Assembling geophysical datasets from Austria

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Abstract

Geophysical data have been collected in and around Austria for more than 150 years, responding to societal needs ranging from navigation, subsurface exploration, natural hazards to basic research. Great value lies in these data, both in a financial as well as an intellectual sense. It is therefore of high interest to collect such information to a degree as complete as possible, and to safeguard it. Nevertheless, efforts for safeguarding have been sketchy in the past, and some of the data appear nowadays difficult to fully recover.

We present here some of the more easily accessible information, about magnetic and gravity field anomalies, tomographic models, seismicity, and we present them together with a current (imperfect) view of subsurface faults in Austria, and an estimate of peak ground acceleration.

The graphic representations are intended to allow comparison of gravimetric, magnetic and seismological data on a qualitative basis. This can serve as a basis for judging needs for further campaigns and comparison with geologic results.

Current collection

The current collection includes:

- earthquake catalogs, instrument parameters (IRIS), seismic hazard maps
- velocity models: near surface (v_s30 - USGS), Eastern Alpine crust (v_p, v_s)
- various tomographic models for Europe and the Alpine region
- geologic units and major faults in Austria
- Moho and basin depths in the Alps and neighboring tectonic provinces
- plate boundaries (MORVEL) and seafloor ages (Müller)
- horizontal and vertical movements (ITRF2008), stress maps (GFZ Potsdam)
- potential field data (magnetics, gravimetry)
- surface heat flow density (GBA - Geological Survey of Austria)
- topographic data (ETOPO, GEBCO, GTOPO30, SRTM3)

Some selected datasets are shown and described to the right. They underline the importance of interdisciplinary considerations and are meant to encourage discussion.

References

AEC, 2012, Austrian Earthquake Catalog, Central Institute for Meteorology and Geodynamics (ZAMG), Department of Geophysics, Vienna.

Behm, M., Brückl, E., Chwatal, W., Thybo, H., 2007. Application of stacking and inversion techniques to three-dimensional wide-angle reflection and refraction seismic data of the Eastern Alps, Geophysical Journal International, doi:10.1111/j.1365-246X.2007.03393.x.

Blaumoser, N., 1992. Eine erste gesamte aeromagnetische Karte von Österreich und ihre Transformation, Mitt. Österr. Geol. Ges., 84, S 185-203, Wien.

Giardini, D., Grünthal, G., Shedlock, K., Zhang, P., 1999. Global seismic hazard map, scale 1:35,000,000, Global Seismic Hazard Assess. Proj.,U. N. Int. Decade of Nat. Disast. Reduct., Int. Lithosphere Program, Swiss Seismol. Serv., Zurich, Switzerland.

Geological Map of Austria, 1999, edited by the Geological Survey of Austria (GBA), Vienna.

GTOPO30, 1996, U.S. Geological Survey, EROS Data Center Distributed Active Archive Center (EDC DAAC).

Howe, T. C., Bird, P., 2010. Exploratory models of long-term crustal flow and resulting seismicity in the Alpine-Aegean orogen, Tectonics, 29, TC4023, doi:10.1029/2009TC002565.

Meurers, B., Ruess, D., 2009. A new Bouguer gravity map of Austria, Austrian Journal of Earth Sciences, Vol. 102, 62-70, Vienna.

Figures

Fig. 1: Peak ground acceleration with a 10 % chance of exceedance in 50 years, corresponding to a return period of 475 years (Giardini et al., 1999). Earthquake locations (circles) were taken from AEC (2012).

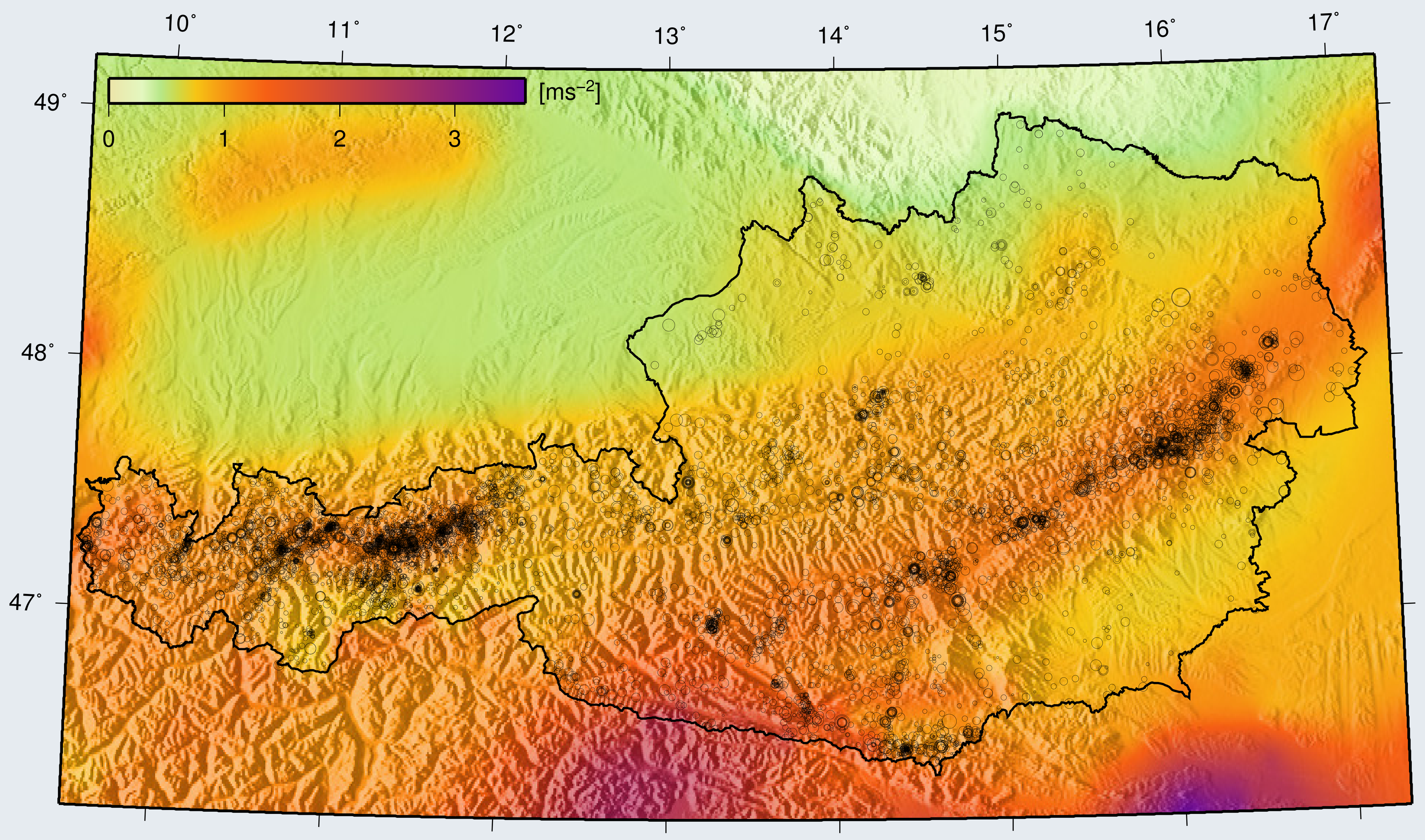
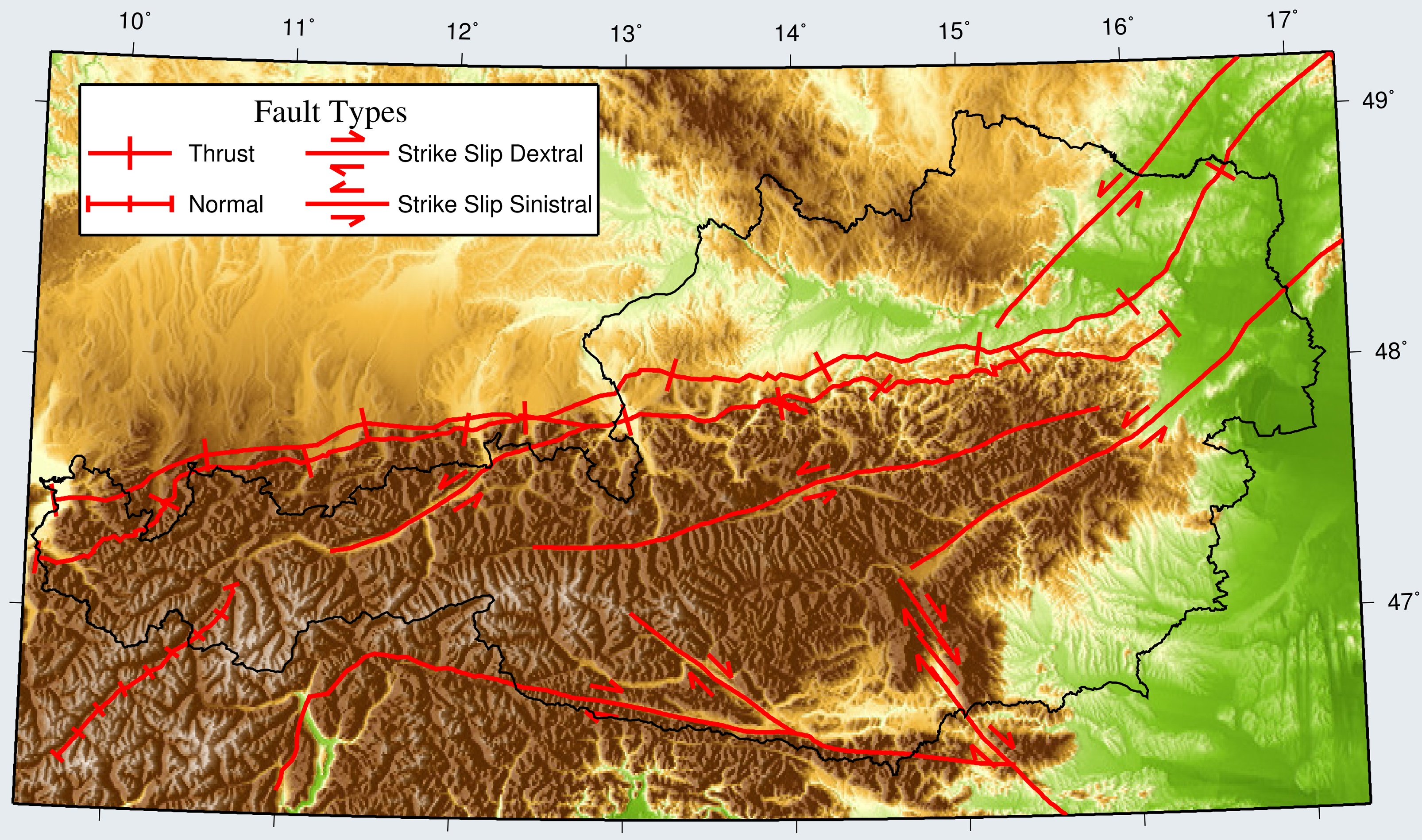


Fig. 2: Major faults are presented after the Geological Map of Austria (GBA, 1999), Brückl (pers. com.) and Howe & Bird (2010). The GTOPO30 (1996) dataset was used to image topography.



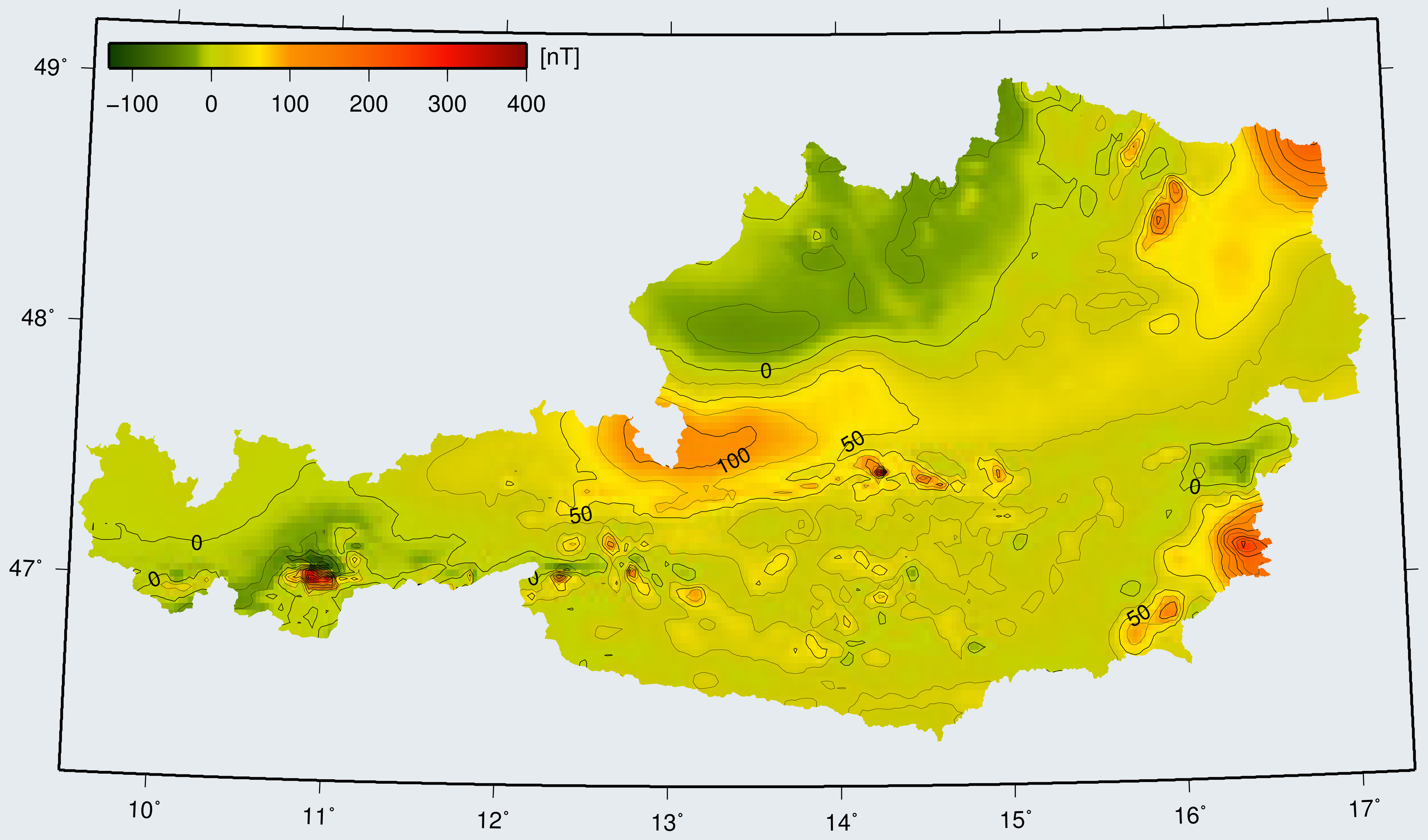


Fig. 3: Magnetic residual field derived from aerial surveys (1977-1982) continued to a common height of 3000 m above sea level (Blaumoser, 1992).

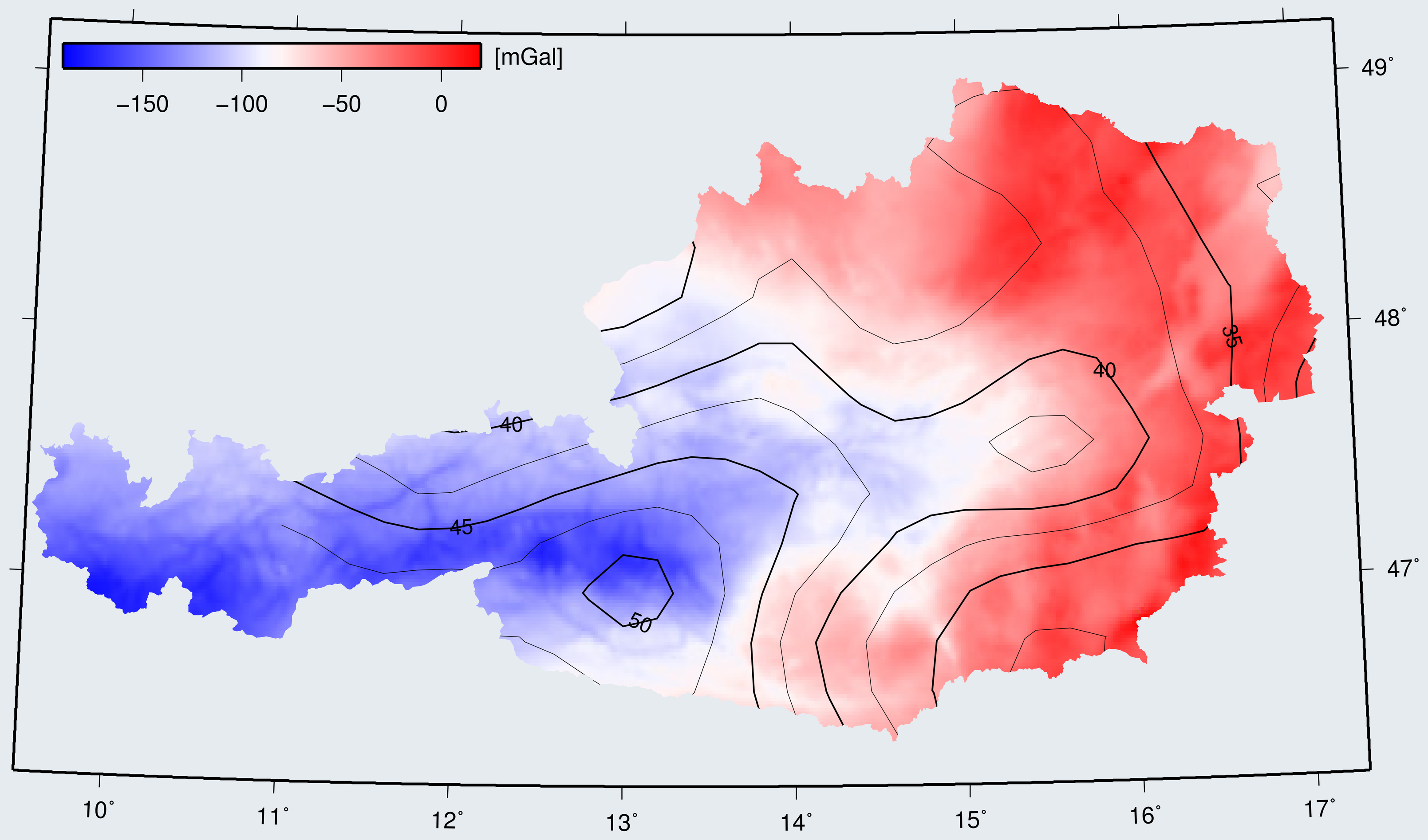


Fig. 4: Bouguer Anomaly map based on the orthometric height system (Meurers & Ruess, 2009). Contour lines depict Moho depths in km (Behm et al., 2007).

Seismicity and geology

Earthquake locations from the AEC (2012) are illustrated in Fig. 1. Such information was used by Giardini et al. (1999) to compile a map of the probable level of ground shaking associated with the recurrence of earthquakes, also presented in Fig. 1. Moreover, earthquake locations in some cases show a clear relation with faults presented in Fig. 2. Fault locations are under debate in several places; the illustrated major faults in Austria are extracted from digital maps (GBA, Brückl) and available online resources (Howe & Bird, 2010).

Potential field data

Aeromagnetics (Fig. 3) can help identify geological units. For example, the Berchtesgardener Anomaly of about 100 nT around Salzburg could be caused by remaining oceanic crust, whereas in the Styrian Basin tertiary volcanic activity is apparent (Blaumoser, 1992). As gravity reflects density distributions in the subsurface, crustal thickness can be inferred. In Fig. 4 the Bouguer Anomaly map (Meurers & Ruess, 2009) is compared with Moho depths derived from P-wave velocities (Behm et al., 2007).