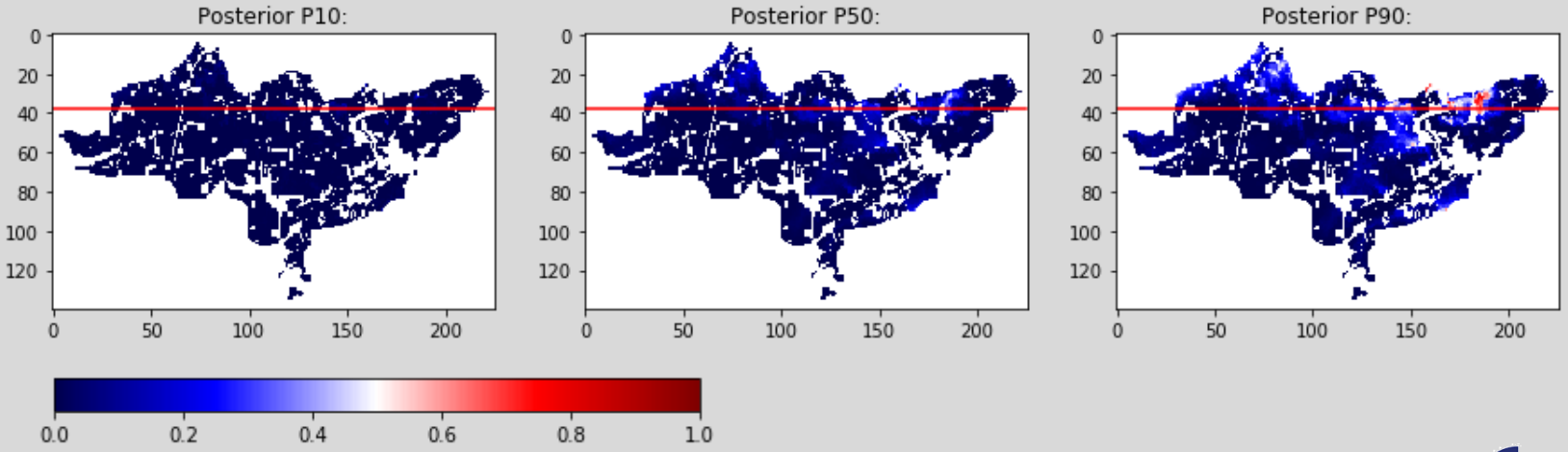
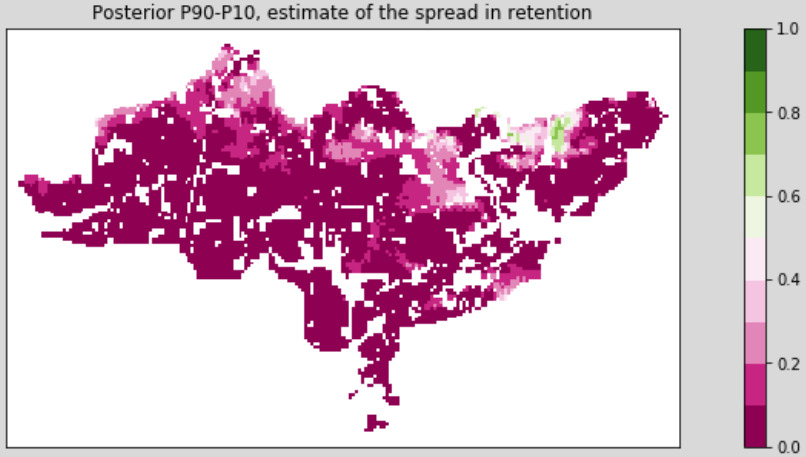
Uncertainty on Retention mapping







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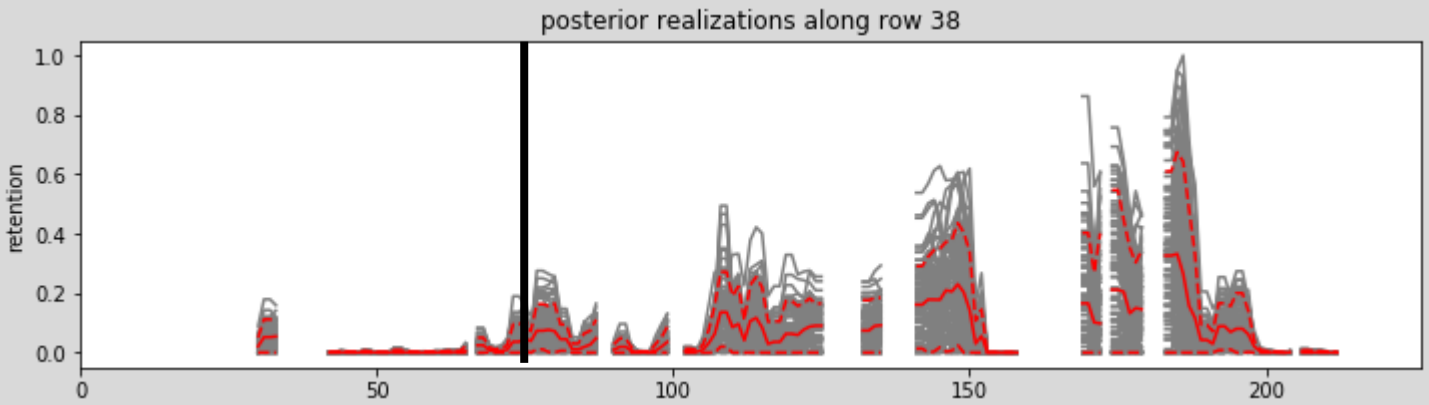
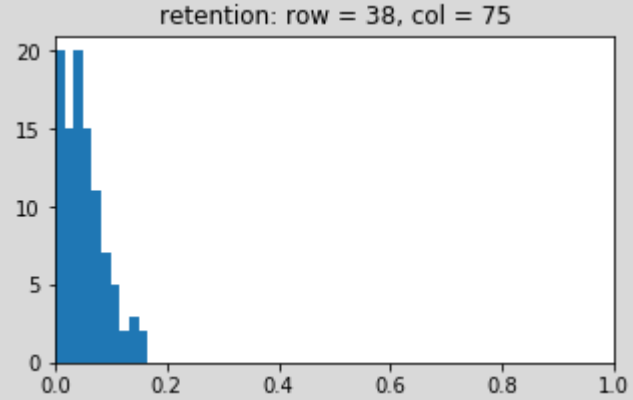
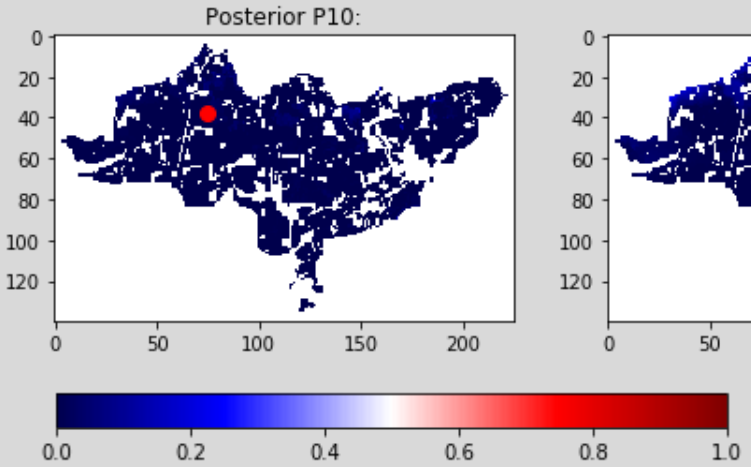
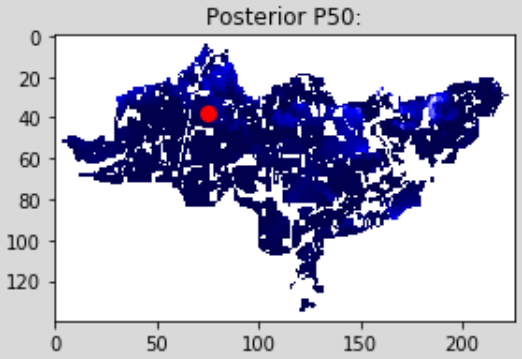
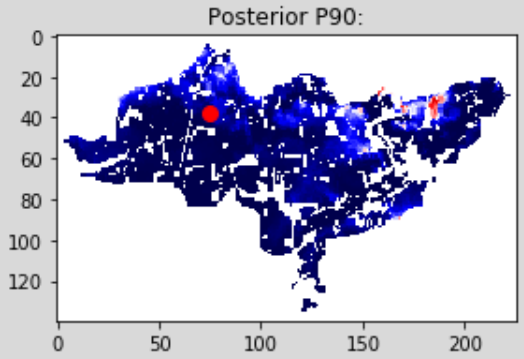
Uncertainty on Retention mapping

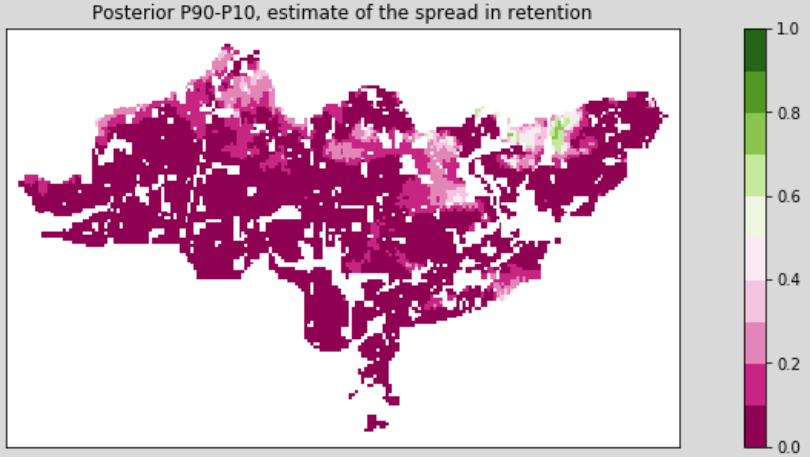












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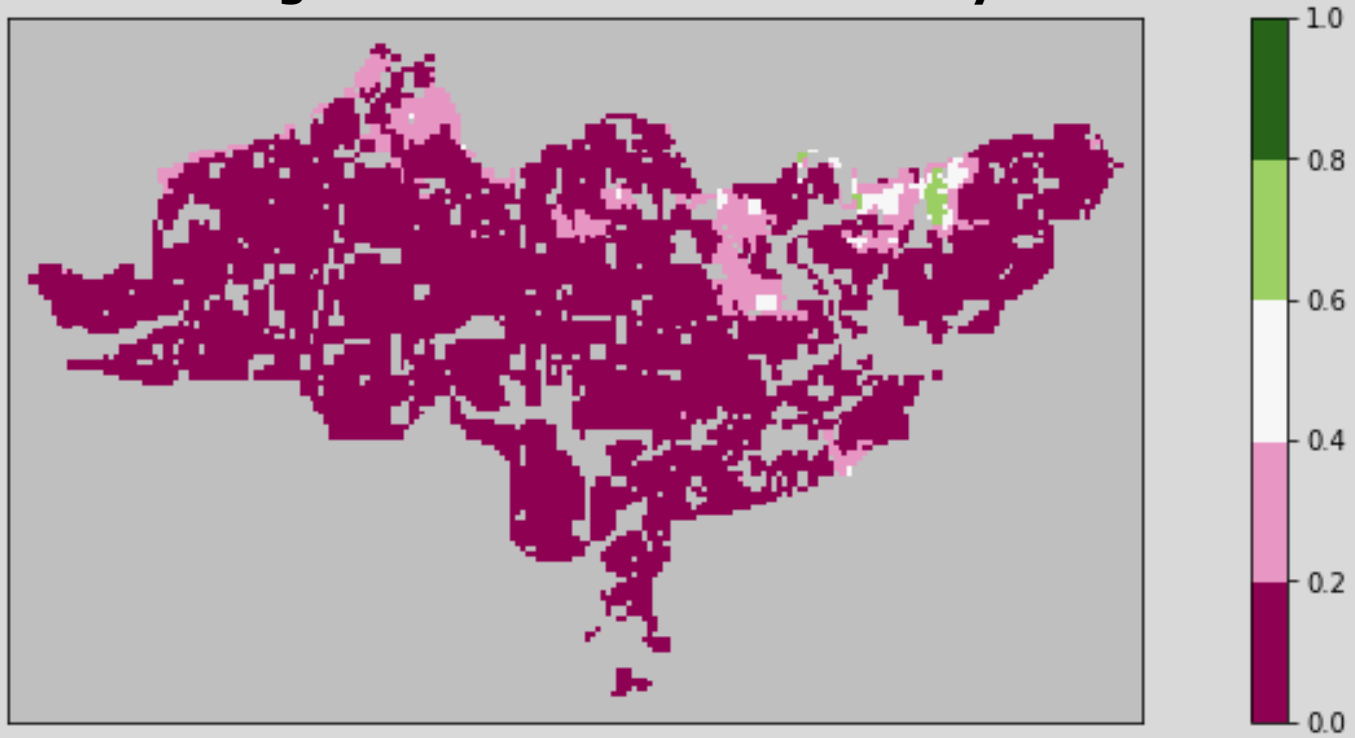
Uncertainity

- Drain dominated catchment with general low retention
- Uncertainty is in generally below 20%

Highest ÷Lowest = uncertainity



Konklusion

- **Der ligger et (næsten) færdigt beslutningsstøtteværktøj til beregning af N-retention på hektarskala**
  - Effektive geofysiske målemetoder
  - Geokemisk forståelse for udbredelse og omsætning af nitrat
  - Effektiv og datadrevet hydrologisk modelleringsmiljø
  - Usikkerhedsanalyser er fuldt integreret

Tak

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