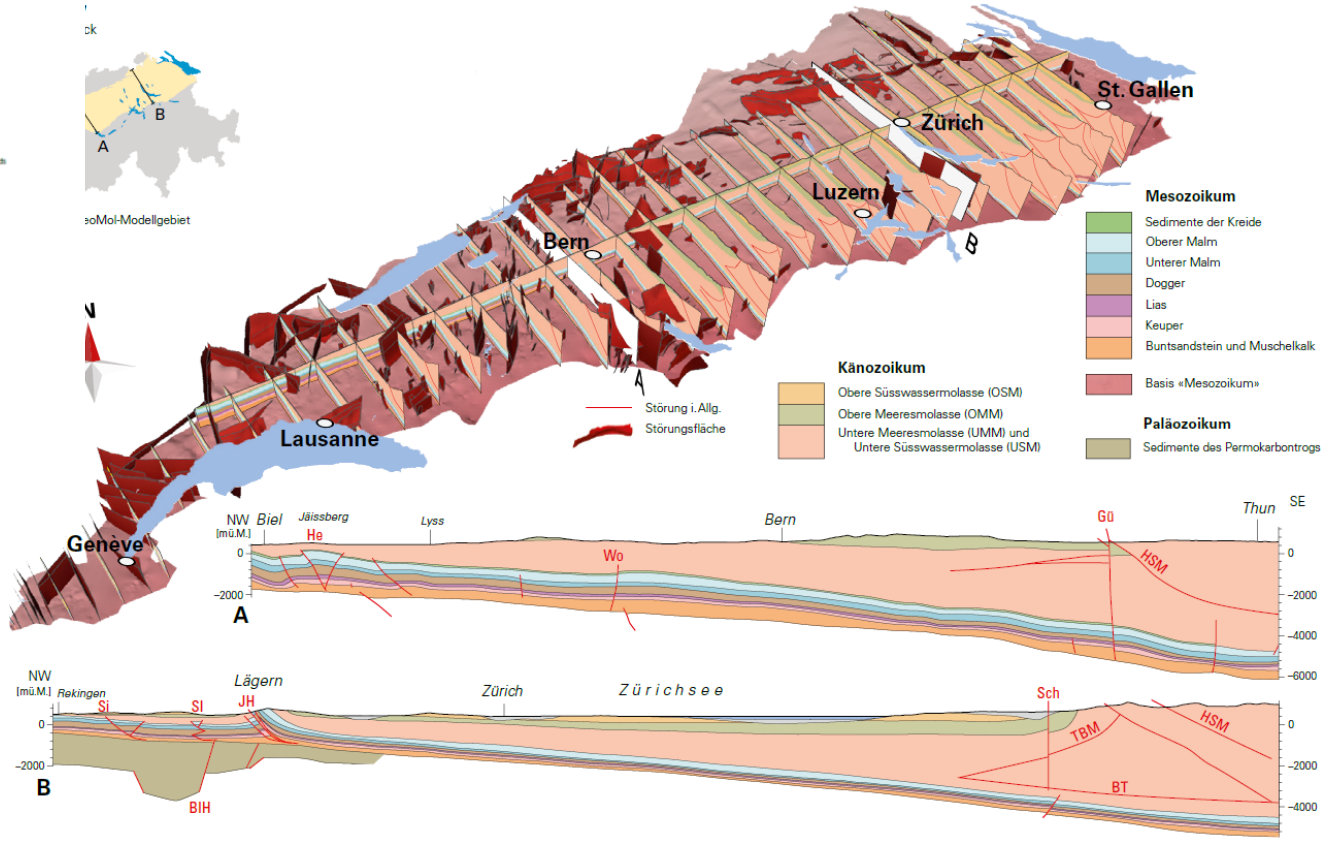
GeoMol Switzerland – Completed!

Online access

https://viewer.geomol.ch

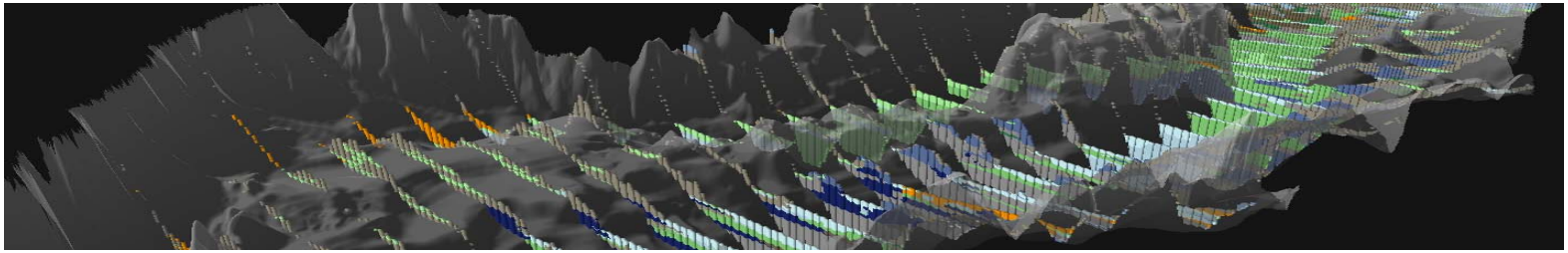
Contact

Robin Allenbach, Roland Baumberger



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Landestopografie swisstopo
Landesgeologie



wissen wohin
savoir où
sapere dove
knowing where

swisstopo

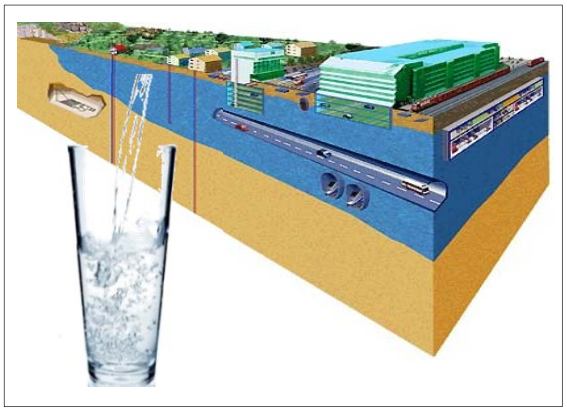
GeoQuat project:
Semi-automated 3D voxel modeling of Quaternary deposits and post-products generation

Philip Wehrens

4th European Meeting on 3D Geological Modelling,
Orléans 21-23 February 2018

Managing the subsurface
Importance of 3D distribution of Quaternary deposits

Hydrogeology



Geothermal Energy

Geotechnics

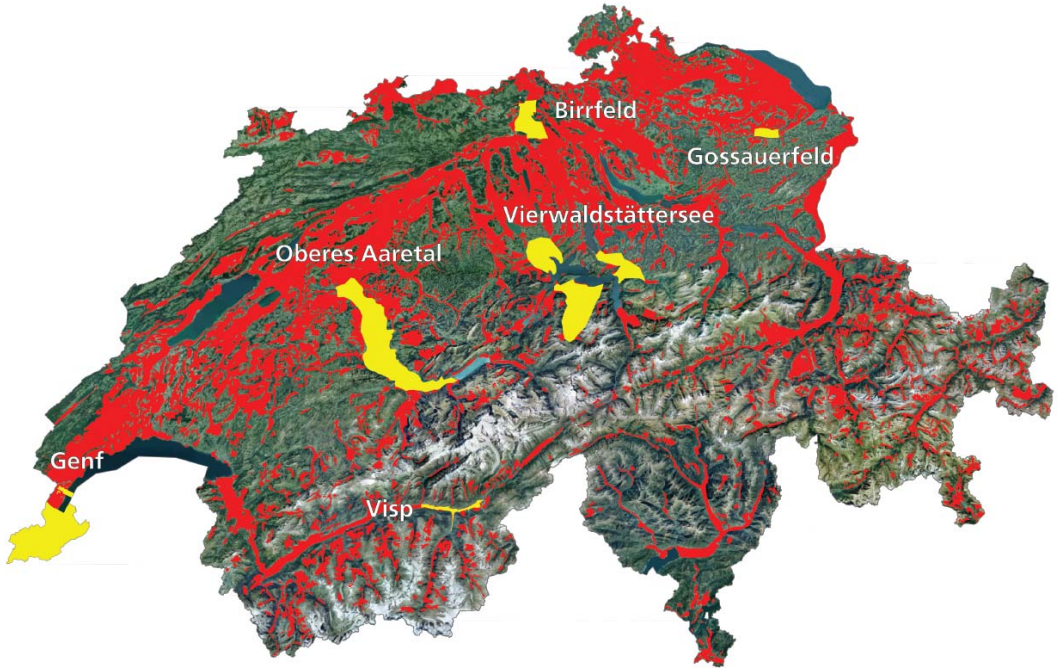
Raw material resources

Earthquakes

The GeoQuat project

Building a semi-automated infrastructure for Quaternary data

Standardization → Harmonization → 3D modelling → Derived products



The GeoQuat project

Building a semi-automated infrastructure for Quaternary data

Standardization → Harmonization → 3D modelling -> Derived products

Why Voxel Modelling?

Complexity

Heterogeneous structure of the Quaternary with lateral and vertical discontinuous processes and complex geometries have to be modelled

Reproducibility

Input data as well as the creation of the 3D model can be documented to allow reproduction (e.g., algorithms, anisotropies).

Update efficiency

New data has to be efficiently used to update /re-run the model (Canton Bern ca. 1000 new boreholes per year)

Volume models

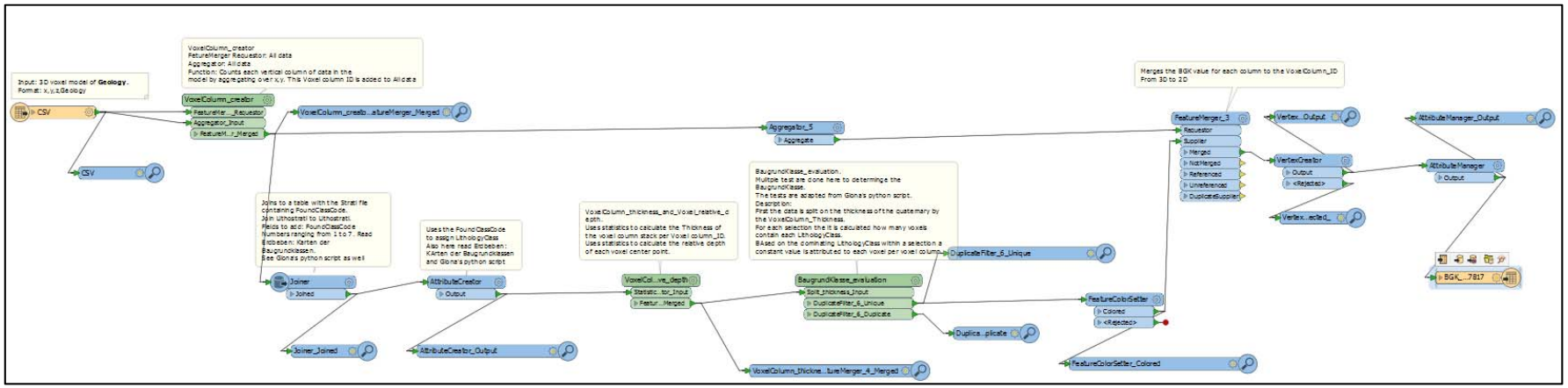
Efficient calculation / generation of derived volume based products

The GeoQuat project

Building a semi-automated infrastructure for Quaternary data

Standardization → Harmonization → 3D modelling → Derived products

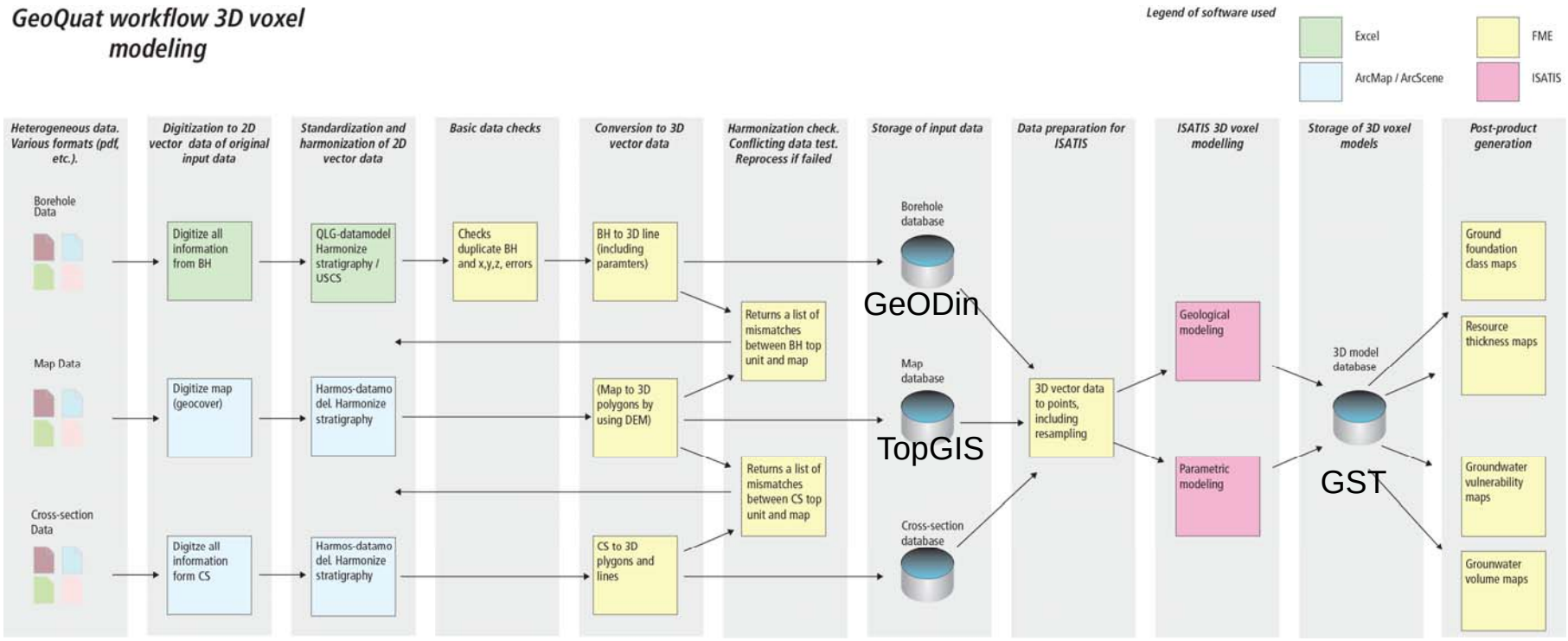
Automation using FME (Feature Manipulation Engine by safe software)



Visual display of data manipulation

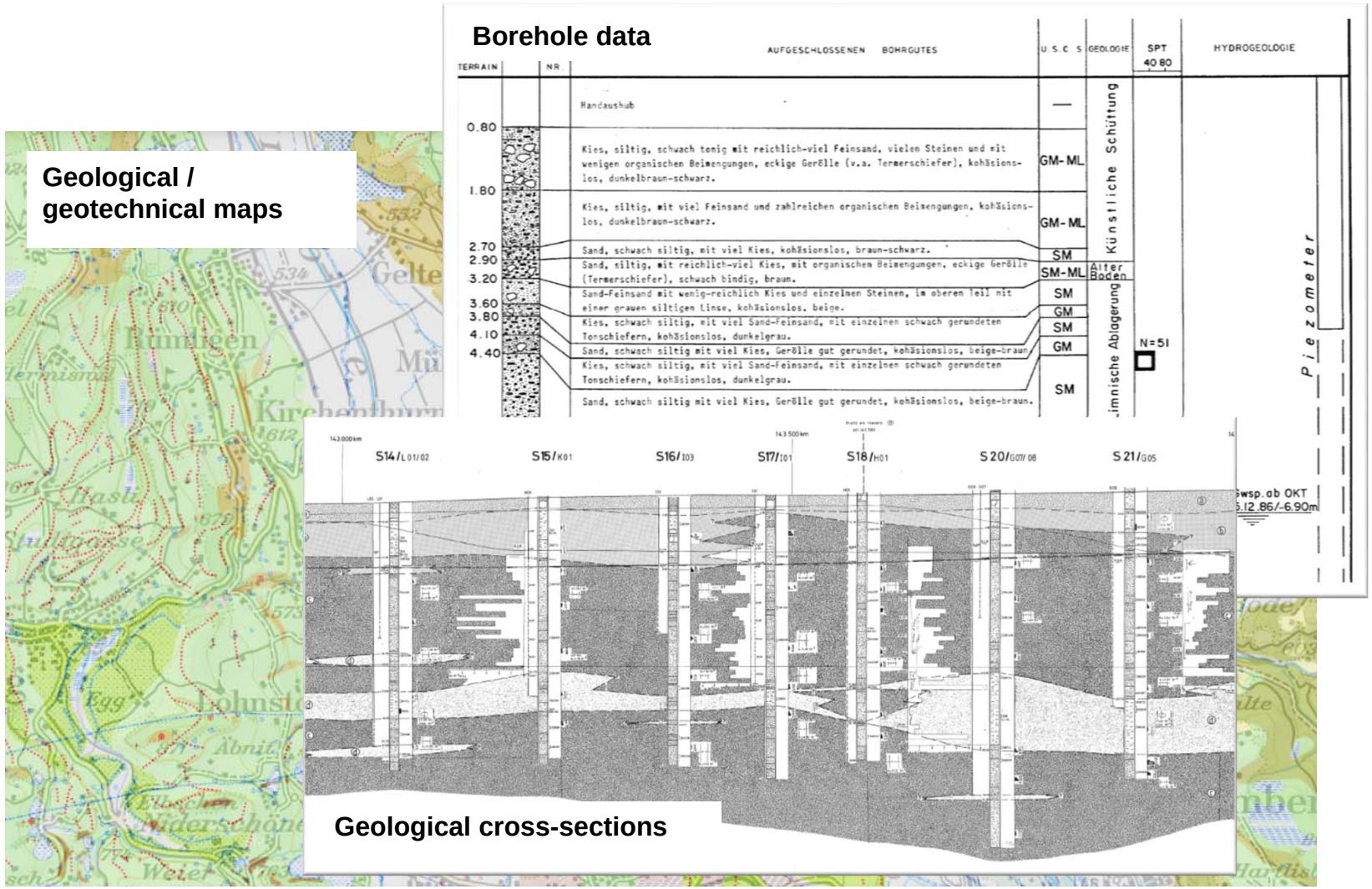
Easy to document data manipulation

Workflow and automation overview

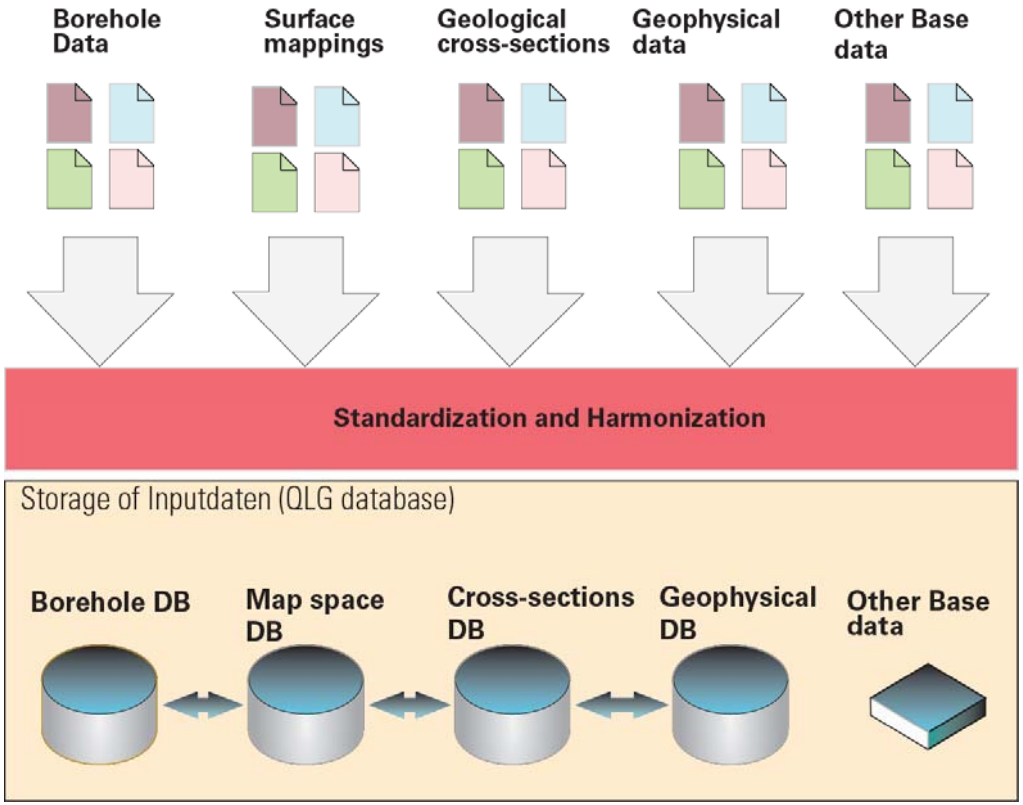


Standardization and Harmonization → **Data checks and 3D vectorization** → **Voxel modeling** → **Post-product generation**

Heterogeneous input data



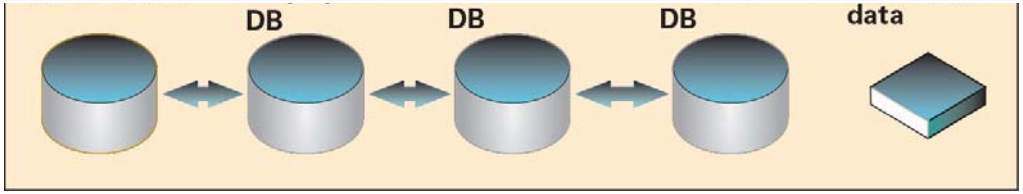
Standardization and harmonization
- prerequisite for DB storage, automation and 3D modelling



Standardization and Harmonization → Data checks and 3D vectorization → Voxel modeling → Post-product generation

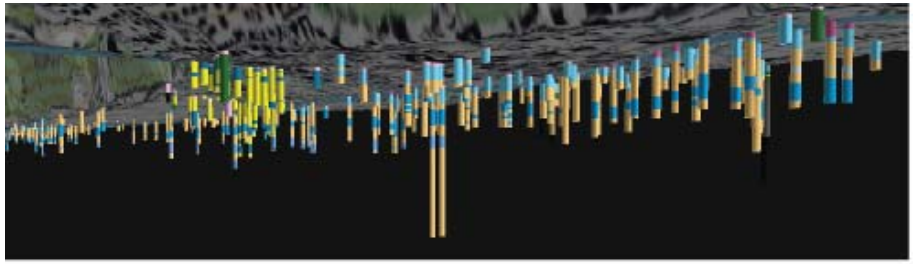
Standardization and harmonization
- prerequisite for DB storage, automation and 3D modelling

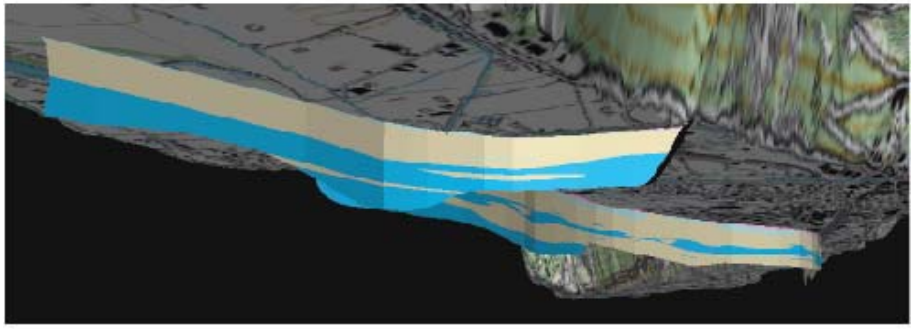
Pilot region	No. boreholes	Borehole length	No. layers
Birrfeld	1'577	37'230	19'830
Visp	788	17'955	11'674
Aaretal	3'280	60'215	36'275
Vierwaldstättersee	741	15'423	8'120
Genf	615	11'240	7'143
St. Gallen	686	7'300	2'170
Total	**7'687**	**149'363**	**85'212**



Standardization and Harmonization → Data checks and 3D vectorization → Voxel modeling → Post-product generation

Vectorization and 3D data checks





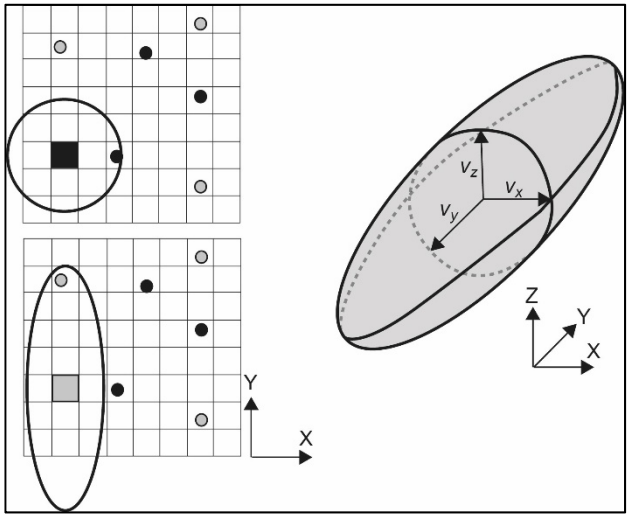
→ Visualization in ArcScene

- Automated mismatch list between maps and cross-section and boreholes
- Visual checks in 3D

Standardization and Harmonization → **Data checks and 3D vectorization** → Voxel modeling → Post-product generation

Voxel modelling in ISATIS

3D Voxel Models	Modelled Parameter	Type	Method
Geological	Lithostratigraphy	Discrete	Nearest Neighbour
Geological	*Lithostratigraphy*	*Continuous + Discrete*	*Sequential Geological Probabilistic Modelling (Indicator Kriging)*
Parametric	Hydraulic conductivity	Continuous	Co-Kriging

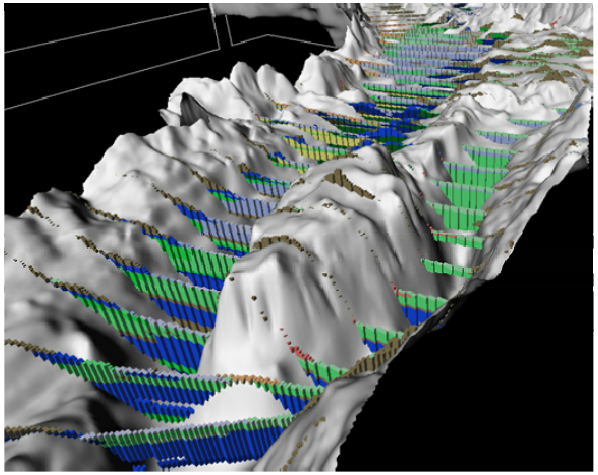


- Variogram statistics is not automated
- Definition of modelling parameters is not automated
- Modelling runs are automated

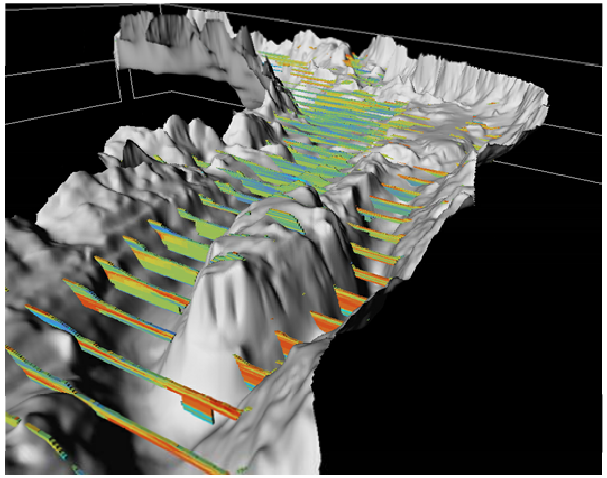
Standardization and Harmonization → Data checks and 3D vectorization → **Voxel modeling** → Post-product generation

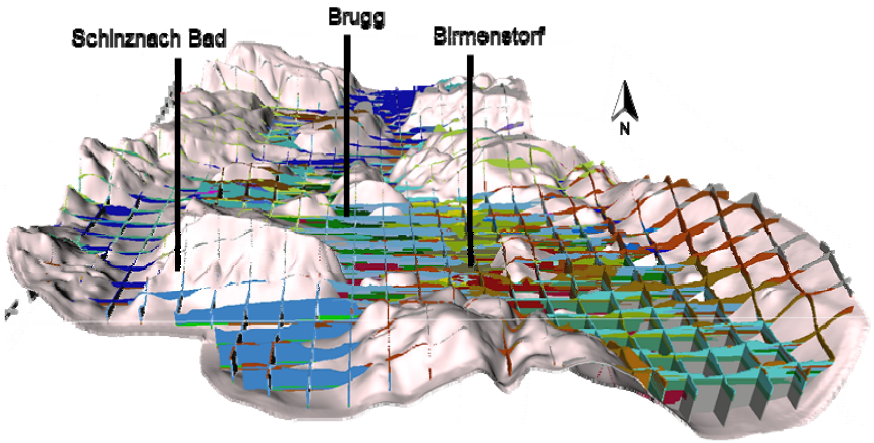
Examples of 3D models

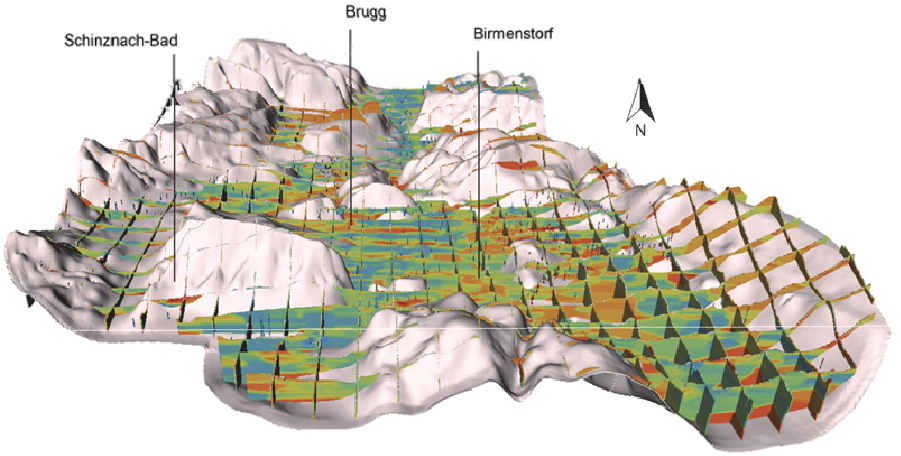
Geological model



Parametric model

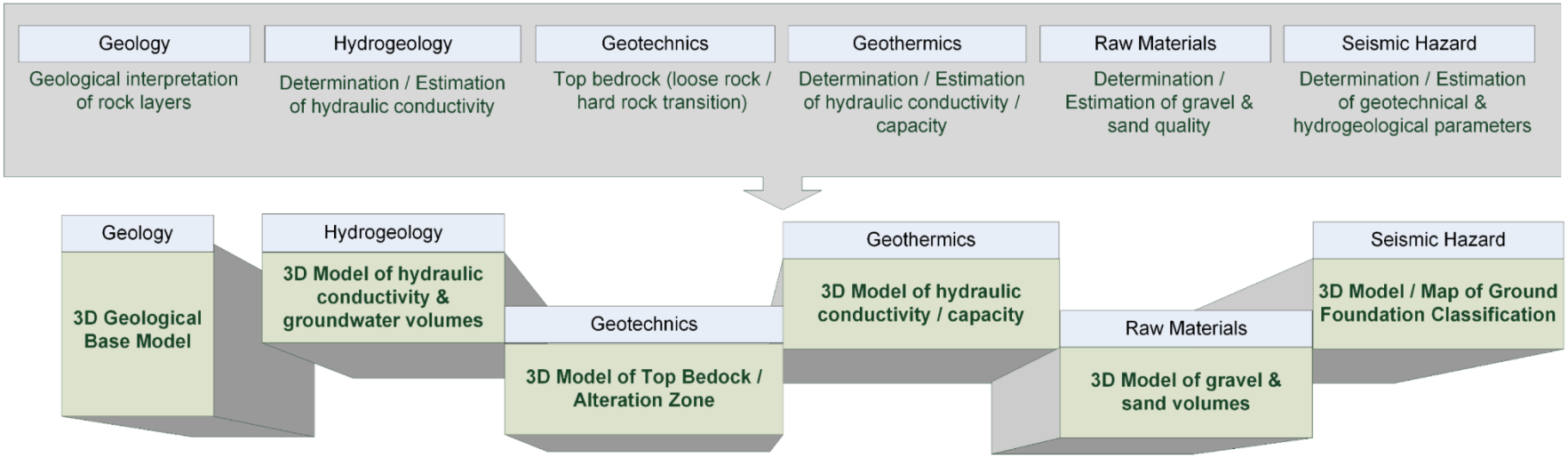






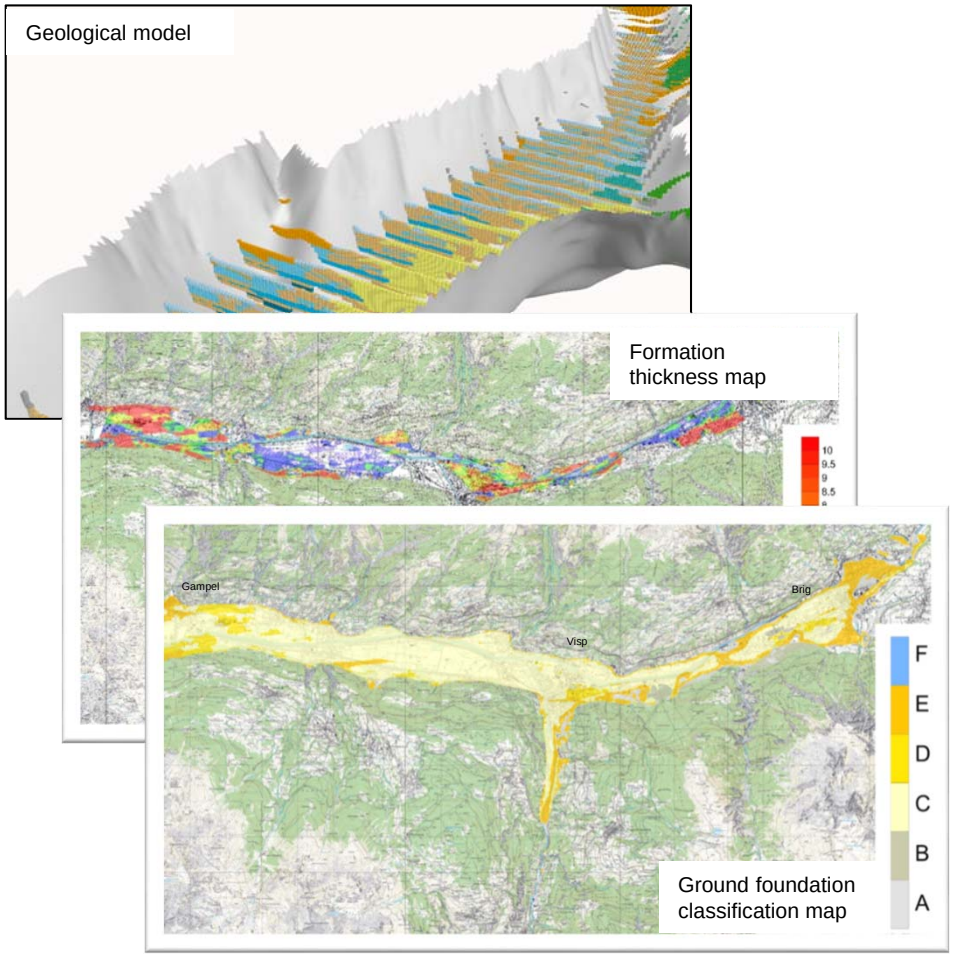
Standardization and Harmonization → Data checks and 3D vectorization → **Voxel modeling** → Post-product generation

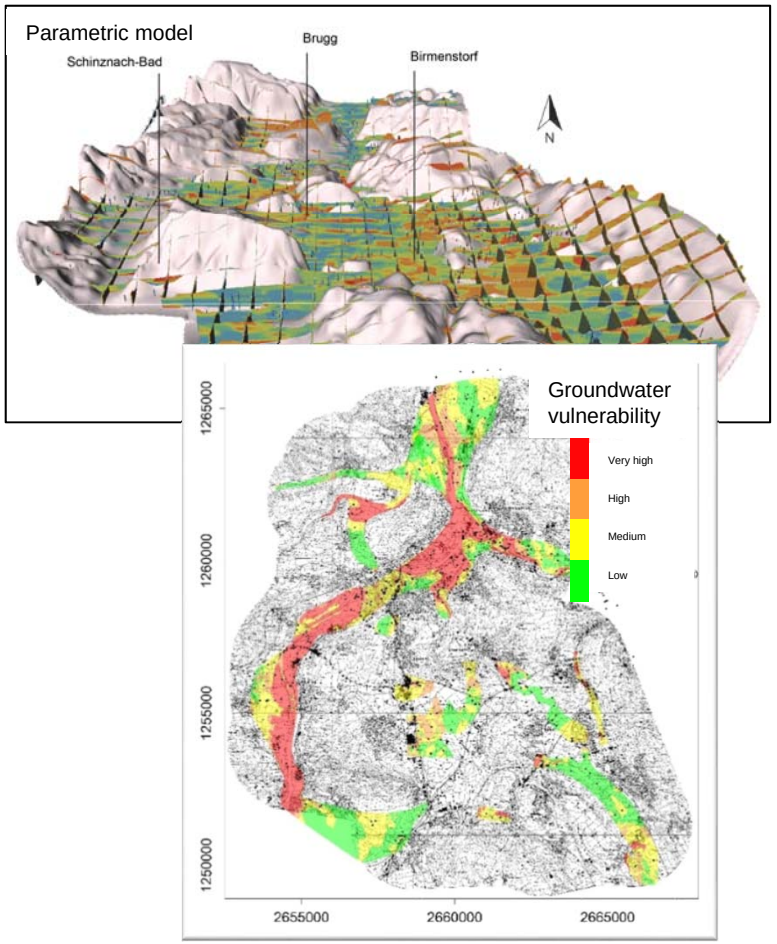
3D models and post-products



Standardization and Harmonization → Data checks and 3D vectorization → Voxel modeling → **Post-product generation**

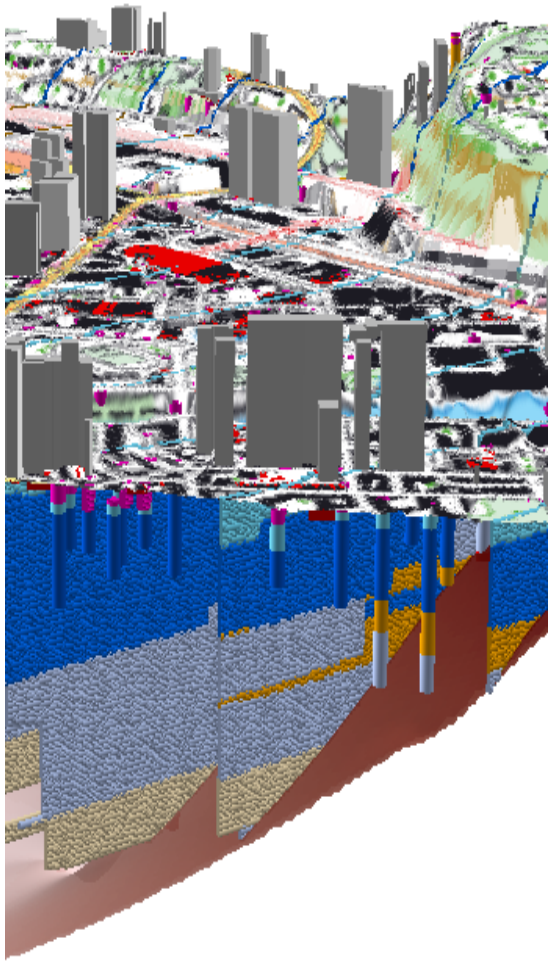
Examples of post-products





Standardization and Harmonization → Data checks and 3D vectorization → Voxel modeling → **Post-product generation**

Outlook



- Testing the developed data infrastructure and workflows in in urban environment
  → pilot area Geneva
  → interaction with BIM data
- Optimizing the derived products in collaboration with the cantons and other partners
  → check different options to visualize and analyse geological 3D data
- From project to process:
  Implement the developed data infrastructure and workflows in the SGS processes

Thank you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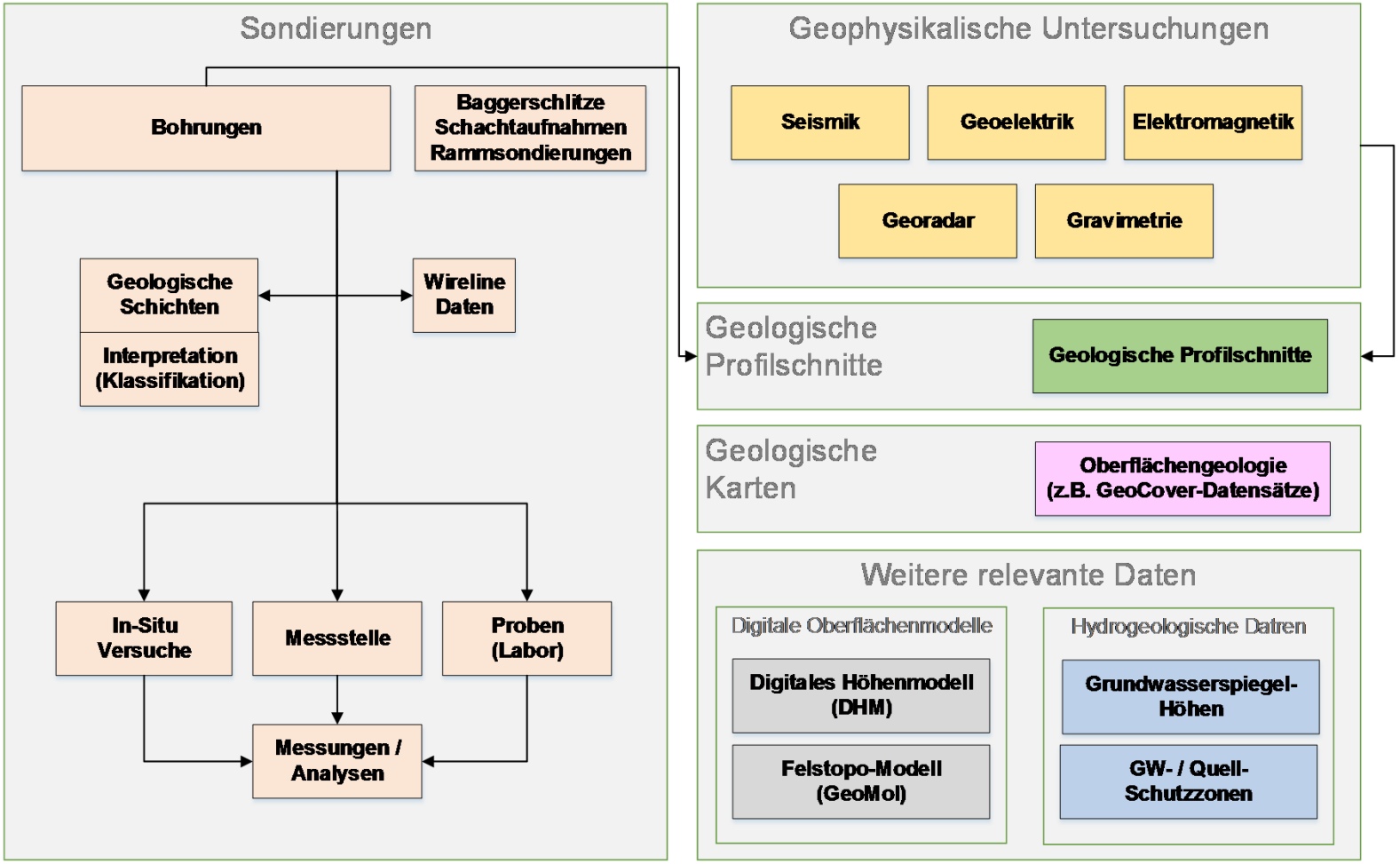
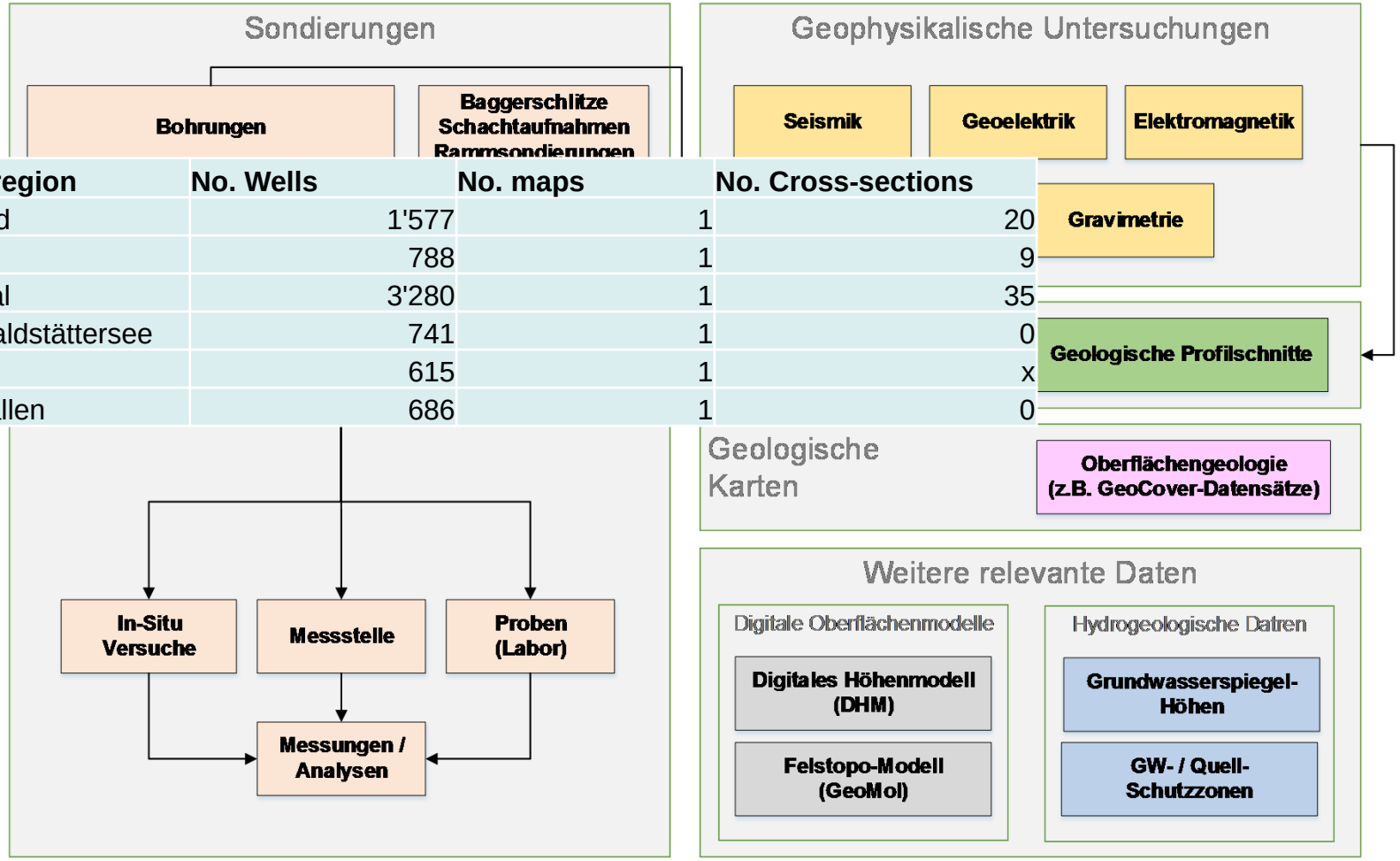
GEOLOGICAL
VOXEL MODELING
3D
NEW
STARTER KIT

Standardization of data
- prerequisite for automation

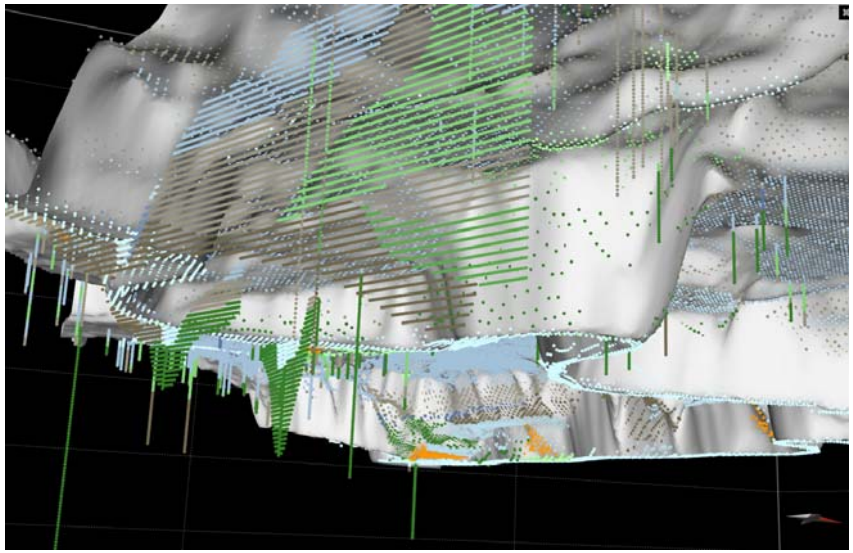


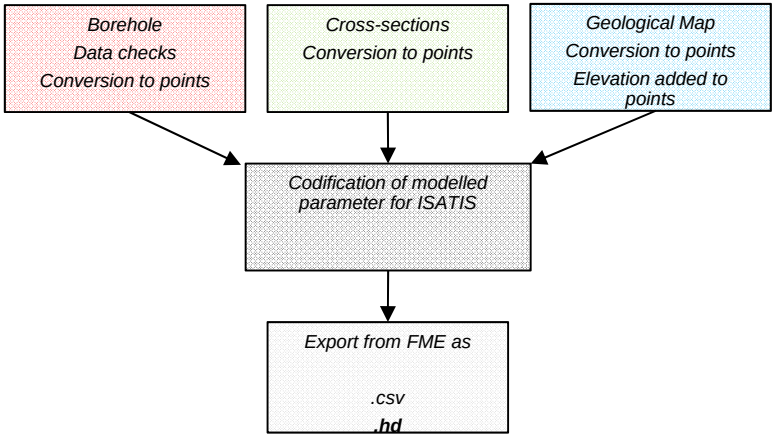
Standardization of data
- prerequisite for automation

Pilot region	No. Wells	No. maps	No. Cross-sections
Birrfeld	1'577	1	20
Visp	788	1	9
Aaretal	3'280	1	35
Vierwaldstättersee	741	1	0
Genf	615	1	x
St. Gallen	686	1	0



Preparing data for modelling





→ Visualization in Move3D

- Automated conversion of all data to points and prepared for ISATIS 3D voxel modelling

Data checks and 3D vectorization → **Conversion to points** → Voxel modeling → Post-product generation