Data Management and Visualisation of 3D-Objects in the Geothermal Information System GeotIS

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Leibniz-Institut für Angewandte Geophysik

Funding & Partners

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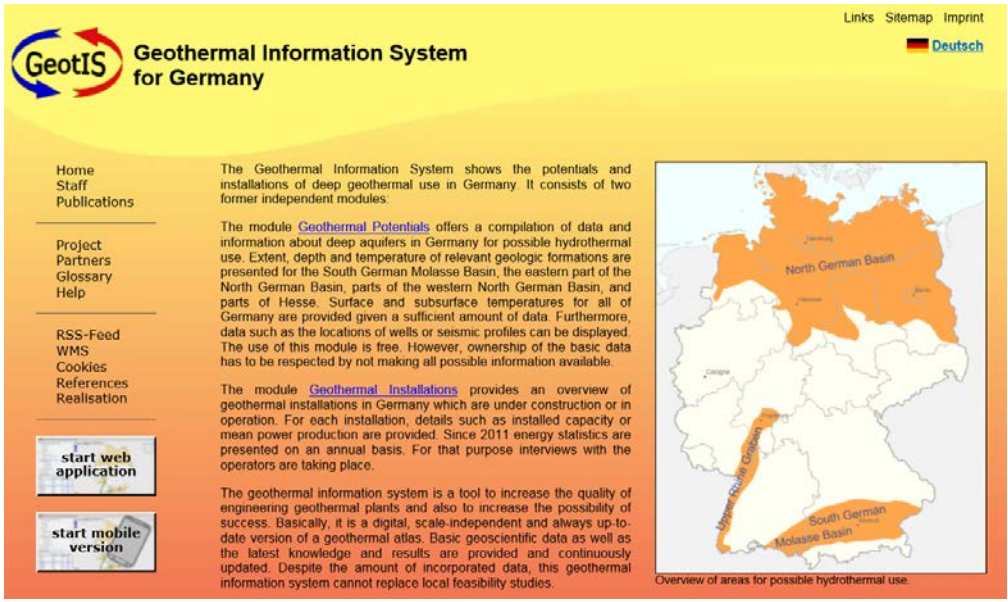
Web Site:

http://www.geotis.de

Current Partners:

GeotIS – Web-Based Geothermal Information System

- Location of geothermal facilities
- Operating parameters
- Geothermal energy statistics
- Areas of hydrothermal resources
- Well data
- Location of seismic surveys
- Stratigraphic models (3D)
- Subsurface temperature (3D)
- Hydraulic properties of formations
- Major fault network + fault literature



☛http://www.geotis.de

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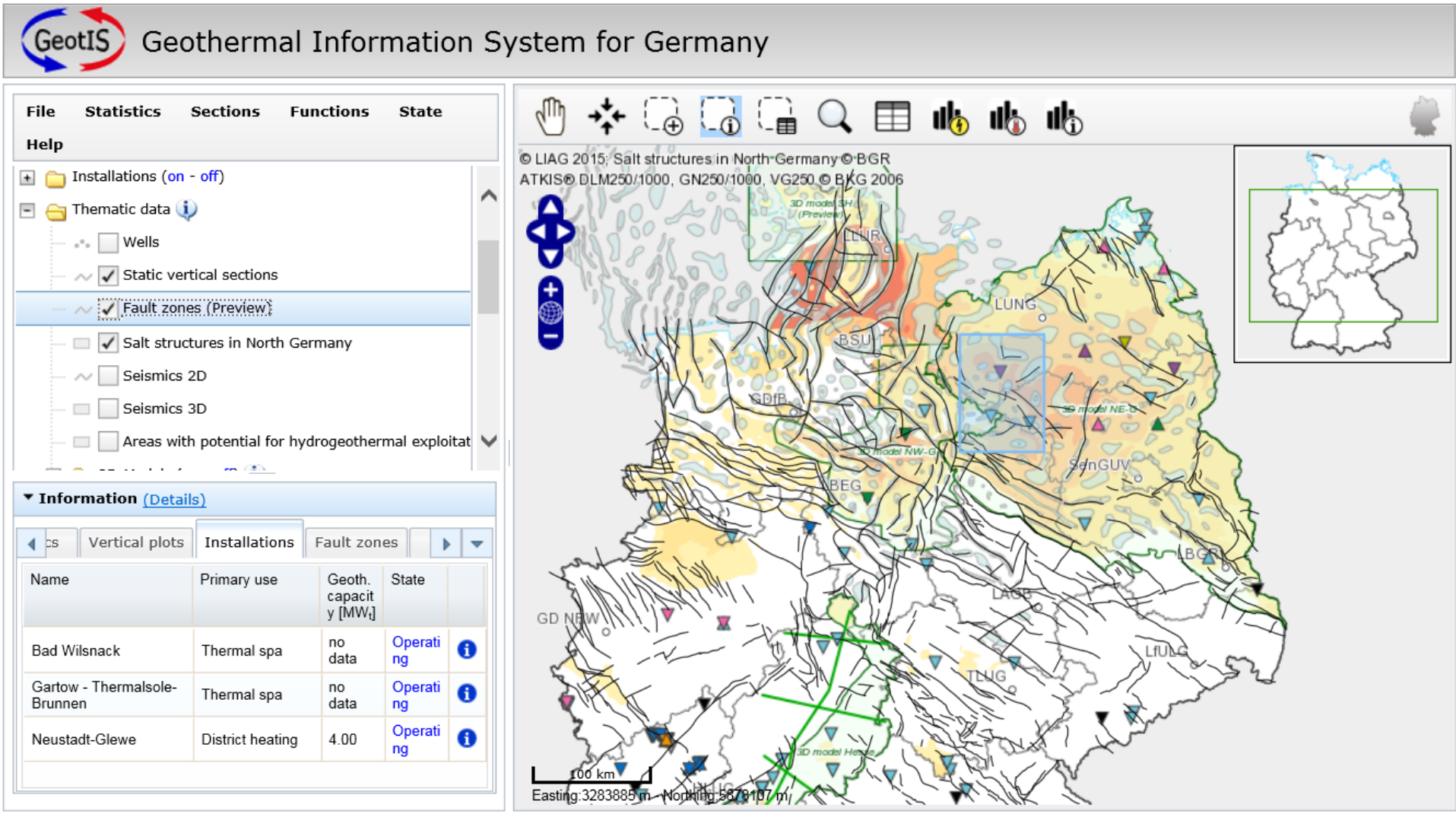
GeotIS Web Interface



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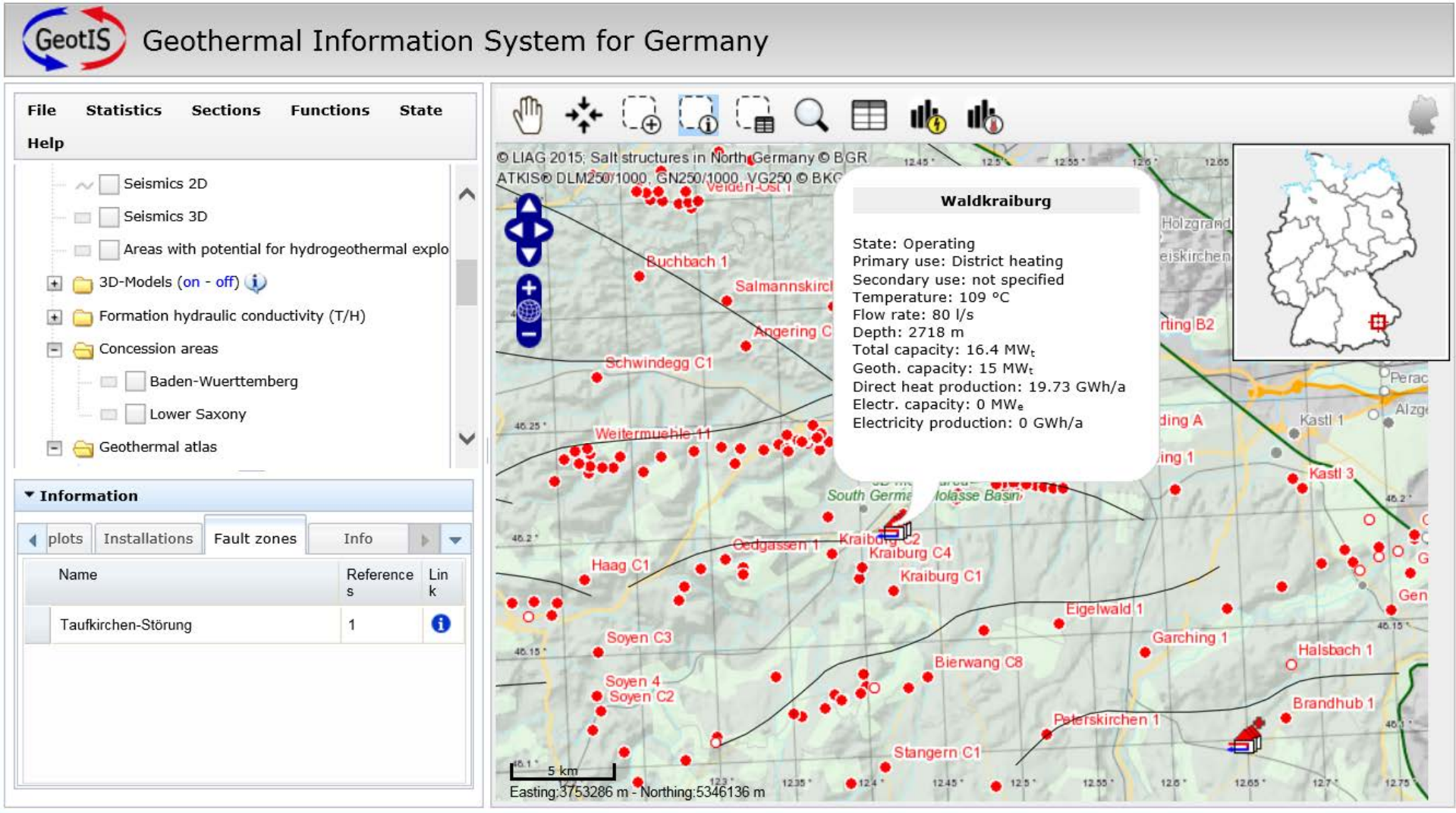
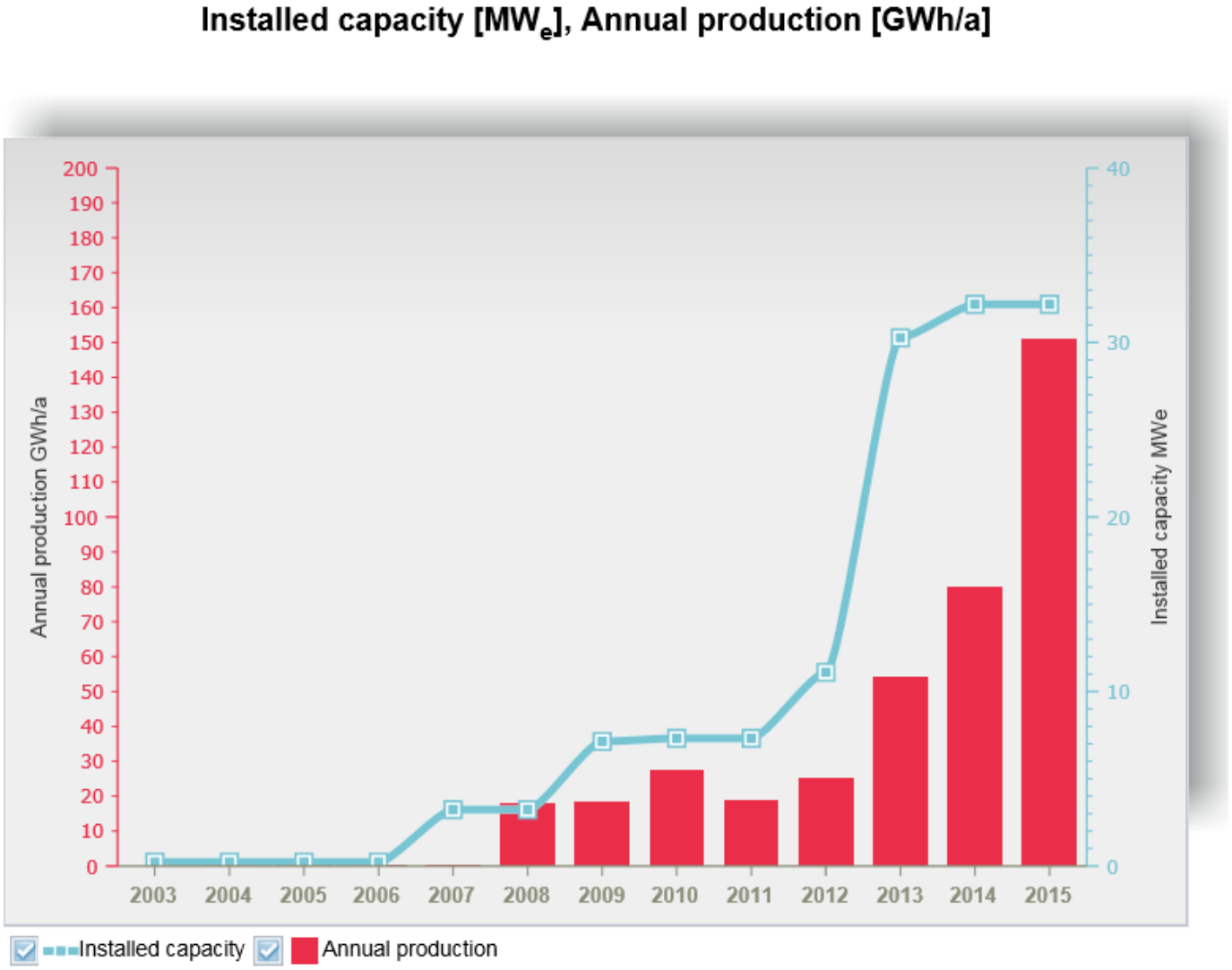
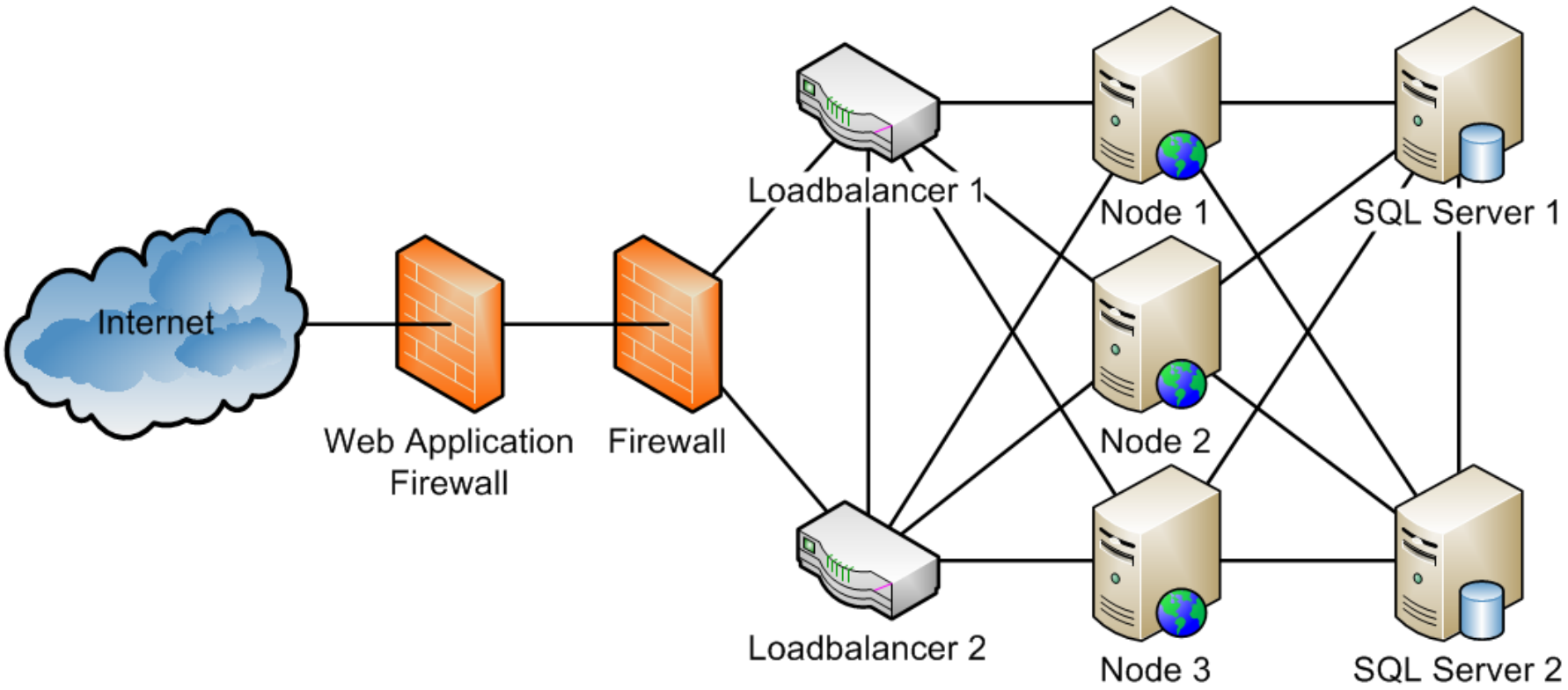
GeotIS Web Interface



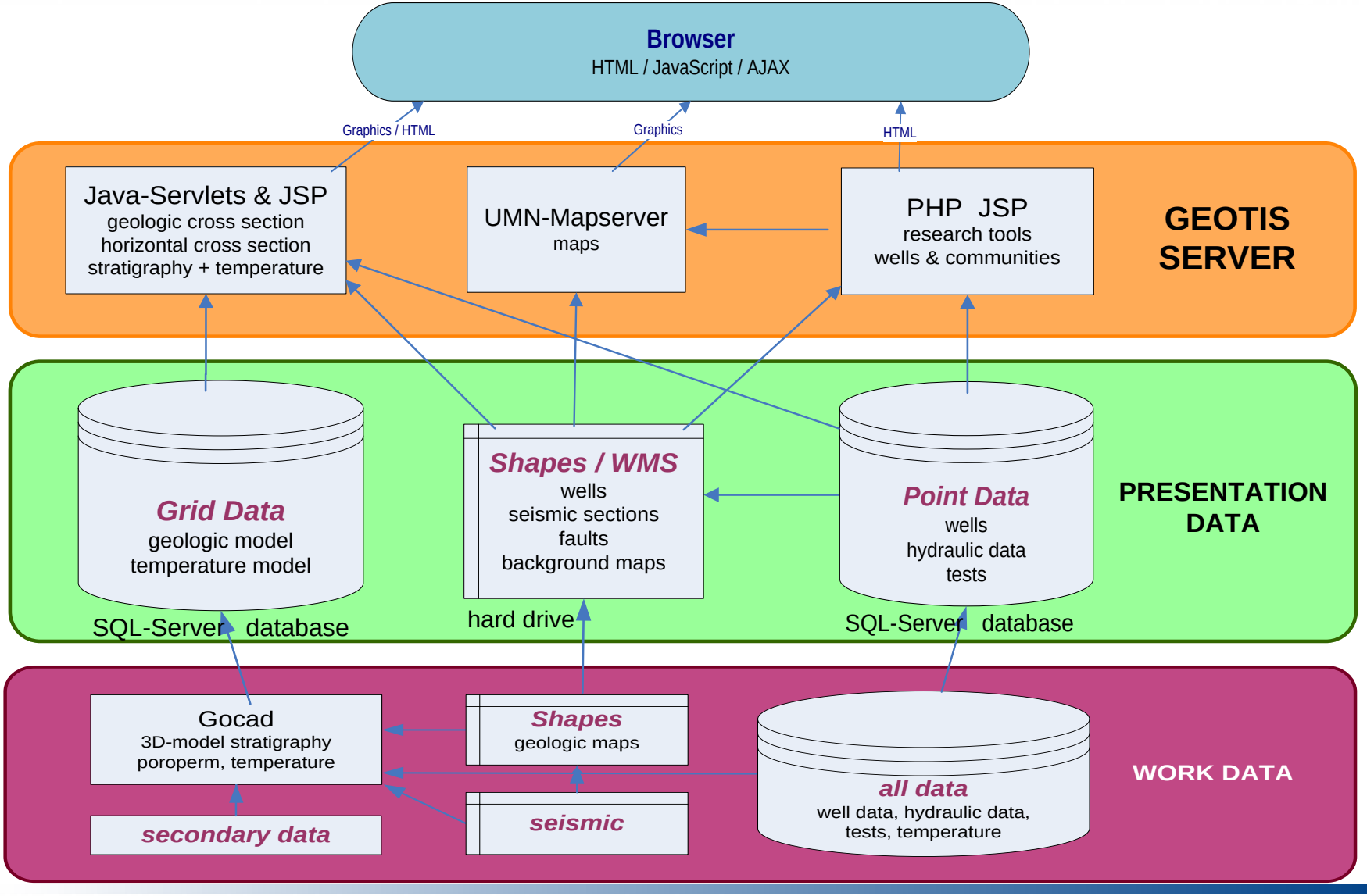
GeotIS Energy Statistics



GeotIS IT-Architecture



3 Layer Concept



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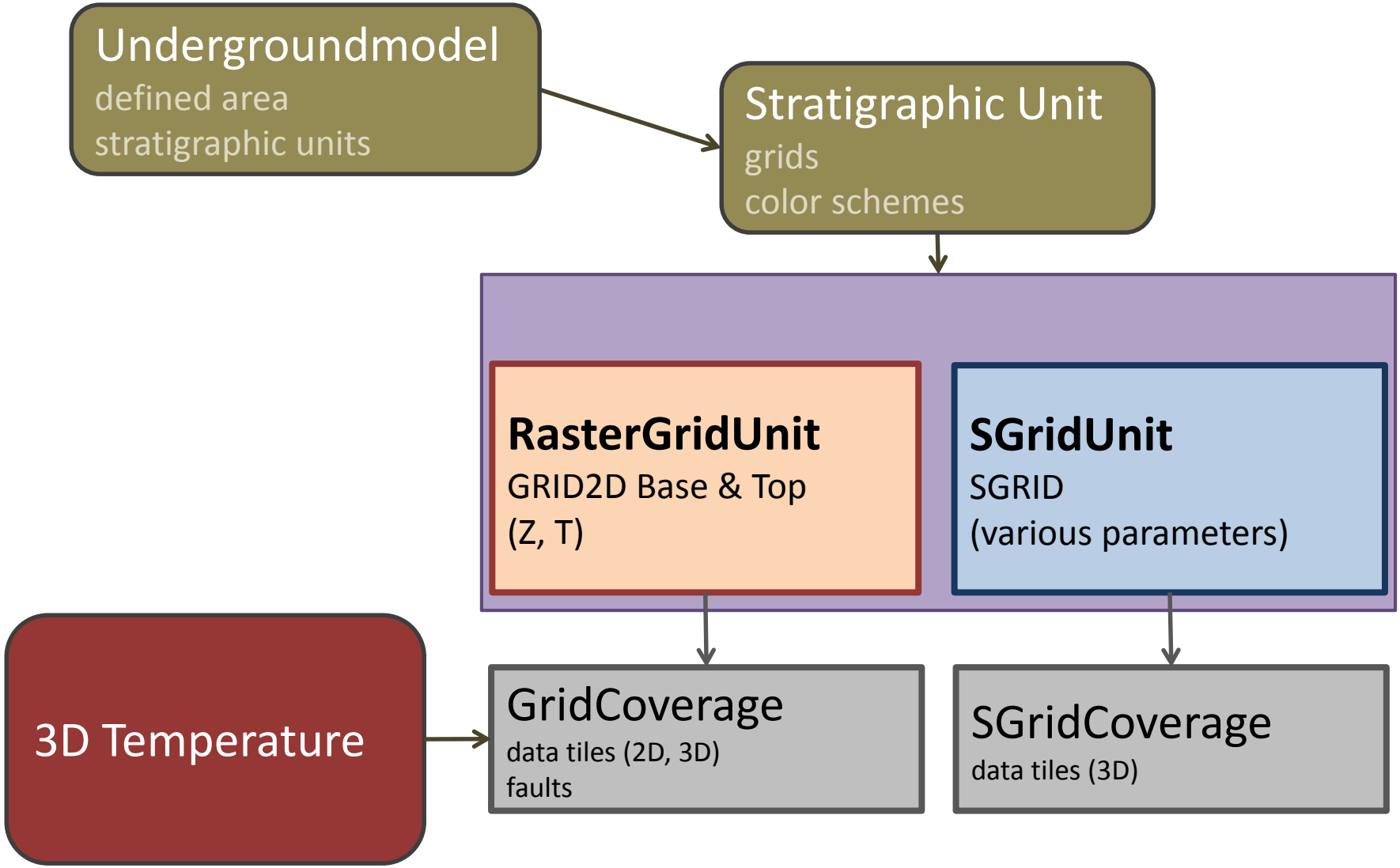
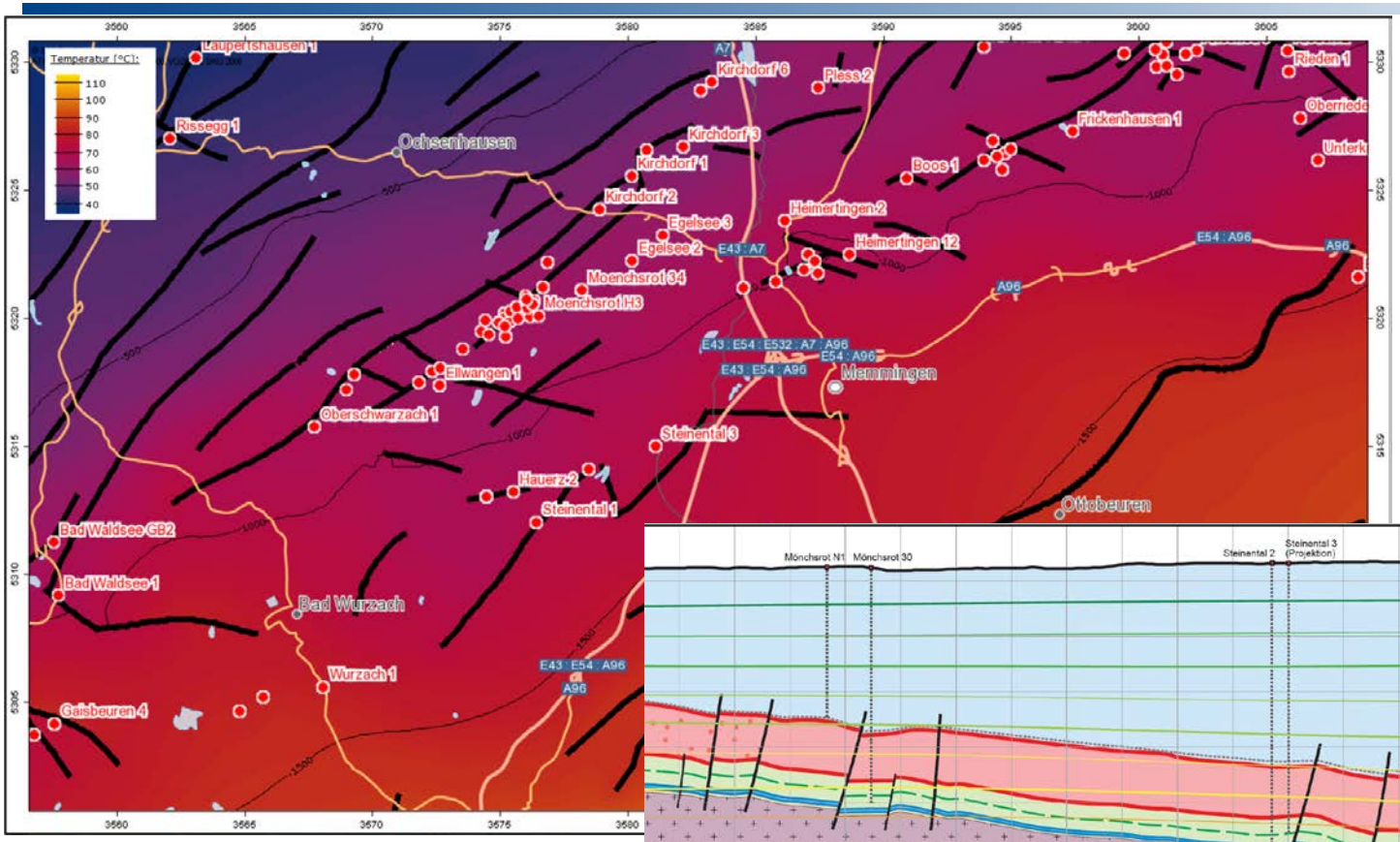
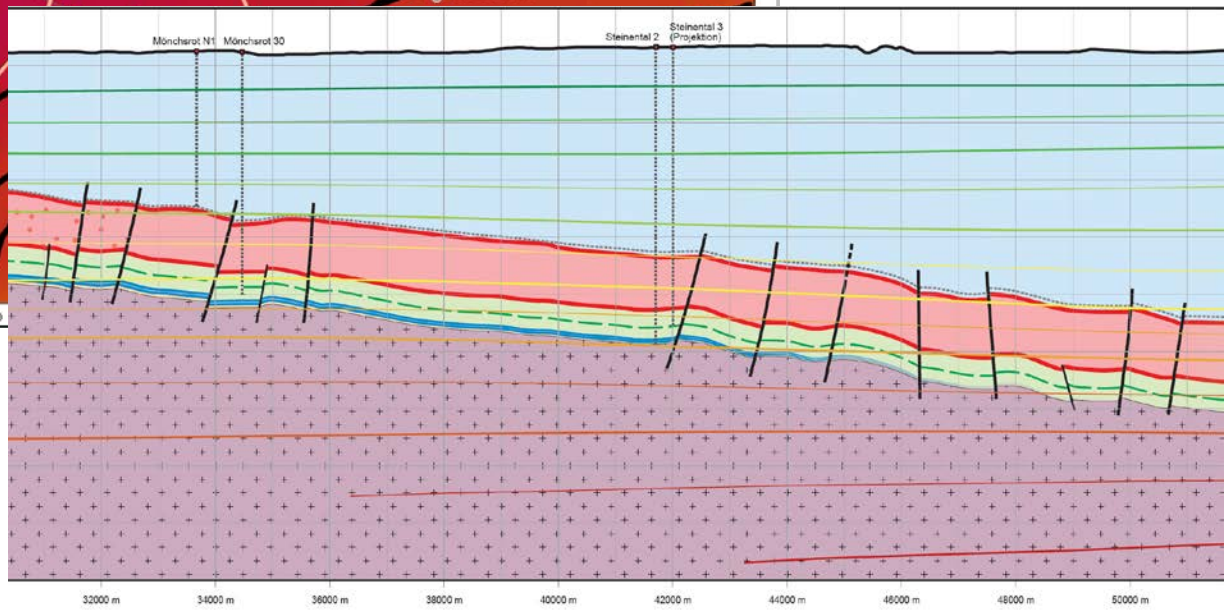
Grid Data


Undergroundmodel
defined area
stratigraphic units
Stratigraphic Unit
grids
color schemes
RasterGridUnit
GRID2D Base & Top
(Z, T)
SGridUnit
SGRID
(various parameters)
3D Temperature
GridCoverage
data tiles (2D, 3D)
faults
SGridCoverage
data tiles (3D)

Viualisation of Faults in GeotIS





Molasse (Tertiär)
Oberjura (Malm) Helvetische Fazies
Oberjura (Malm) Schwäbische Fazies
Oberjura Riffstrukturen
Mittlerer/Unterer Jura Keuper
Oberer Muschelkalk

20 °C
40 °C
60 °C
80 °C
100 °C
120 °C
140 °C
160 °C
180 °C
200 °C

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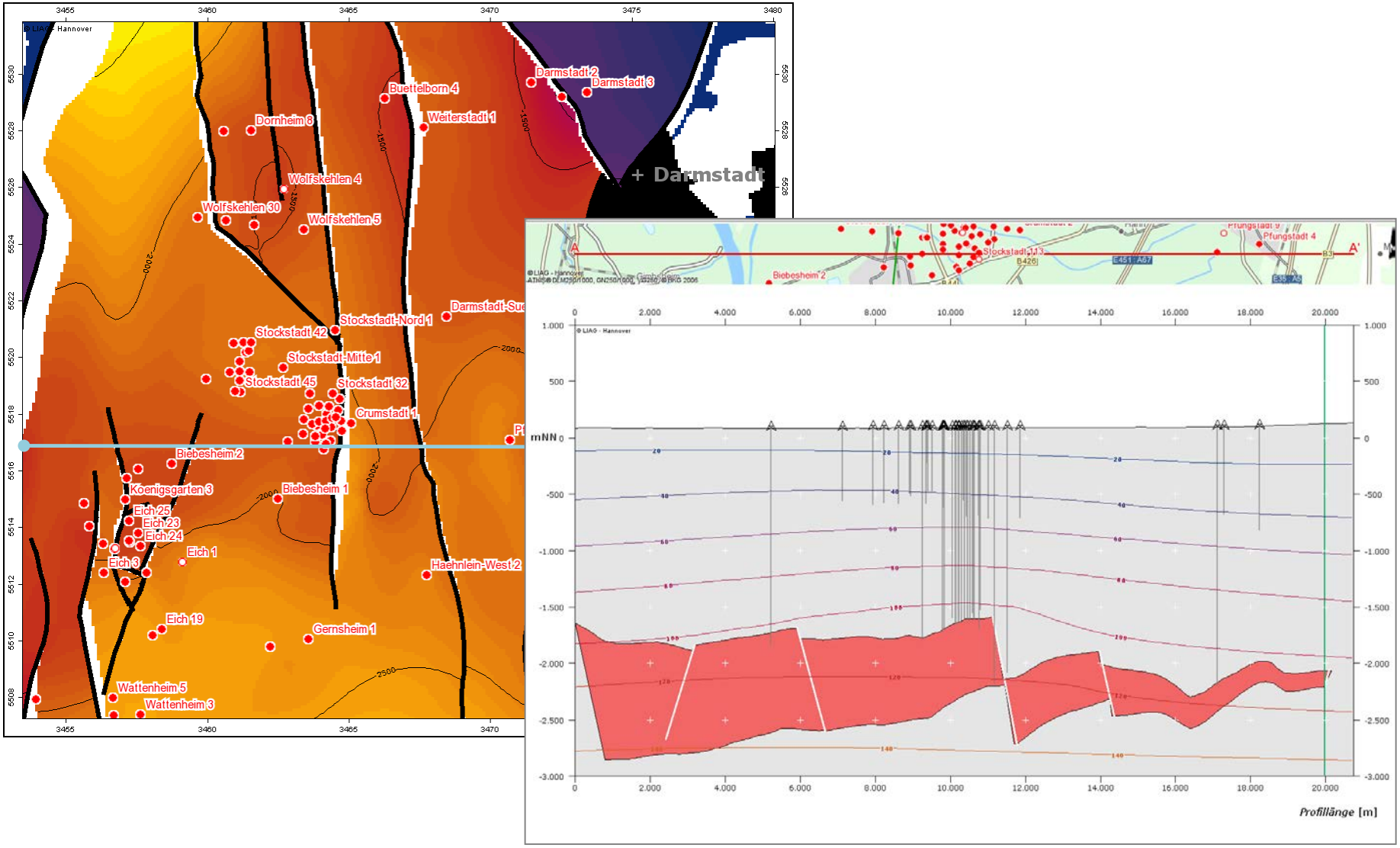
Visualisation of Faults and Interactive Cross Sections



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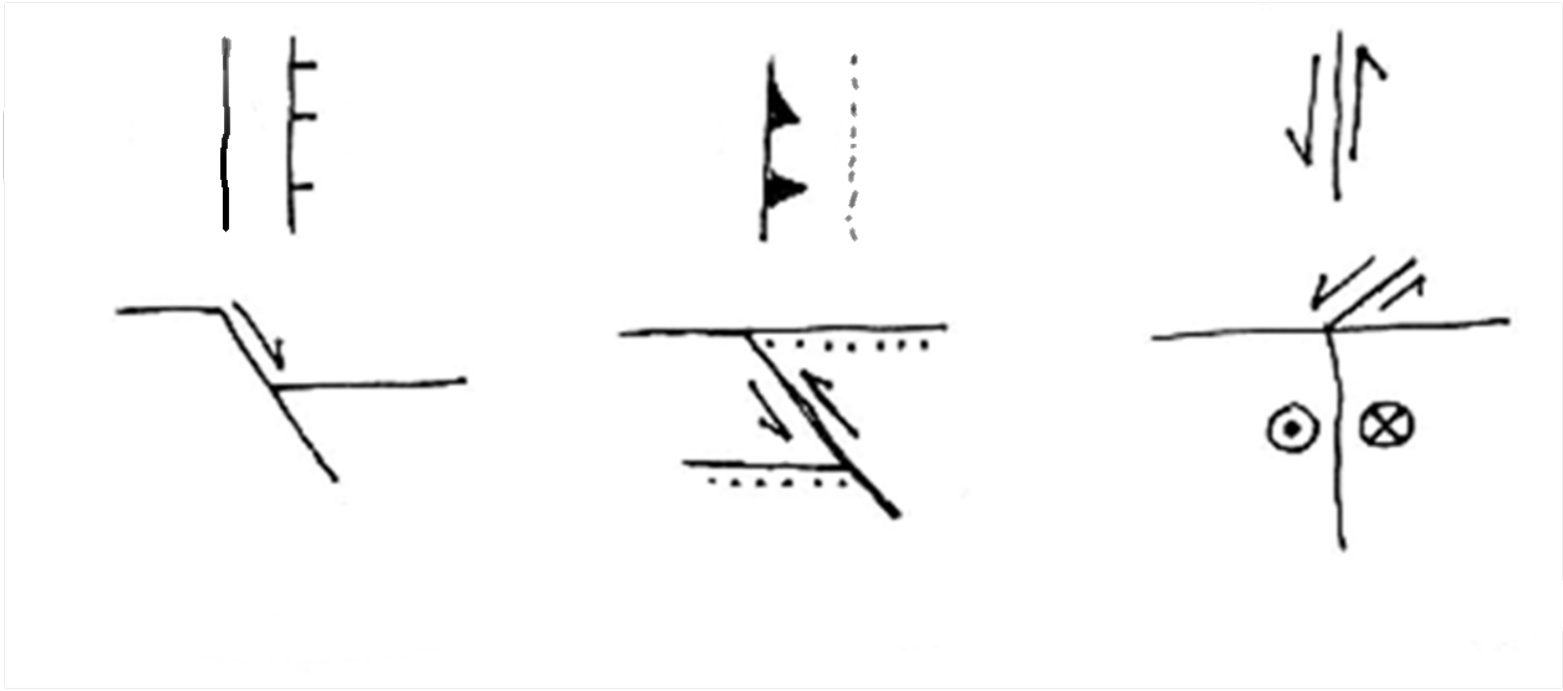
Visualisation of Faults in GeotIS



2½D Raster (GRID2D)

TIN:

Triangular Irregular Network
Node spacing: 50 - 5000 m (variable)

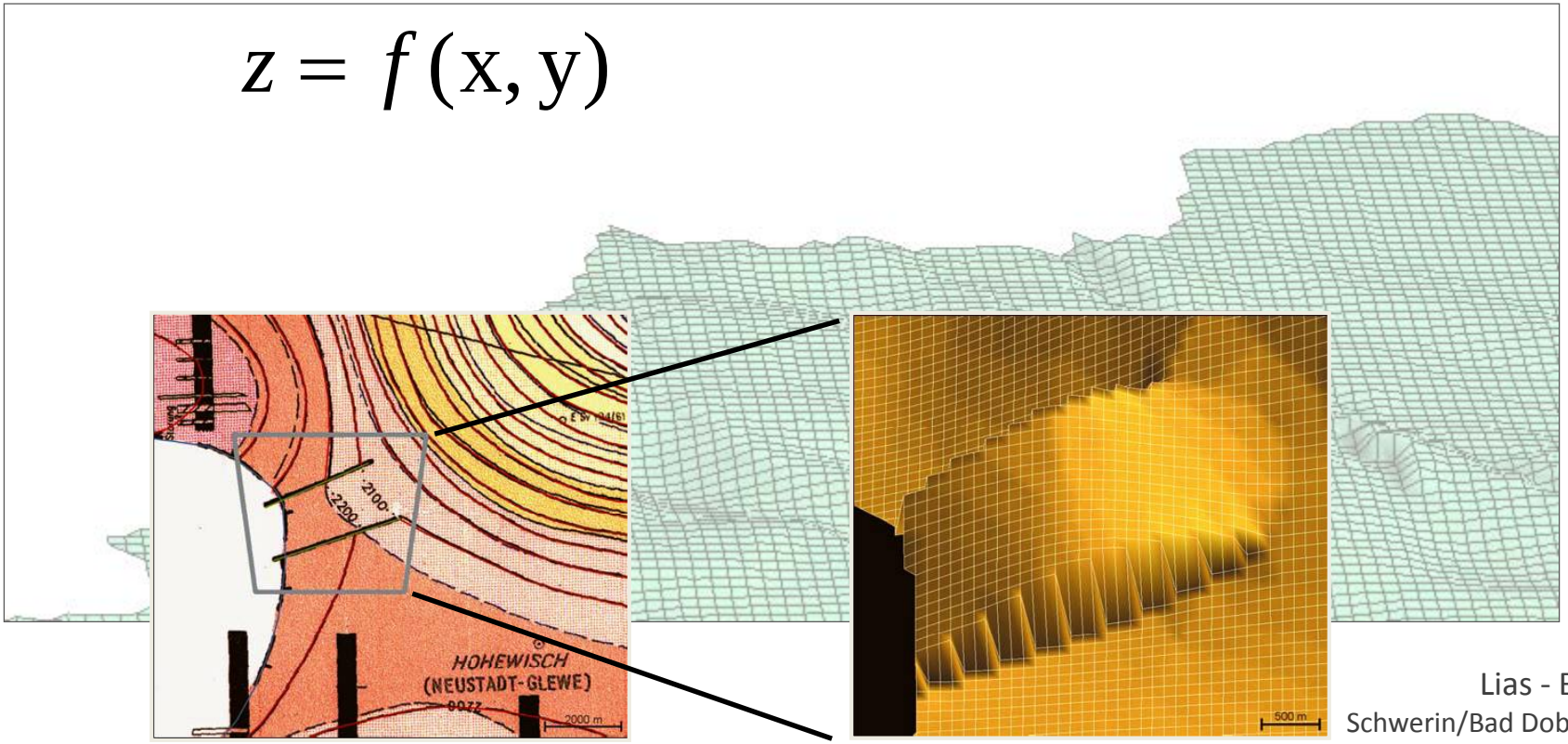
GRID2D:

regular, orthogonal

Node spacing: 100 m (fixed)

Import as CPS3 file

$$z = f(x, y)$$



Lias - Base
Schwerin/Bad Doberan

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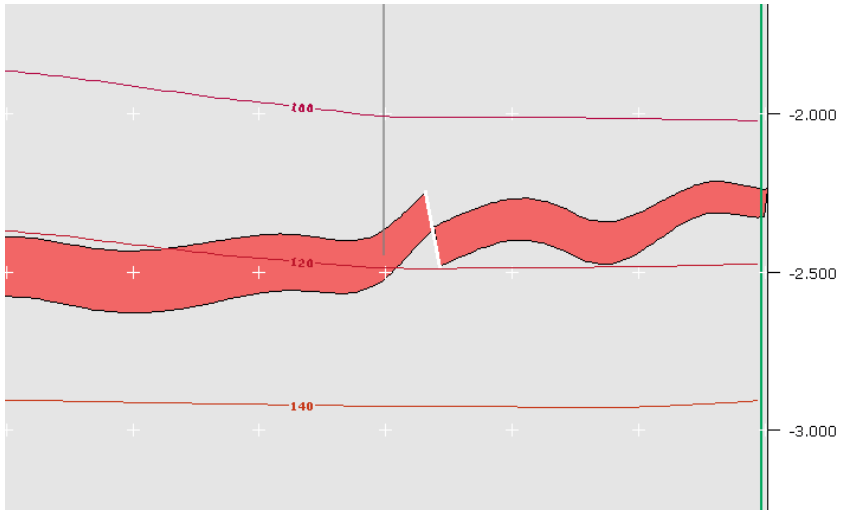
2½D Raster (Grid2D)

Advantaes:

- Very fast grid operations
- cross sections and top views are simple to create
- Simple generalization (scale adaption)
- Little memory usage
- Export option in Gocad/Skua

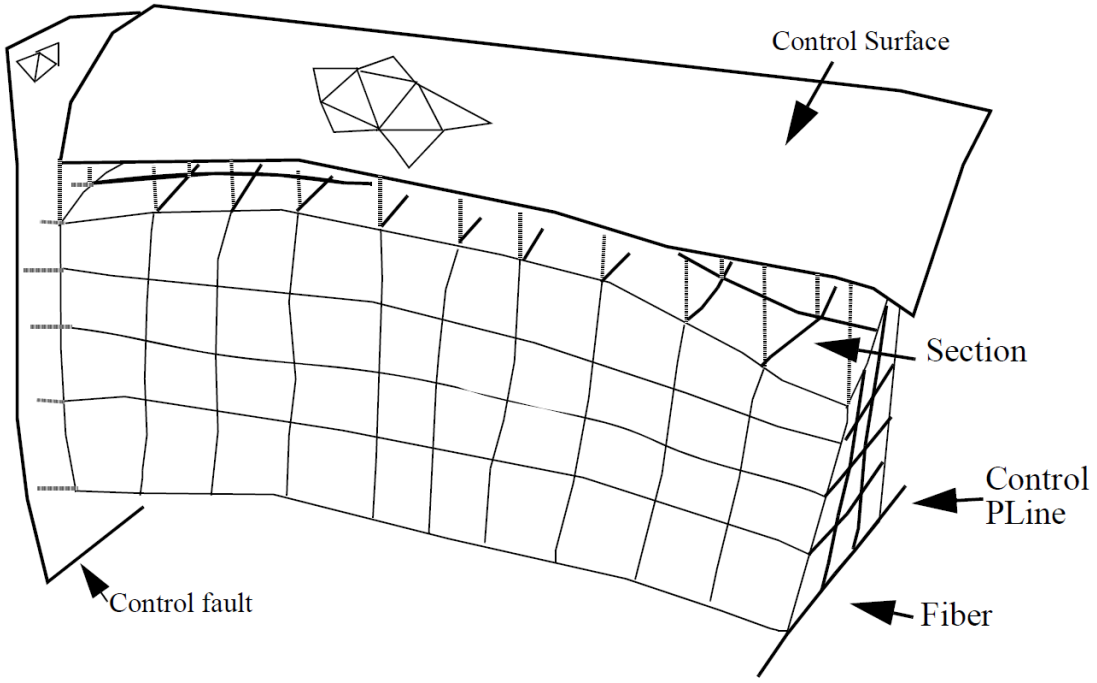


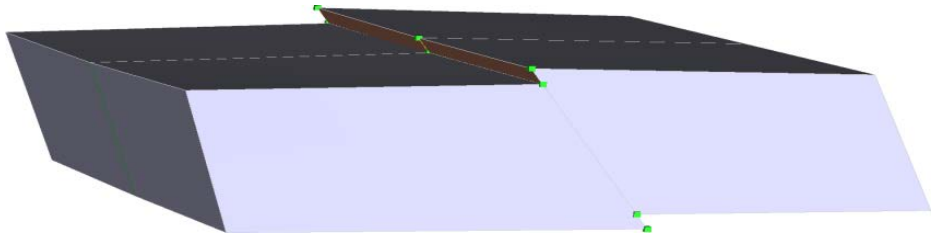
Disadvantages:

- Fault geometry not part of grid
- Geometrical restrictions: no thrust faults or overturned formations
- Realization of normal faults are very laborious

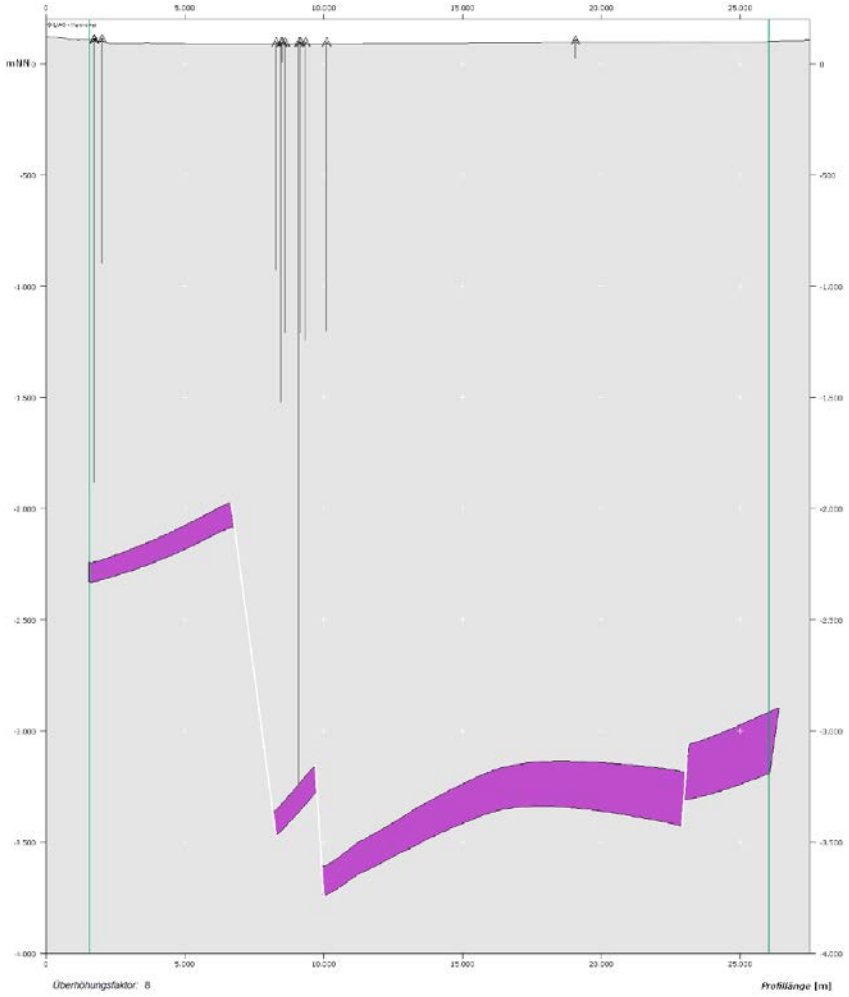
Stratigraphic Grids (SGRID)

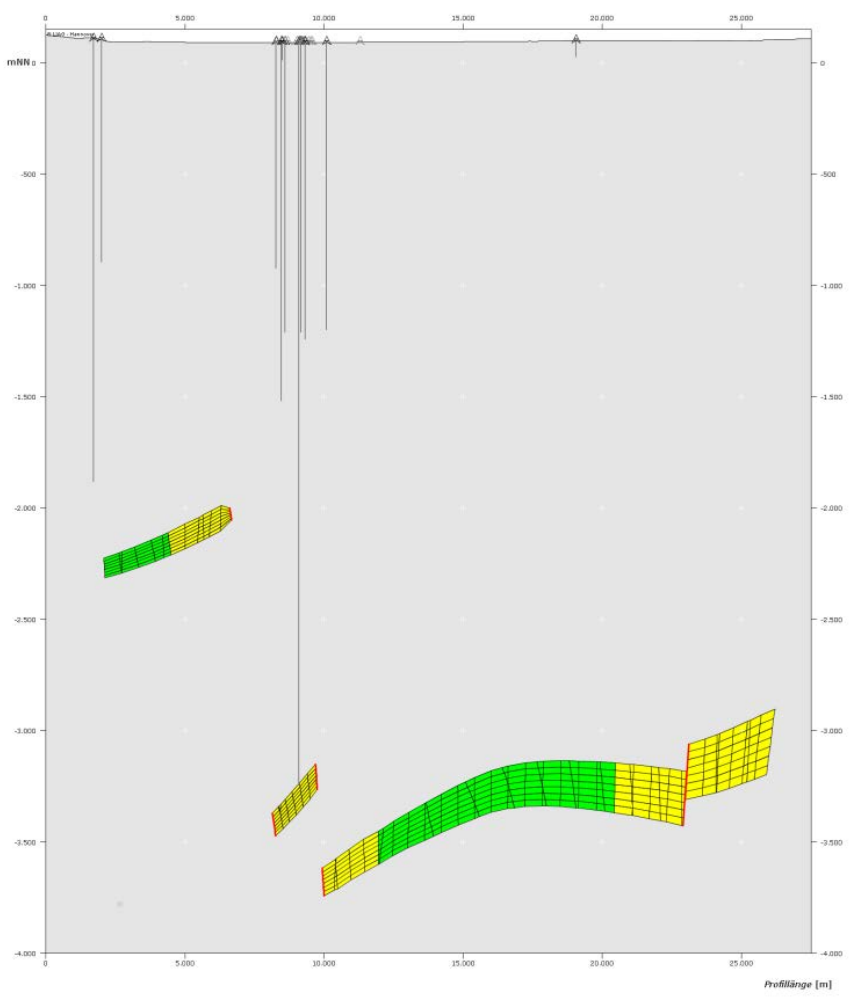
- **Hexahedron** network / volume grid (cells)
- Each node has its coordinate triplet (uvw ⇔ xyz)
- Properties are node or cell centred
- Cells follow horizons, fault planes or lines
- Faults are realised by splitting with up to 7 split nodes for one regular node
- Neighbour cells, dead cells, borders and faults are stored as binary flags
- Import as native Gocad/Skua file
- Easy transformation to tetrahedrons





Cross Sections Based on GRID2D & SGRID





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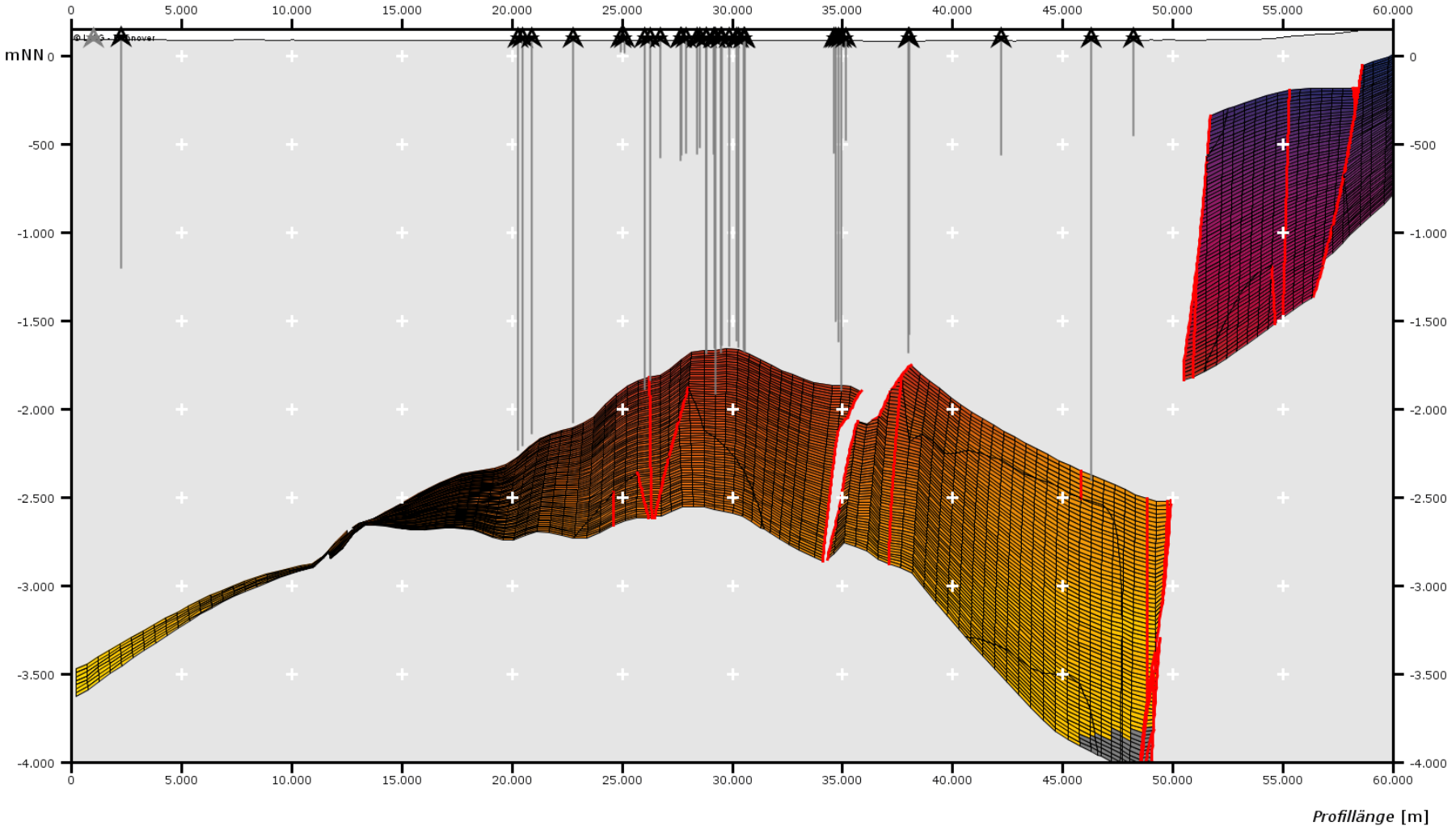
Visualisation of Parameters on Cross Sections



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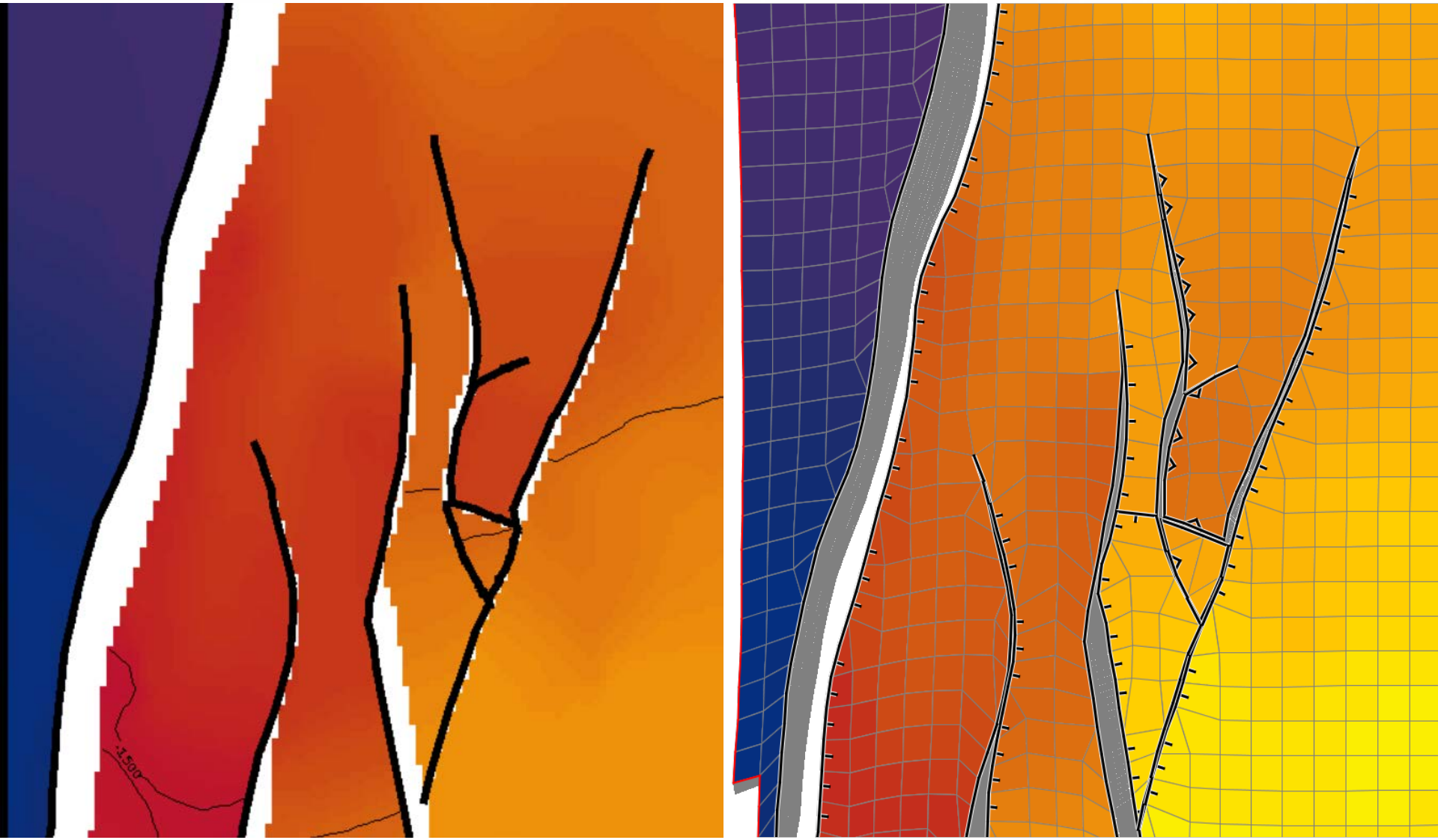
Top View Comparison GRID2D & SGRID



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SGRID Files (Gocad/Skua)

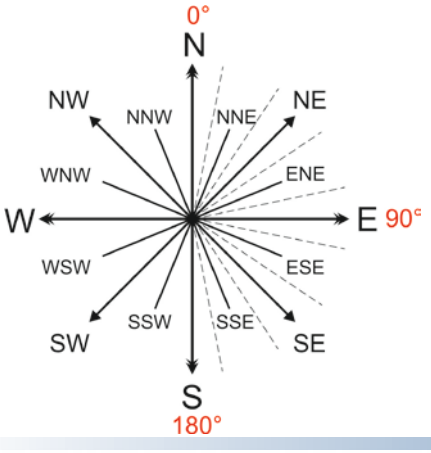
Java Programme ***geotisCore***

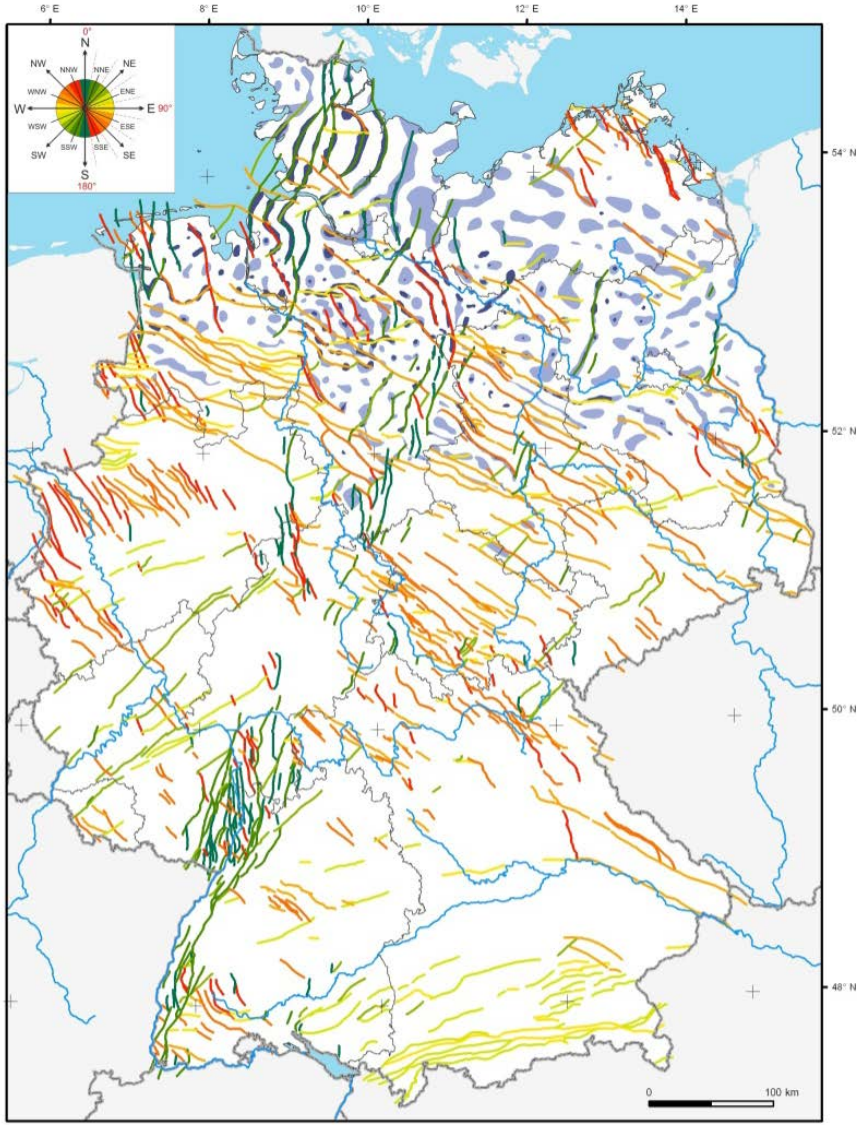
- reading SGrids
  - Filename.sg √
  - FilenameObjectname__ascii@@ √
  - FilenameObjectname__flags@@ √
  - FilenameObjectname__region_flags@@ X
- Validating Hexahedrons, killing flat cells √
- Generating cross section √
- Generating top view √

Characterization of Fault Systems

Attributes of fault lineaments:

- Code number
- Category, horizon
- Name of fault zone
- Reference
- Length, strike
- Map sheet (GÜK200)





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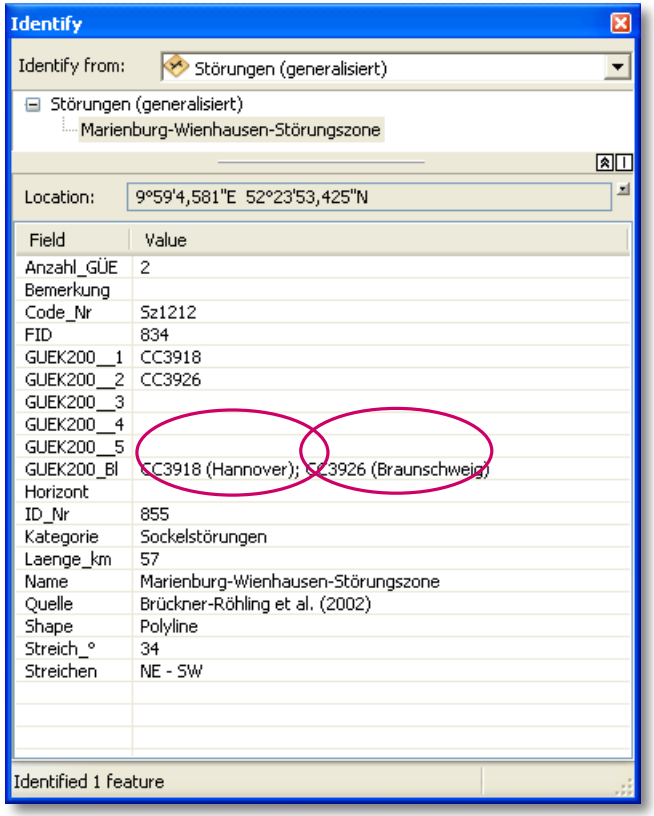
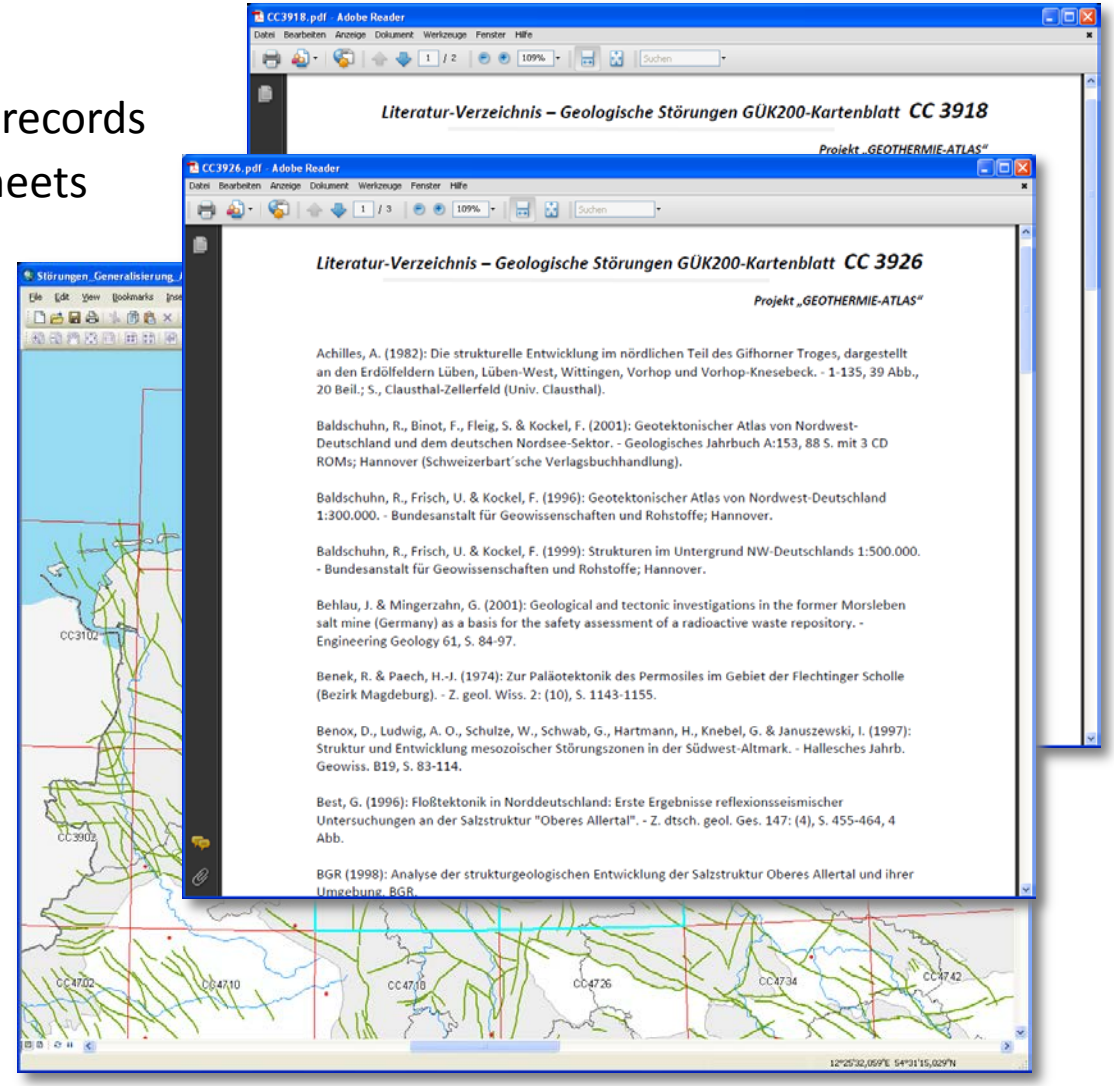
Characterization of Fault Systems

Literature Review:

- Approx. 1000 references in the records
- Linking lineaments with map sheets





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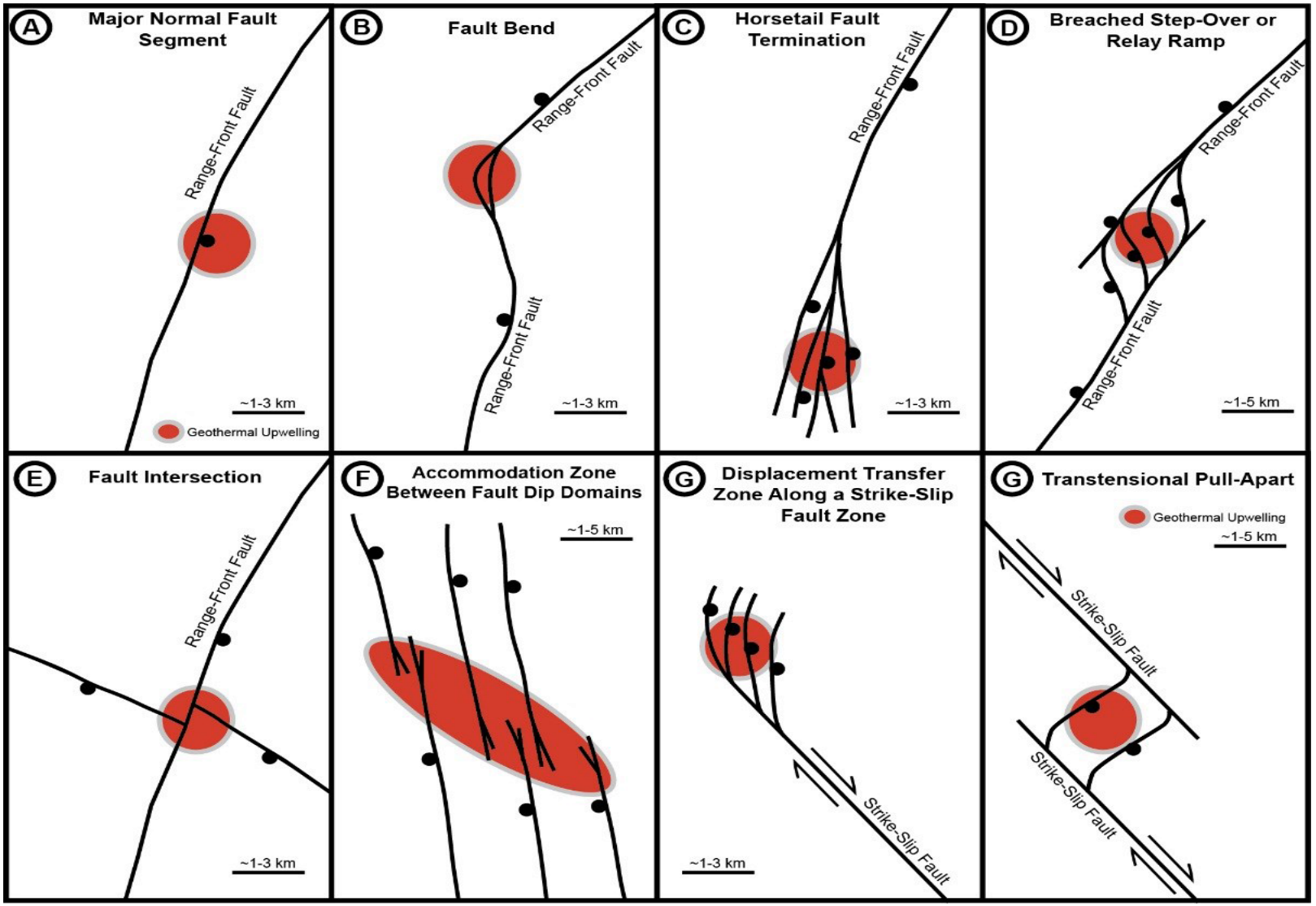
Fault Geometric Setting



Faulds & Hinz (2015)

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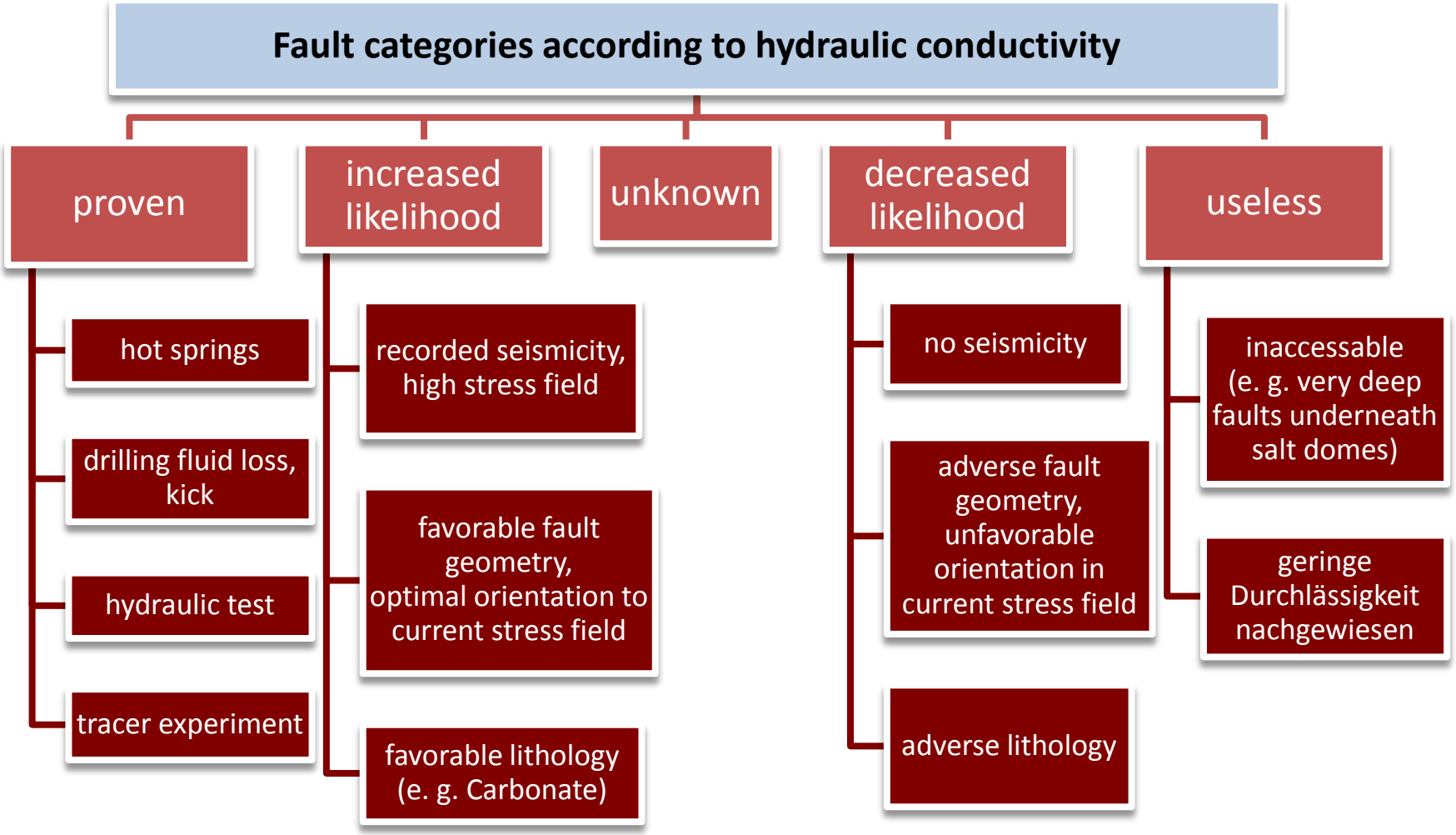
Geothermal Classification of Deep Faults in Germany



Summary

- Web-GIS with complex client-server architecture
- Data storage in files and in a relational database (> 100 tables)
- Clear separation between working data and presentation data
- Sophisticated workflows for updating database
  - wells
  - geothermal output statistics
  - geologic models
  - temperature model
  - fault literature
- GeotIS improved data import interface
- New algorithms for SGRIDs visualization

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