Willkommen im

Bundesamt für Eich- und Vermessungswesen

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The Austrian GEOID 2008

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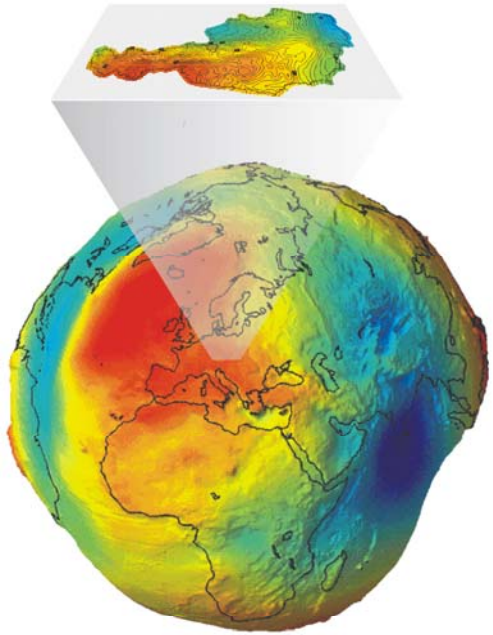
TOPICS

- **Project GEOnAUT**
- **Data**
- **Computation**
- **Evaluation**



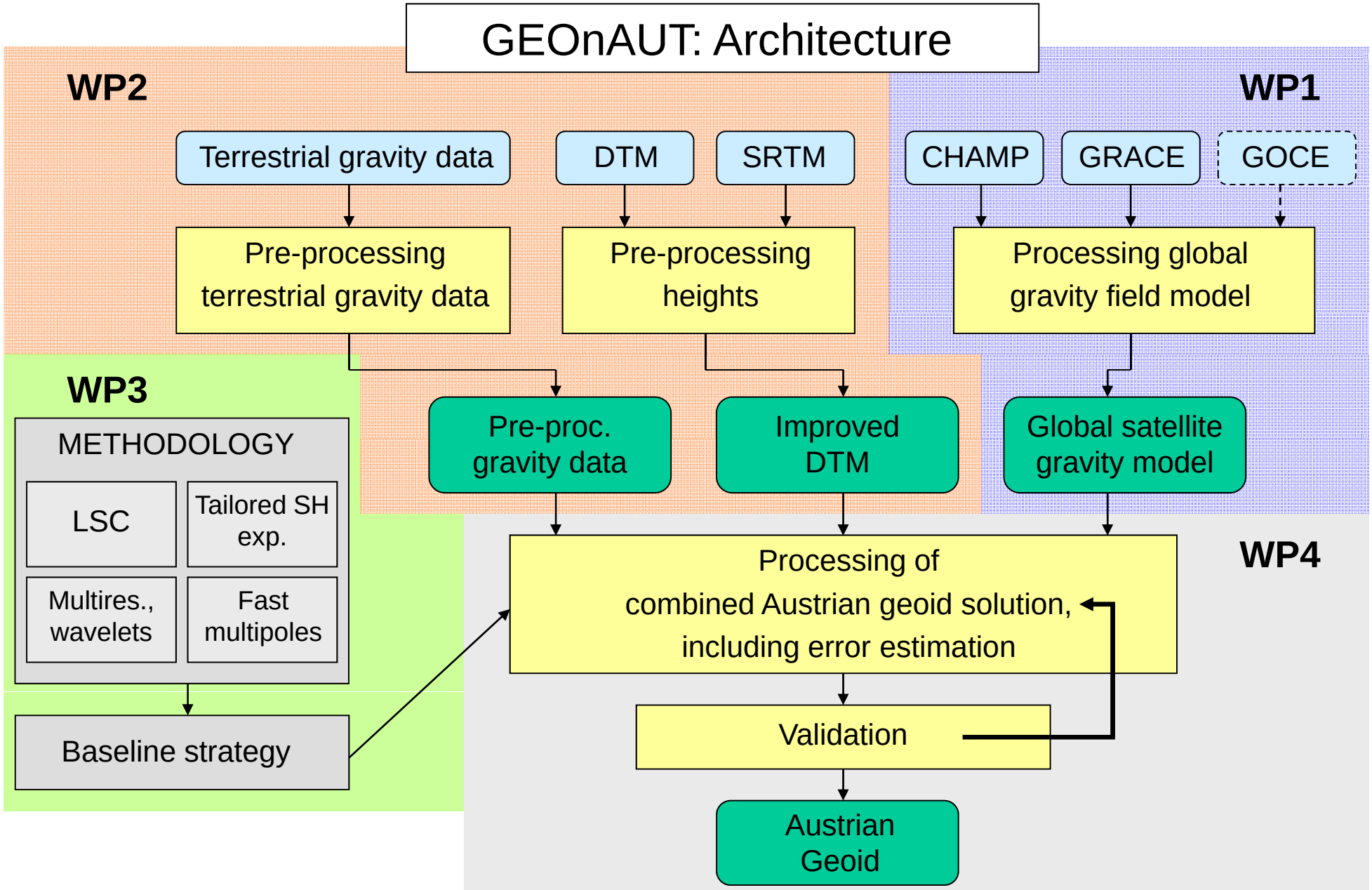
Project GEOnAUT

- **Objective:** Improved Austrian Geoid solution

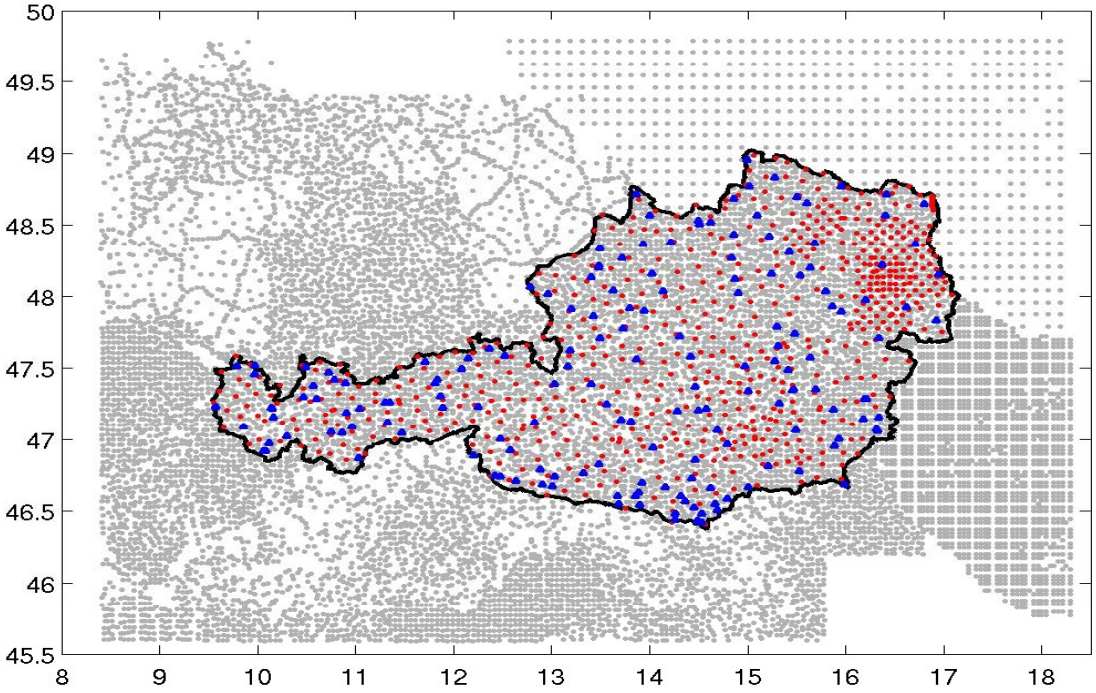
- **Sponsor:** Austrian Research Promotion Agency (FFG)

- **Partner of the Project:**

• Institute of Navigation and Satellite Geodesy (INAS)/TU Graz
• Institute of Numerical Mathematics/TU Graz
• Federal Office of Metrology and Surveying


GEOnAUT: Architecture
WP2
WP1
Terrestrial gravity data
DTM
SRTM
CHAMP
GRACE
GOCE
Pre-processing terrestrial gravity data
Pre-processing heights
Processing global gravity field model
WP3
METHODOLOGY
LSC
Tailored SH exp.
Multires., wavelets
Fast multipoles
Baseline strategy
Pre-proc. gravity data
Improved DTM
Global satellite gravity model
WP4
Processing of combined Austrian geoid solution, including error estimation
Validation
Austrian Geoid

Gravity Field Data



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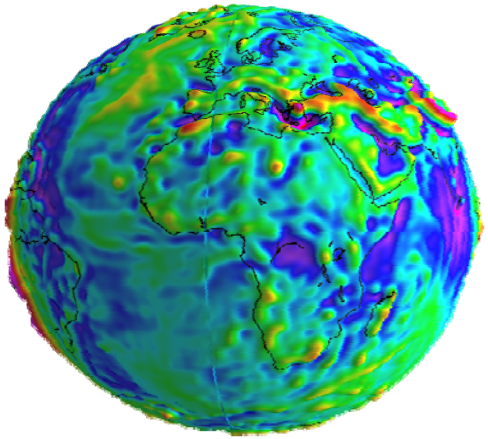
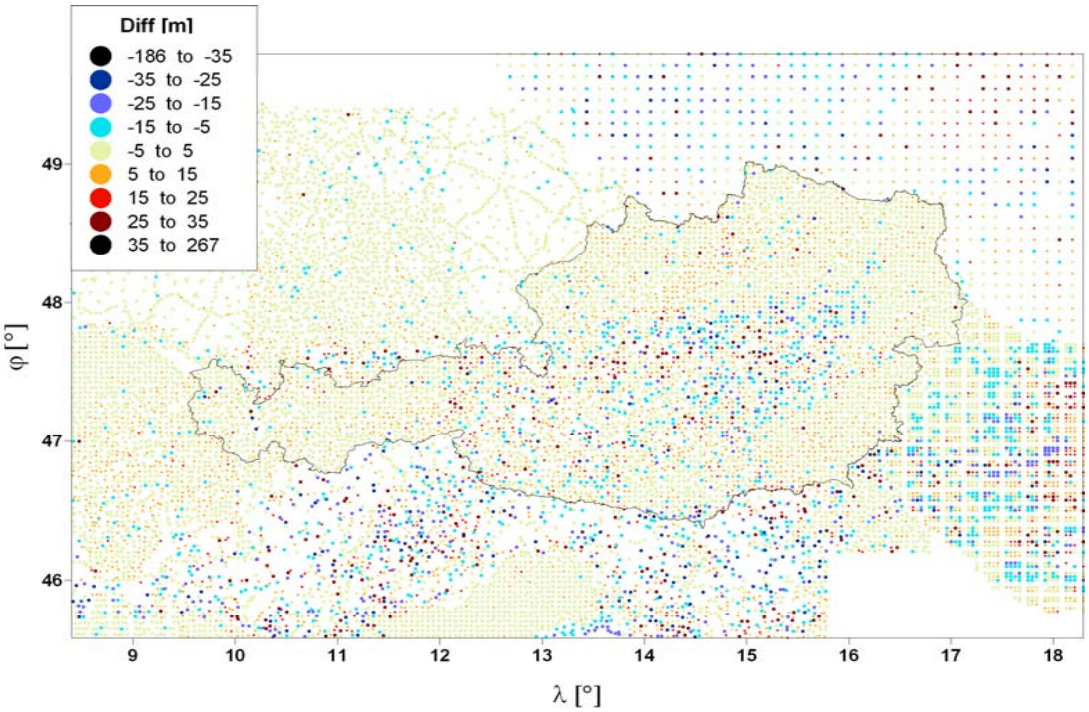


- **Gravity anomalies: 14 001 selected stations (out of >60 000); average distance 4 x 4 km**
- **Deflections of the vertical: 670 stations**
- **Highly precise GPS/levelling observations: 170 stations**
- **Global gravity field model EIGEN-GL04S (complete to degree/order 70)**

Digital Terrain Model (DTM)



Differences [m] of the DTM at the gravity anomaly stations

New combined DTM with resolution 44 x 49 m was assembled:

- **highly accurate regional DTM of Austria (BEV)**
- **highly accurate regional DTM of Switzerland (swisstopo)**
- **SRTM in neighbouring countries (corrected by Corine Land Cover CLC90 model)**

Geoid computation (1)

Free-air anomalies, reduced by:

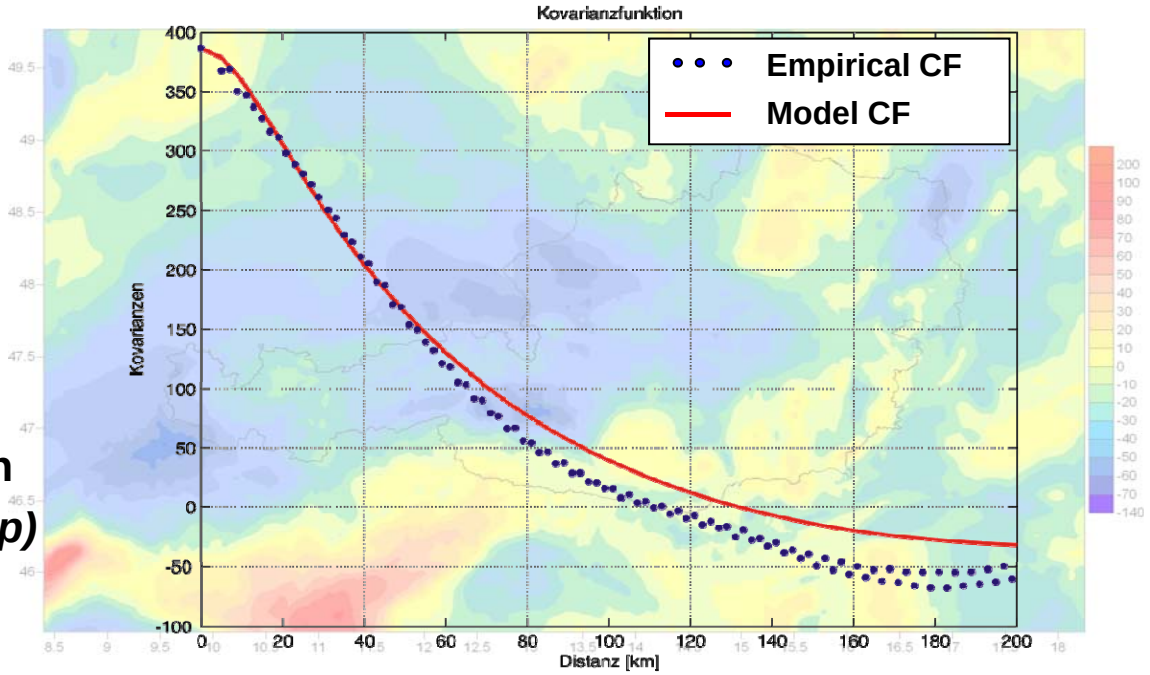
- **global model EIGEN-GL04S (GRACE)**
- **topography & isostasy**

Method:

Least Squares Collocation

Empirical and model covariance function

Degree variance model (*Tscherning-Rapp)*

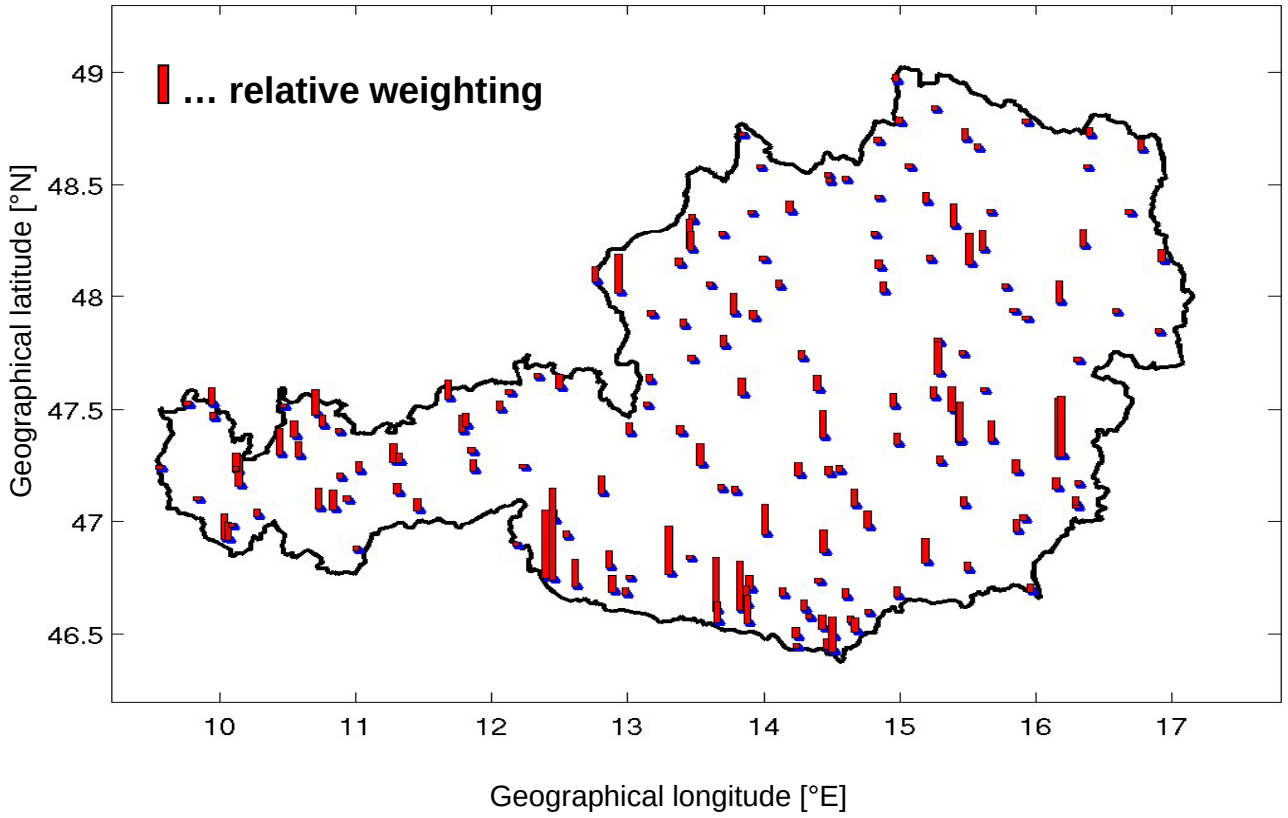


Variance: **396 mgal^2**

Correlation length: **42.6 km**

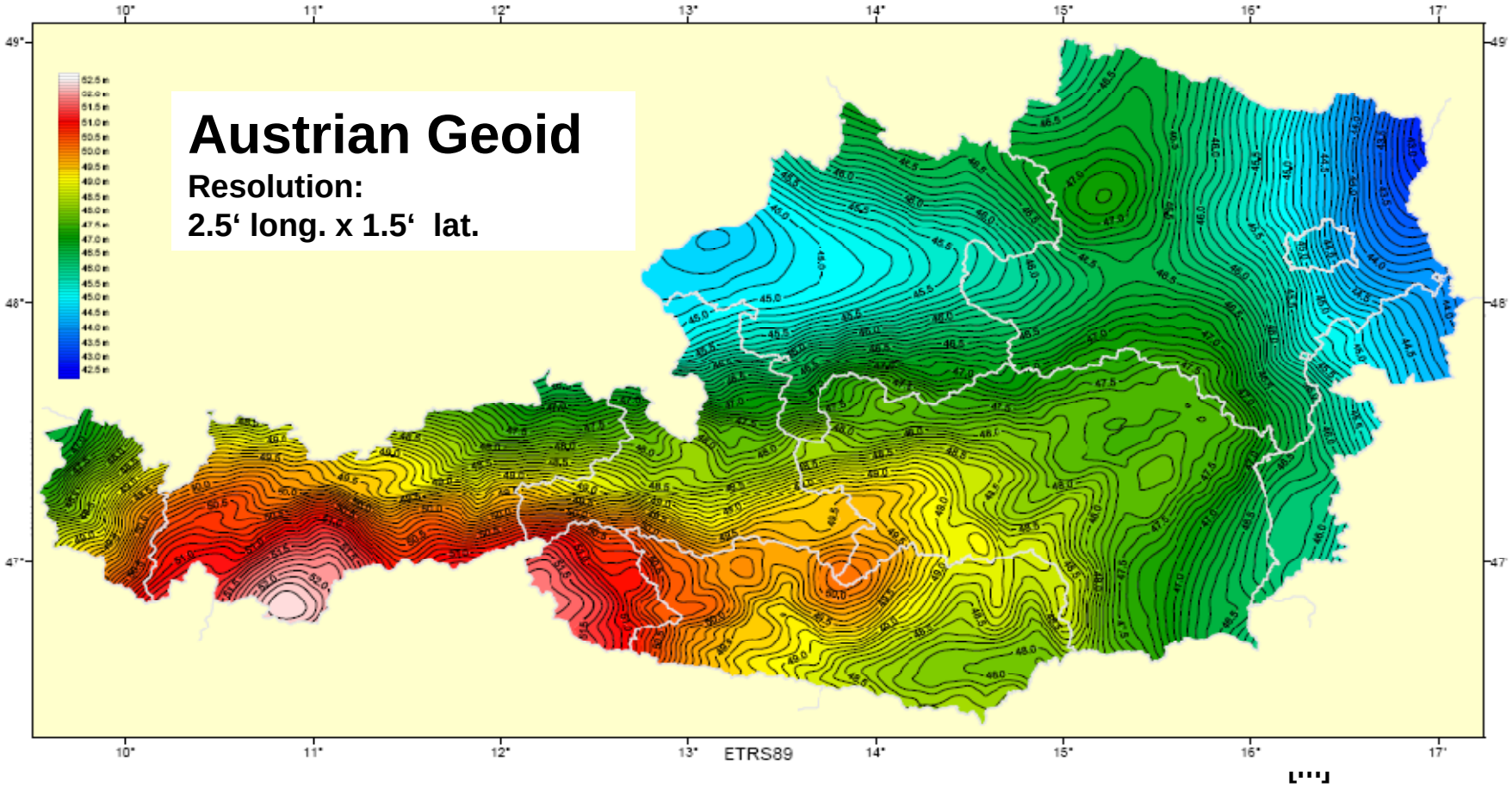
Geoid computation (2)

- Estimation of relative weighting from residuals in GPS/levelling stations
- Final solution with individual weighting of GPS/levelling observations



170 GPS/Levelling stations

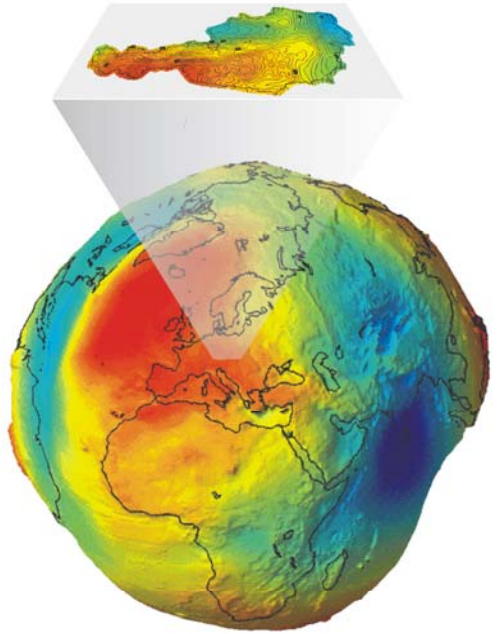
Final solution of Austrian Geoid



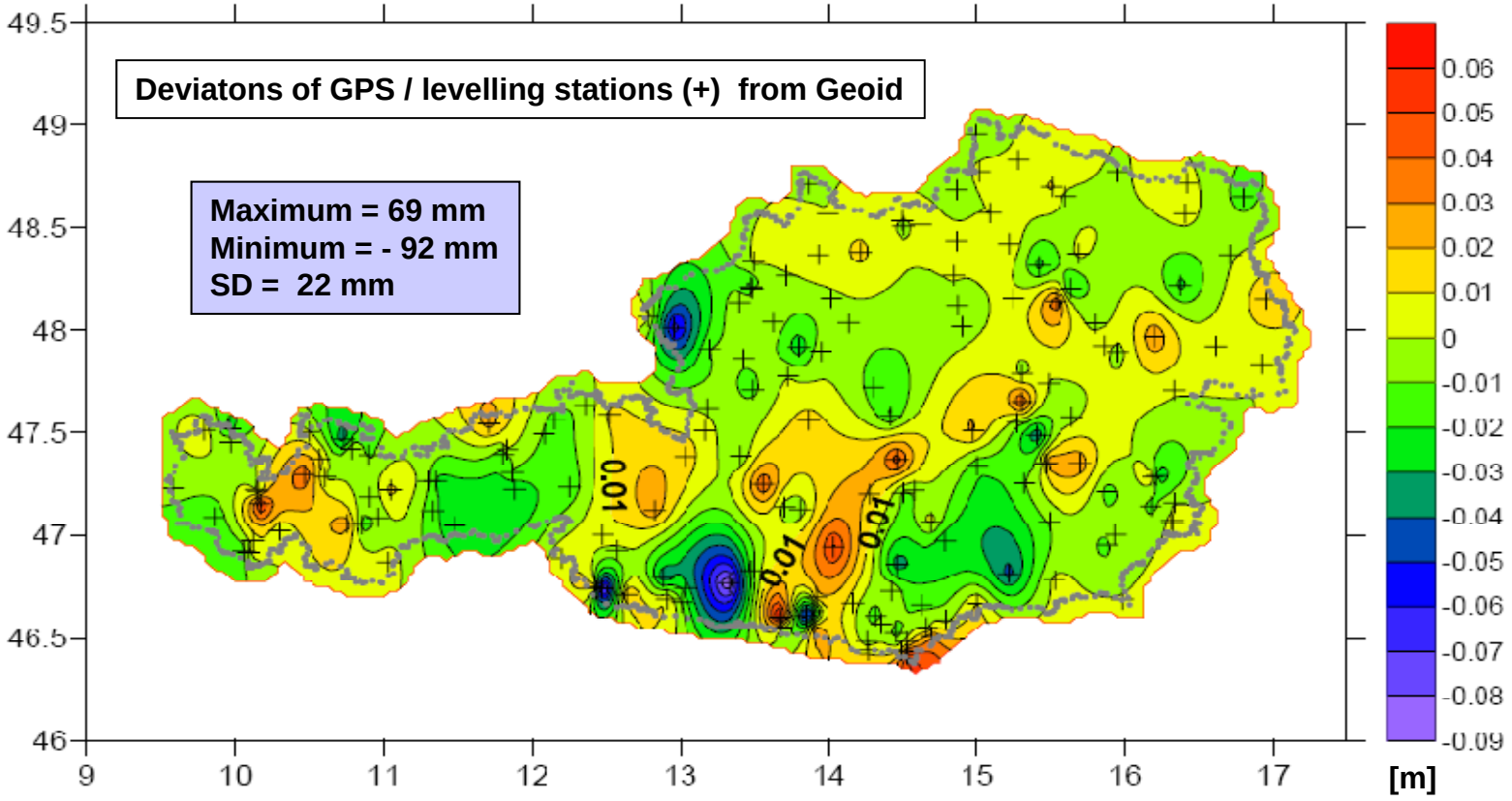
Beside the Geoid solution a Quasi-Geoid solution was computed

Evaluation of the Austrian Geoid

- GPS/Levelling points
- Comparision with Swiss Geoid
- Comparision with European Geoid/Quasi-Geoid



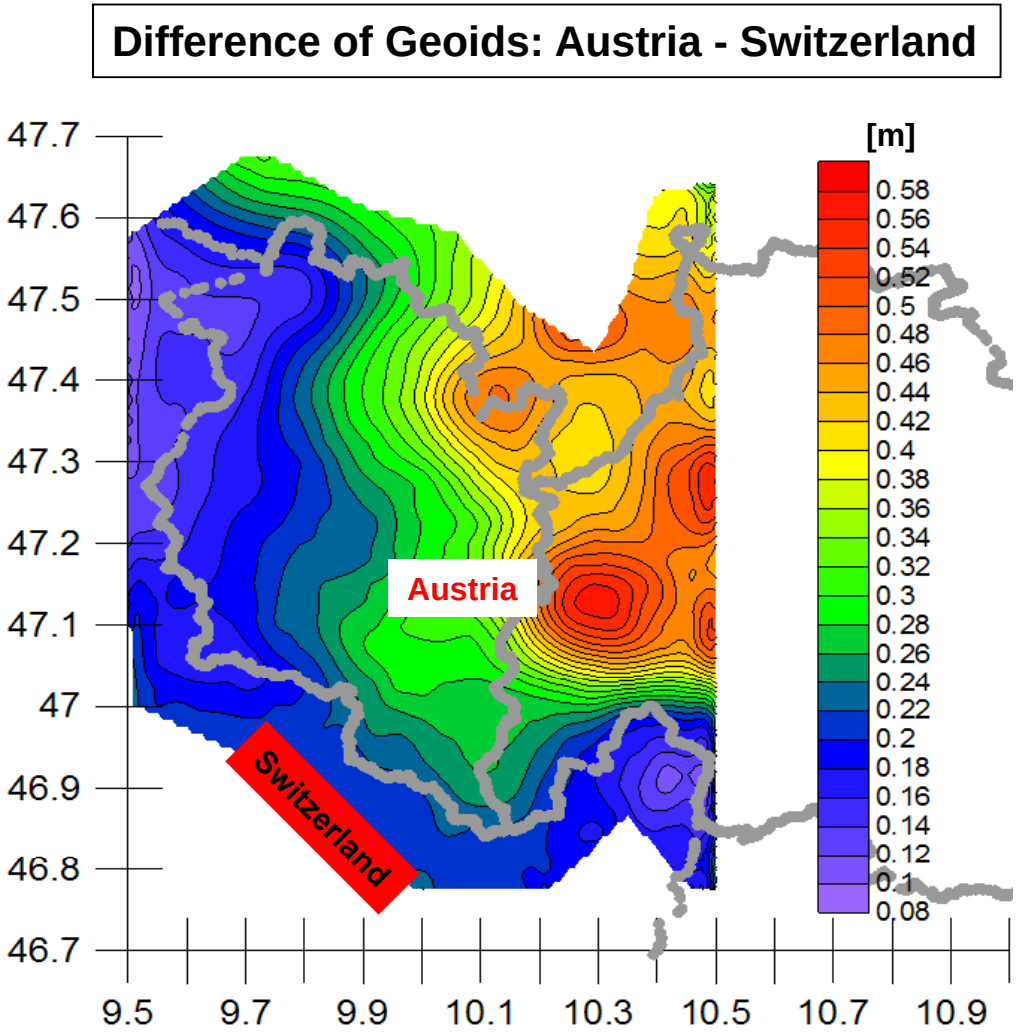
GPS / levelling data



170 stations with highly precise ellipsoidal heights and orthometric heights

+ … these stations are included in the geoid solution

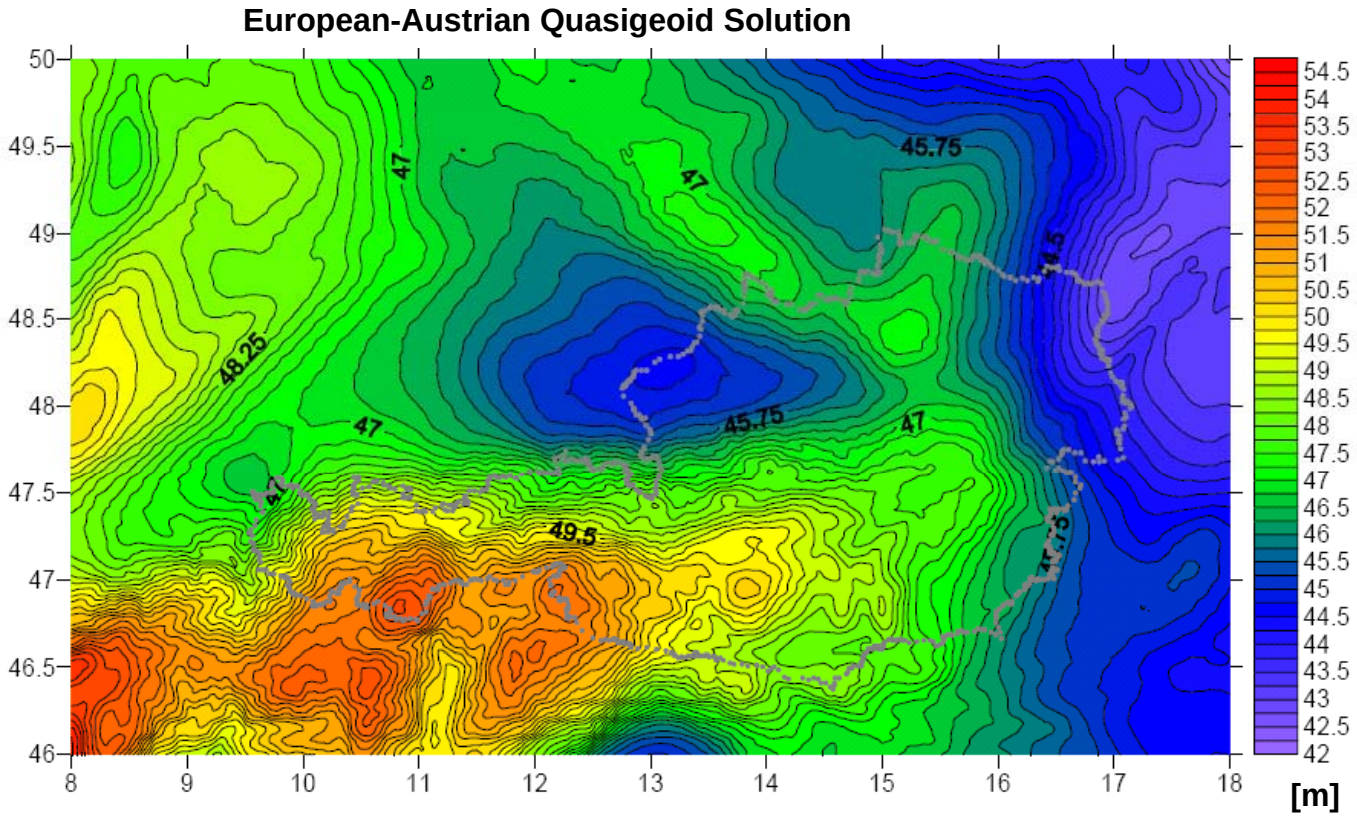
Comparison to Geoid of Switzerland



Along the border Austria - Switzerland there is a step of appr. 15 mm

Explanation:
Austrian and Swiss Geoid are both adjusted to GPS / levelling stations in their countries

European-Austrian Quasigeoid EQG-AU



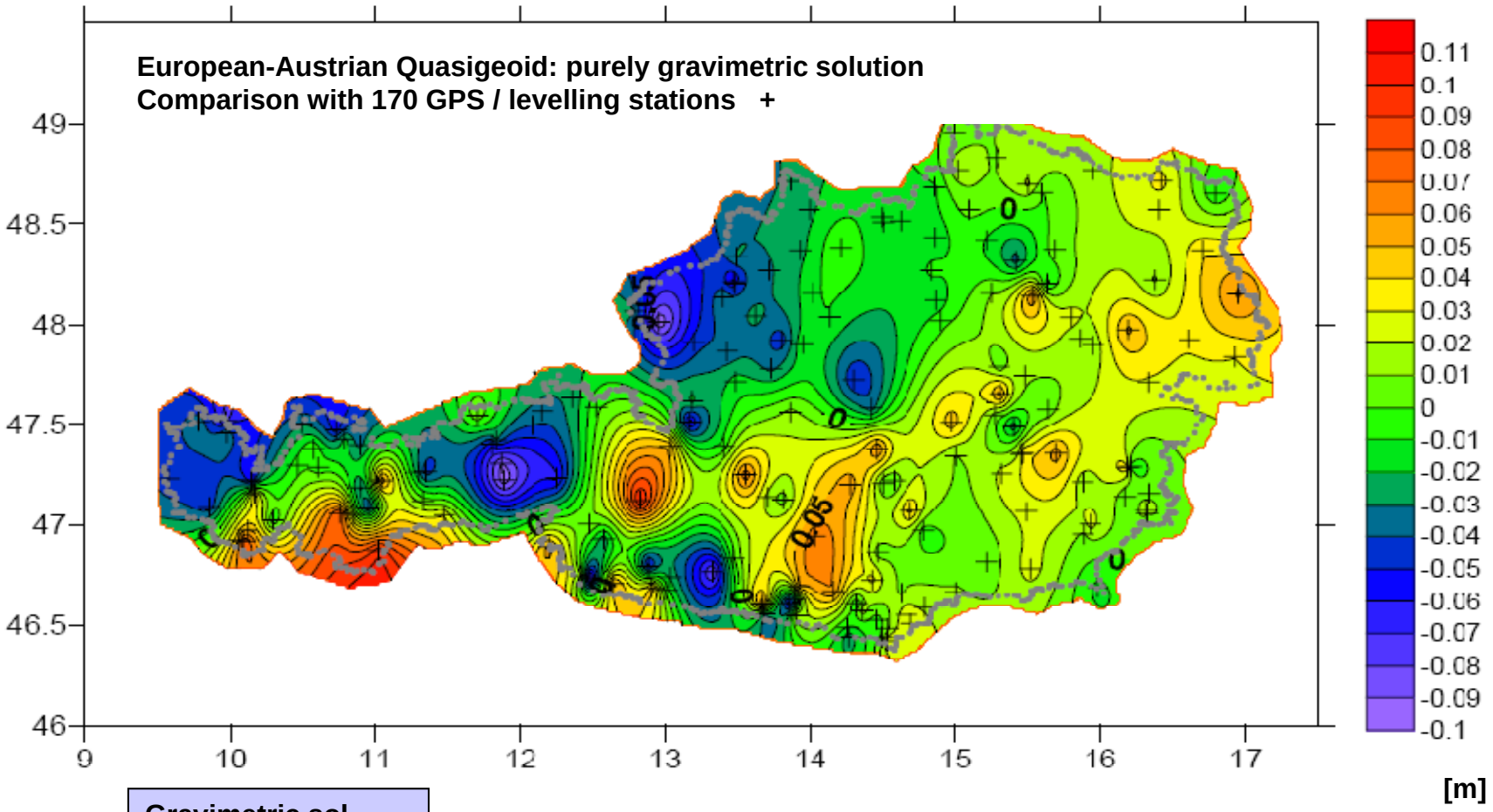
A special Austrian solution of the European Quasigeoid was calculated by IAG/Denker (IfE)

- **EGG-AU was adjusted to the 170 GPS / levelling stations like in the Geoid solution**
- **5 solutions: one purely gravimetric and 4 weighted solutions:**

  Sol. A is the best adjusted to GPS/lev.,

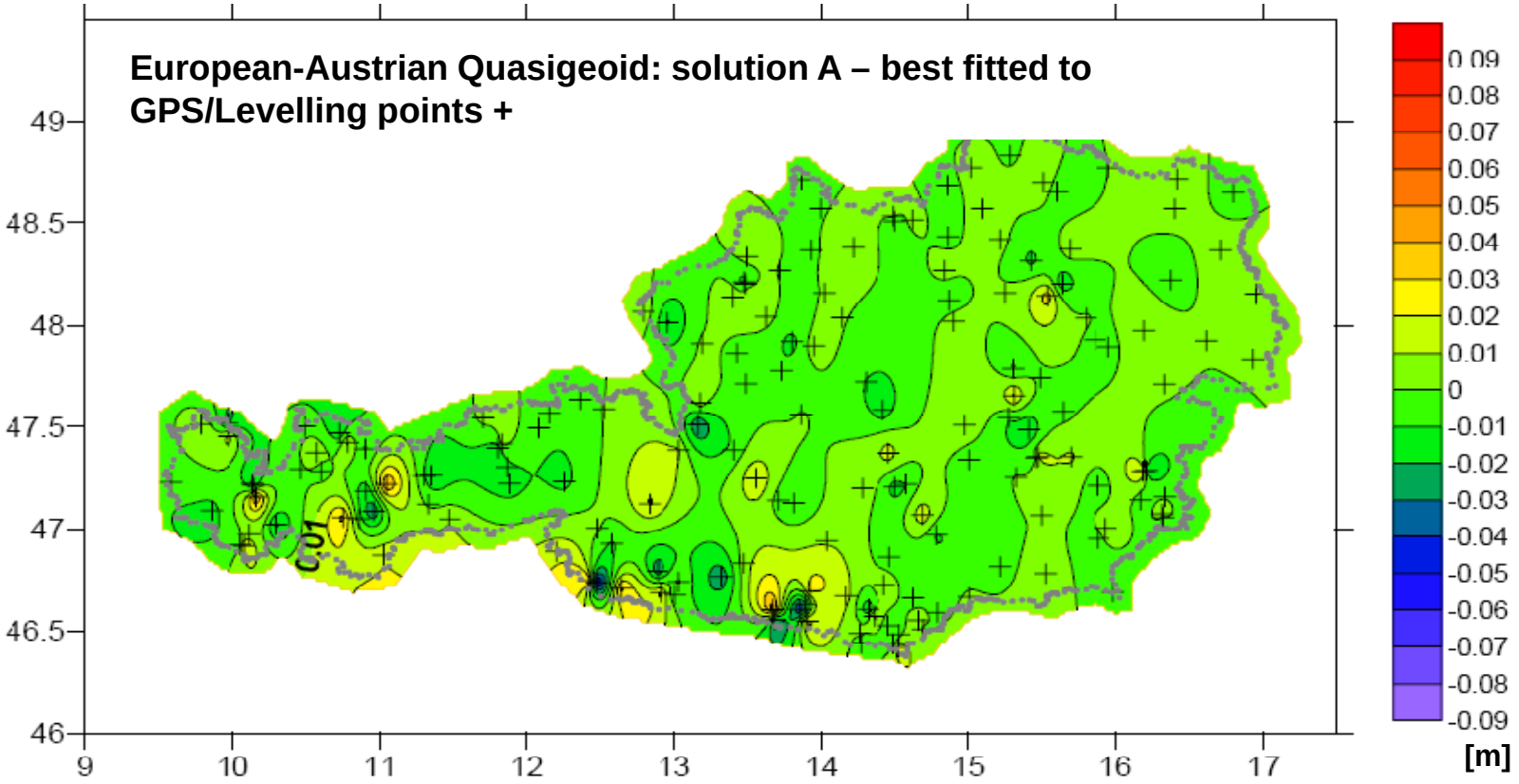
  Sol. B,C and D less adjusted to GPS / lev. stations

EQG-AU Solution- Evaluation (1)



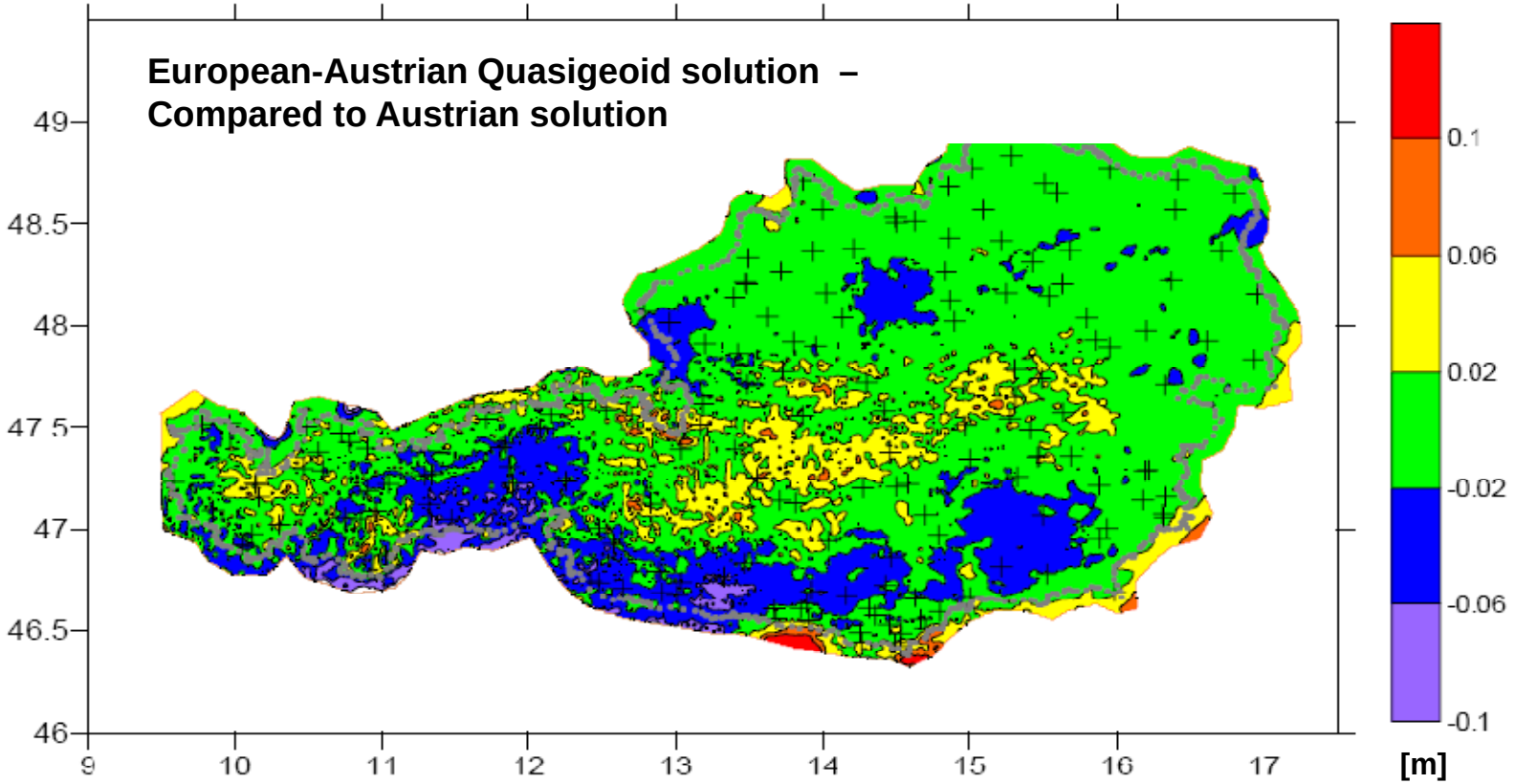
Gravimetric sol.
Max = 103 mm
Min = - 80 mm
SD = 38 mm

EQG-AU Solution- Evaluation (2)

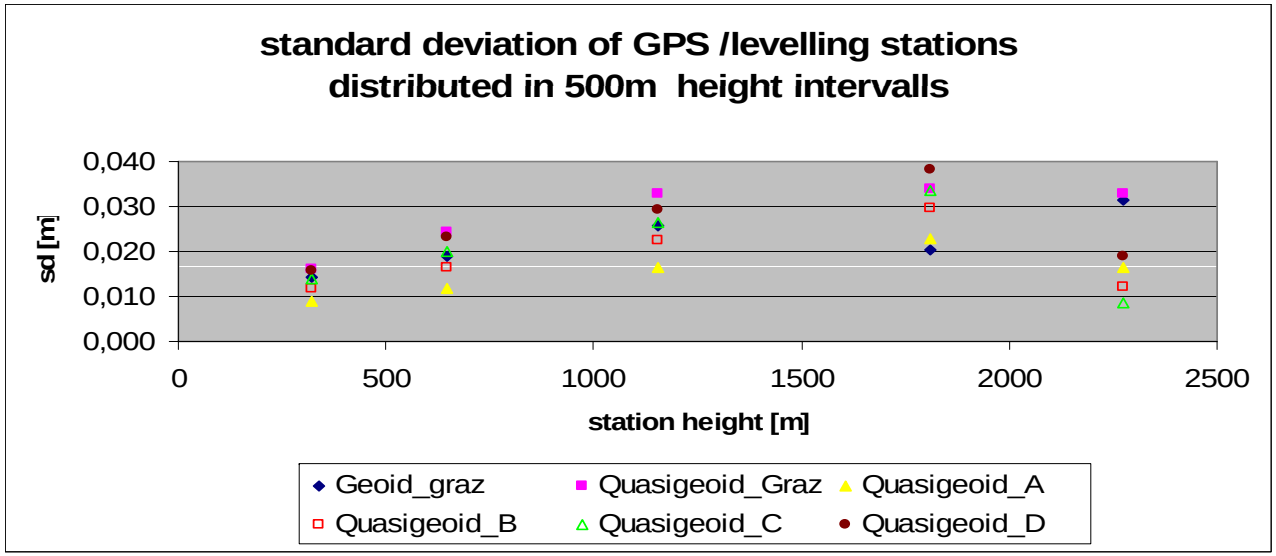


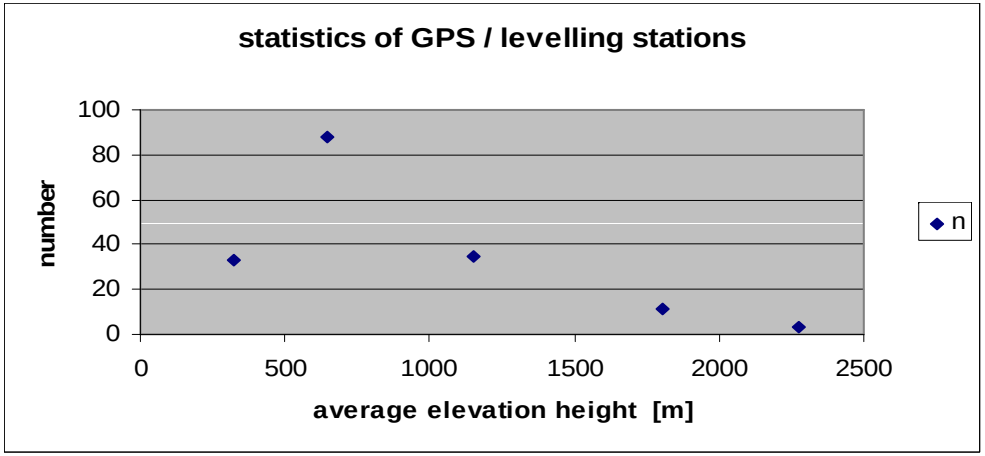
Solution A
Maximum = 47 mm
Minimum = - 58 mm
SD = 15 mm

EQG-AU solution- Evaluation (3)



Statistics of GPS / levelling data

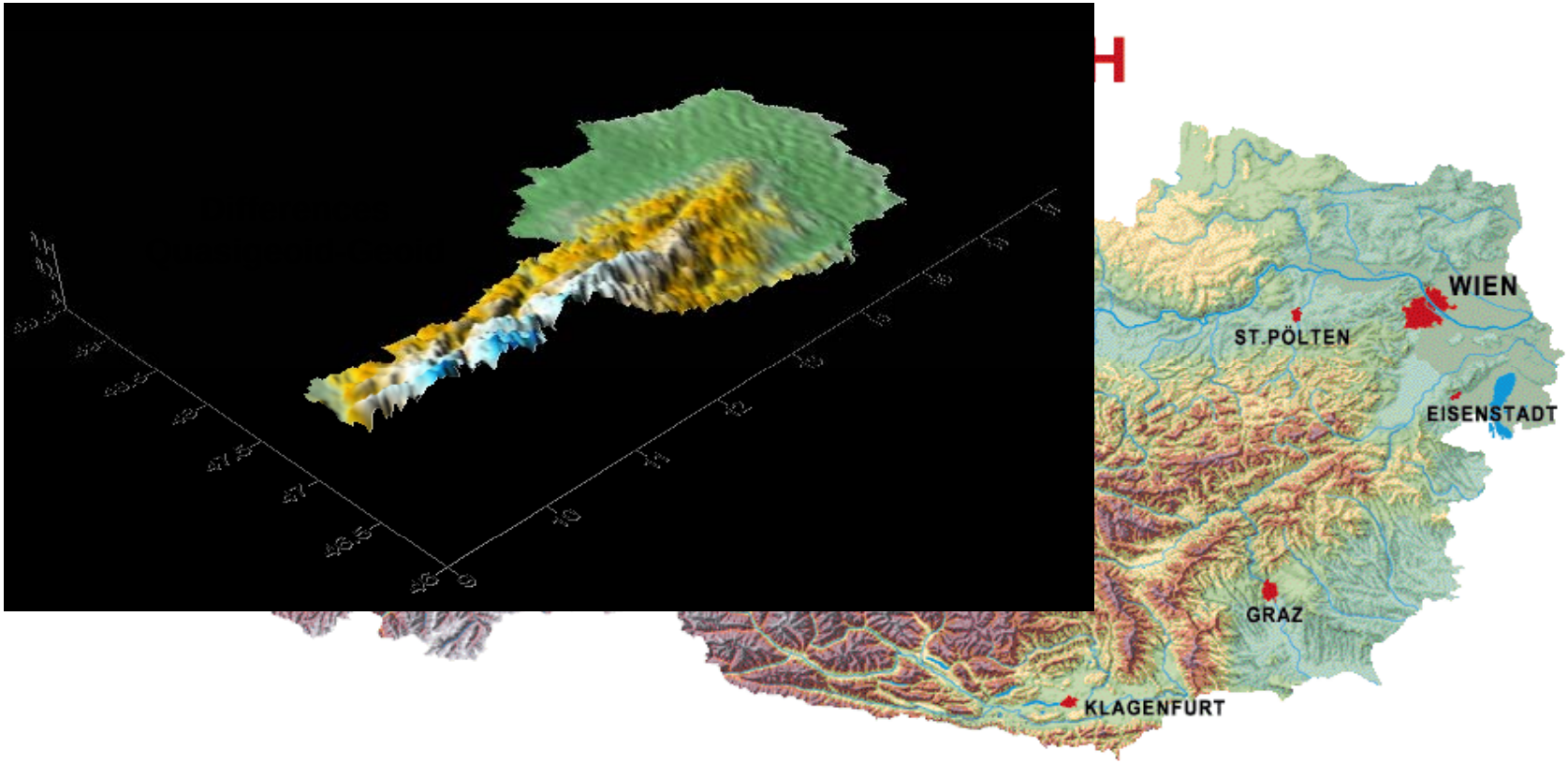




For non- mountainous areas (elevation < 1000m) the Austrian geoid solution seems to be much better than 20 mm !

Additional error source: GPS and levelling data were not measured at the same epoch ! Difference in time up to 50 years

Difference Quasigeoid - Geoid



topography

The difference between Quasigeoid and Geoid mirrors the topography

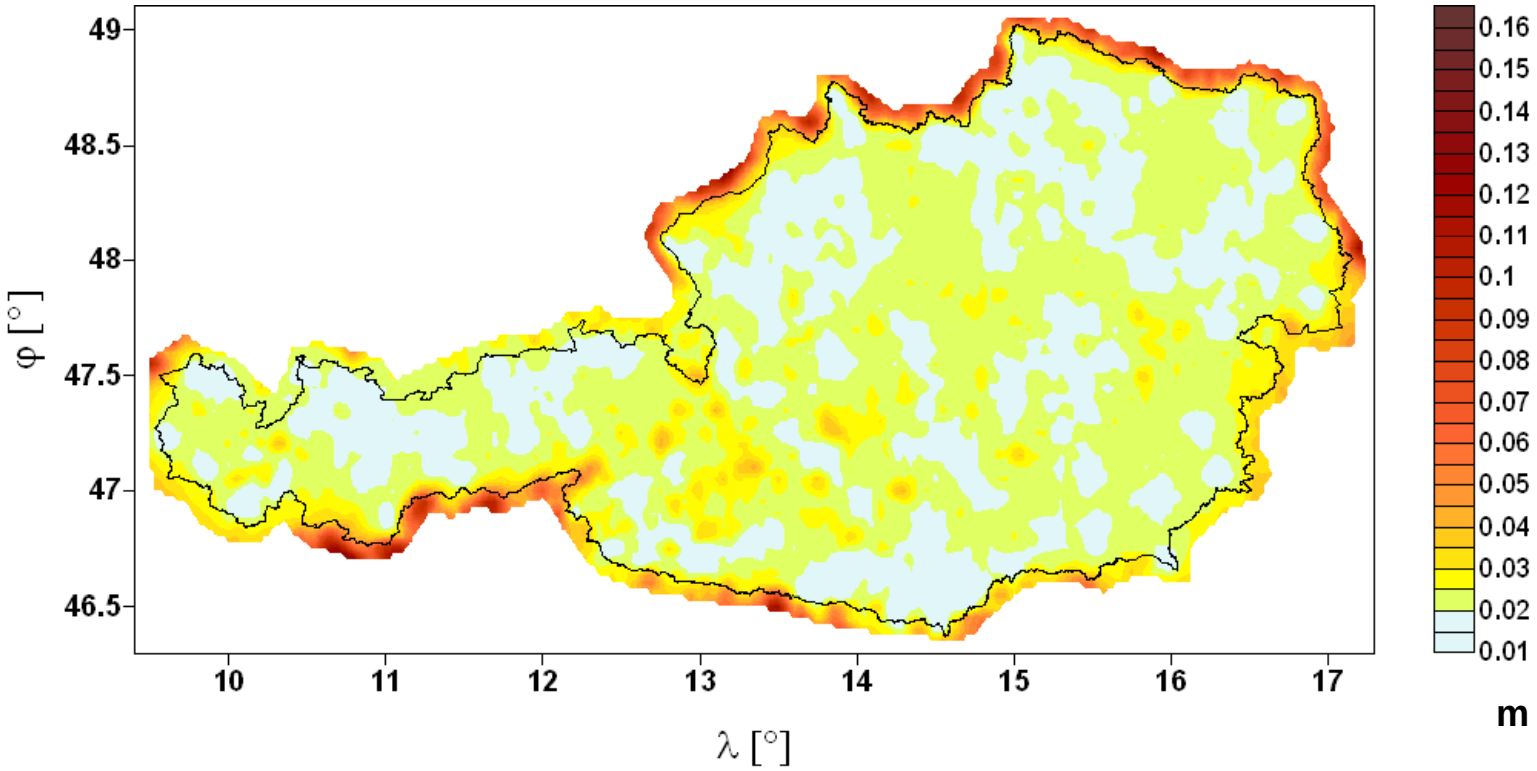
Conclusion

- Successful Cooperation between the project partners
- Improvement of „power of ten“ compared to the solution from 1987
- In good accordance with the international solution by IAG
- Full advantage of this new Geoid/Quasigeoid Solution is only in combination with explicit defined heights available:

  Orthometric or Normal Heights

Thank you for your Attention

Austrian Geoid: error estimates



Formal errors, rescaled using the standard deviation of the residuals at selected GPS/levelling control points → realistic estimate for the total error: 2 – 3 cm

Degraded accuracy in the Austrian boundary regions due to input data distribution.